Infrasound and low-frequency-noise: does it affect human health?

http://www.engineersjournal.ie/2018/01/23/ilfn-infrasound-low-frequency-noise-turbine-health/
23 January 2018

Biomedical engineer **Dr Mariana Alves-Pereira** recently studied the impact of ILFN from wind turbines in Ireland, concluding that noise regulations need updating to reflect noise levels that endanger human health

On the **Engineers Ireland website**, a search for 'infrasound' or 'low-frequency noise' yields zero results. A search on 'noise', however, **yields 44 results**. Why is it that i**nfrasound and low frequency noise (ILFN)** is still such a taboo subject? While it is improbable that this particular question will be answered here, an exposé of ILFN will be provided with a brief historical account of how and why ILFN was ultimately deemed irrelevant for human health concerns. Infrasound and low-frequency noise (ILFN) are airborne pressure waves that occur at frequencies ≤ 200 Hz. These may, or may not, be felt or heard by human beings. In order to clarify concepts, in this report the following definitions are used:

- *Acoustic phenomena:* airborne pressure waves that may or may not be perceived by humans;
- *Sound:* acoustic phenomena that can be captured and perceived by the human ear;
- *Noise*: sound that is deemed undesirable;
- *Vibration:* implies a solid-to-solid transmission of energy.

In the early part of the 20th century, Harvey Fletcher of the Western Electrics Laboratories of AT&T, was tasked with improving the quality of reception in the telephone. To generate the sounds in a telephone earpiece, he used an AC voltage and had some of his colleagues rate the loudness of the sound received compared to the quietest tone heard.

The company was already using a logarithmic scale to describe the power in an electrical cable and it made sense to rate the loudness of the sounds also on a logarithmic scale related to the quietest voltage that could just be heard.

Initially he called this metric a 'sensation unit' but later, to commemorate their founder Alexander Graham Bell, they renamed it the 'Bel'. A tenth of a Bel became known as the deciBel, corrupted to decibel, which has stuck with the scientific community to this day.

Fletcher-Munson curves and the dBA metric

To address the problem of industrial noise in the early 20th century, measurement was essential, as was a metric. At that time, researchers were critically aware that the readings on a sound level meter did not represent how loud or intense the sound was with respect to the subject's perception of hearing.

From a biomedical perspective, this concept of perception is subjective, and changes between individuals and over timescales from minutes to decades. These serious constraints notwithstanding, it was acknowledged that some average measure of loudness would have some value for medicine and public health.

Harvey continued his research with Wilden Munsen, one of his team, by varying the frequency of the electricity to give pure tones, to which it is understood 23 of his colleagues listened to different levels of loudness, again through a simple telephone earpiece. (It is assumed they all had good hearing). They were then asked to score the sounds for equal loudness to that generated by an alternating current at 1000 cycles per second.

The level of the sound of course depended on the voltage applied, which could be measured. It is important to note two significant constraints here: The sounds were 'pure' sine waves, which are not common in nature, and the headphones enclosed the ear of the subject. This is a very unnatural way to listen to a very unnatural sound.

The numerical results of this study are known as the Fletcher-Munsen Curves (Fig 1). The (logarithmic) units of these curves are known as ‘phons’ and the inverse of the 40 phon curve forms the basis of the A-frequency weighting scale used everywhere today

(Fig 2).

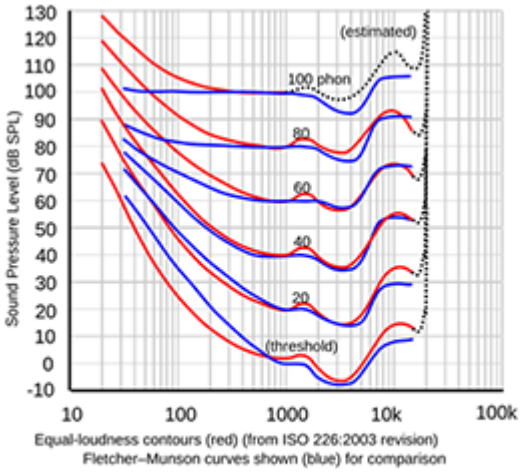

Fig 1: Fletcher Munson curves [2]

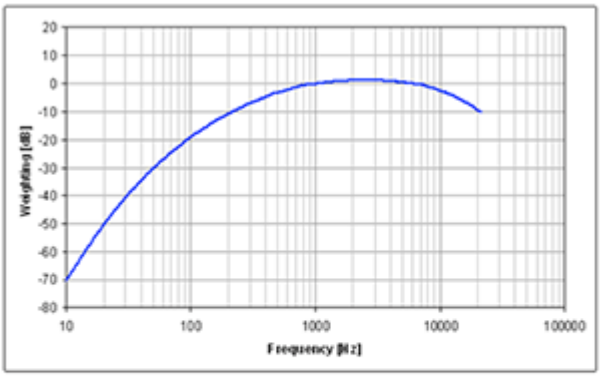

Fig 2: A-weighting frequency response curve [3]

A-frequency weighting scale

The minimum pressure required for humans to perceive sound at 1000 Hz is considered to be 20 micropascal, or an intensity of 10^{-12} watts per square meter. This corresponds to 0 phon on Figure 1, and 0 dBA in Figure 2. For all its shortcomings, the A-weighting has endured for decades and has become the *de facto* standard for environmental noise measurement. But is the A-weighting sufficient for all circumstances?
The answer is an emphatic ‘No’. It relates to the perception of loudness, which heavily discounts all frequencies below 1000 Hz and ends at 20 Hz. This 20-Hz limit was a consequence of equipment limitations of the 1920s and 30s, but has remained as the lower limit of human hearing to this day. The assumption that harm from excessive noise exposure is directly related to the perception of loudness has also remained to this day.

Observe in Fig 2 that, at 10 Hz, there is a 70-dB difference between what is measured and what is, *de facto*, present in the environment. In other words, three-and-a-half orders of magnitude of energy are discounted at this frequency.
The implications for public health are considerable, and within this line of reasoning, any event below 20 Hz becomes of no consequence whatsoever – and more so because it is not implicated in the classical effects of excessive noise exposure: hearing loss.

There are also issues of time and frequency resolution. Acoustic phenomena are time-varying events. A 10-minute average of acoustic events can hide more than it reveals. Similarly, segmenting frequencies into octave or 1/3-octave bands for analysis can also hide much that needs to be seen.

Today, affordable and highly portable equipment can record acoustical environments, and allow for post-analysis in sub-second time increments and 1/36-octave resolution. Waveform analysis from the sound file directly can achieve an even better resolution.

Field studies in Ireland

The following results, recently obtained in field-studies conducted in Ireland (July-November 2017), show why such resolution is needed to understand ILFN-rich environments. The classical metric (in dBA, 10-min averages and 1/3-octave bands) will be contrasted with what is needed for human health-related concerns (in dB with no frequency weighting, and resolutions of 0.2s and 1/36-octave bands), and not merely compliance with regulations.

- *Equipment and methods*

Acoustical environments were recorded with a SAM Scribe FS recording system, a 2-channel recorder with sampling rates up to 44.1 kHz at 16-bit resolution and linear response down to almost 0.1 Hz [4-6]. Recordings were saved as uncompressed WAV files including the 1000 Hz/94 dB reference calibration tone prior to and after measurements. Windshields were placed on both microphones during the entire measurement sessions. Microphones were attached to tripods at approximately 1.5 m above the ground.

- *Location*

Five homes located around the same industrial **wind turbine** (IWT) development have been the object of study. The data presented here refers to Home 1 (Fig 3). Table 1 shows the dates and times of all recordings that have been made to date in this home. The recordings selected for analysis and presentation herein were chosen on their educational value.

Table 1: Dates and times of recordings

Home No.	Date	Time	Blue Channel	Red Channel
1	04 Jul	04:05 – 06:48	In child's bedroom-1	In child's bedroom-2
	05 Jul	15:33 – 17:50		
	10 Oct	17:40 – 18:43		

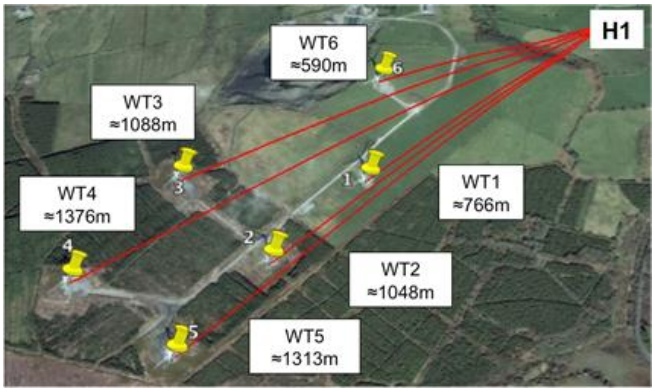

Fig 3: Reconstruction using a Google Earth image and showing the relative position of Home 1 and each of the six industrial wind turbines

The information classically obtained with the dBA metric, 1/3-octave bands and 10-min averaging (on 10 October, 2017, at 18:30) is given in Figs 4 and 5. Weather conditions obtained from Met Éireann for the closest weather tower at this time were as follows: air temperature: 14ºC, precipitation: 0.1 mm, mean sea-level pressure: 1006.0 hPa, wind speed: 5.1 m/s (10 kt), wind direction: southwest (200º az).

Results

The values obtained for the sound pressure level and 1/3-octave bands are seen in Figs 4 and 5. The overall dBA metric (red bars labelled 'Tot') reflects the sound that humans would hear if they were present in this environment.

The sound pressure level in dBLin metric (grey bars labelled 'Tot') reflect the amount of acoustic energy to which humans are concomitantly exposed. The growing discrepancy between the two can be seen as the frequency falls below 1000 Hz.

Figure 6 shows the sonogram corresponding to the same 10-min period. This visual representation of time- and frequency-varying acoustic events provides much more information than the classical approach (Figs 4 and 5).

Here, short-term events can be seen in the region of 20-50 Hz (Fig 6). Tonal components can be seen at 10 Hz and 20 Hz that are not steady in amplitude and may be amplitude modulated, i.e., where the amplitude of the pressure is not continuous and varies periodically with time. The 10-minute averages, used in almost all legislation, hide these variations and are representative only of tonal components that are essentially unvarying over the 10-minute period in question.

The periodogram (Fig 7) over the same 10 minutes shows that there are distinct tonal components that form a harmonic series. When IWTs are the source of ILFN, the rotating blades generate repeated pressure waves as each blade replaces the previous one at any position.

A harmonic series is formed with the ‘blade pass frequency’ as the fundamental frequency (0.8 Hz here). These harmonics constitute what is called the *wind turbine signature* [7], which is impossible to identify using the classical dBA, 1/3-octave, 10-minute averaging methodology.

Final thoughts

Health concerns associated with excessive exposure to ILFN in the workplace have been around since the industrial boom in the 1960s [8]. In recent years, however, residential neighbourhoods have also begun to be flooded with ILFN [9-14]. The family living in Home 1, for example, has abandoned their residence due to severe health deterioration in all family members.

Accredited acousticians cannot ascertain compliance levels for ILFN because there are none – the vast majority of regulations worldwide do not cover this part of the acoustic spectrum. Nevertheless, public health officials and agencies should fulfil their job descriptions by becoming aware of the limitations of current noise guidelines and regulations.
Alternatives exist to gather the acoustic information relevant to the protection of human populations, in both occupational and residential settings. Noise regulations and guidelines need urgent updating in order to appropriately reflect ILFN levels that are dangerous to human health.

Home 1: A-weighting, 1/3 octave bands (0.5-4000 Hz), 10-minute average – Red Channel

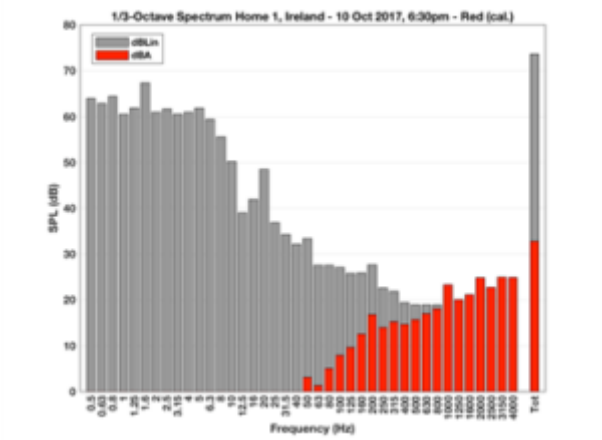

Fig 4: Data covers a 10-minute interval analysed between 0.5-4000 Hz, in 1/3-octave bands, as recorded in Home 1, on 10 October 2017, at 18:30 (red microphone, i.e. inside child’s bedroom-2).
The red bars are A-weighted values, while the gray bars indicate the acoustic energy that is, *de facto* present, in dBLin. In this environment, the human being would perceive through the ear an overall A-weighted pressure-level of approximately 34 dBA (Tot – red bar), while being concomitantly exposed to an overall acoustic pressure-level of approximately 74 dBLin (Tot – grey bar).

Home 1: A-weighting, 1/3 octave bands (0.5-1000 Hz), 10-minute average – Red Channel

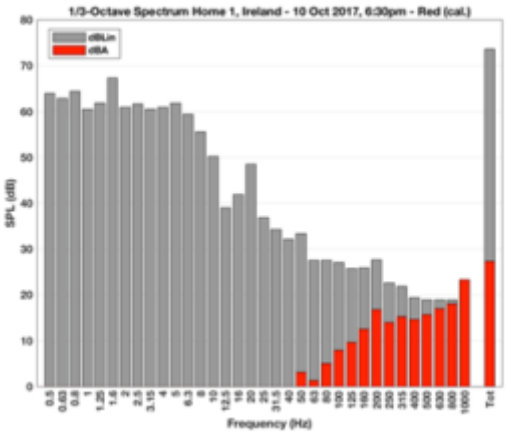

Fig 5: Data covers a 10-minute interval analysed between 0.5-1000 Hz, in 1/3-octave bands, as recorded in Home 1, on 10 October 2017, at 18:30 (red microphone, i.e. inside child's bedroom-2). The red bars are A-weighted values, while the gray bars indicate the acoustic energy that is, *de facto* present, in dBLin. In this environment, the human being would perceive through the ear an overall A-weighted pressure-level of approximately 26 dBA (Tot – red bar), while being simultaneously exposed to an overall acoustic pressure-level of approximately 74 dBLin (Tot – grey bar).

Home 1: No weighting, 1/36 octave bands (0.5-1000 Hz), 0.2 s average – Red Channel

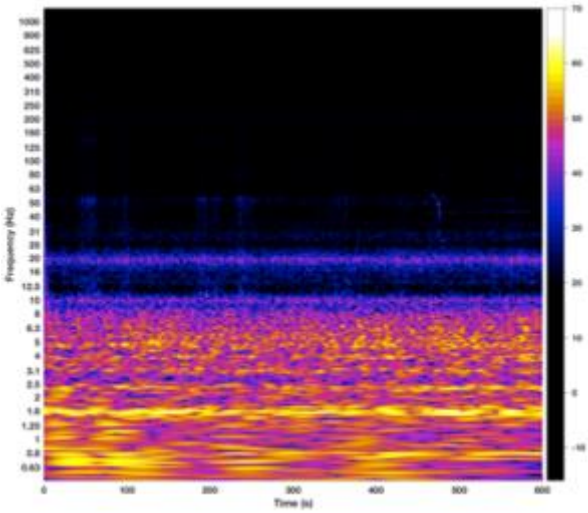

Fig 6: Sonogram that covers the same 10-minute interval (600 s) as in Figs 4 and 5 showing time-varying features. The colour-coded bar on the right indicates sound pressure level values in dB Linear (no weighting). The horizontal line seen at 20 Hz is not a continuous tone because over the 600 s, its pressure level (colour-coded data) varies. A strong (yellow) acoustic phenomenon can be seen to exist at 1.6 Hz and also at 0.8 Hz.

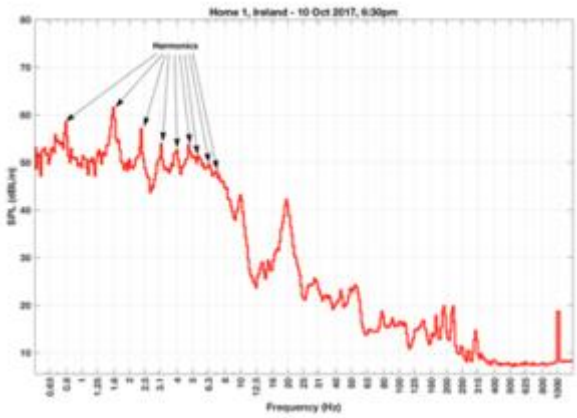

Fig 7: Periodogram covering the same 10-minute interval (600 s) as in Figs 4-6, and analyzed between 0.5-1250 Hz. The blade pass frequency of the IWT is 0.8 Hz. Harmonics of this fundamental frequency are shown in the figure. Each frequency band composing the harmonic series has a well-defined peak, e.g., the horizontal line seen in Fig 7 at 20 Hz is represented here as a peak at 20 Hz.

[redacted]

Authors:

- **Mariana Alves-Pereira**

School of Economic Sciences and Organizations (ECEO), Lusófona University, Lisbon, Portugal

- **Huub Bakker**

School of Engineering and Advanced Technology, Massey University, Palmerston North, New Zealand

- **Bruce Rapley**

Atkinson & Rapley Consulting, Palmerston North, New Zealand

- **Rachel Summers**

School of People, Environment and Planning, Massey University, Palmerston North, New Zealand

The opinions expressed in this article are the authors' own and do not represent the views of Engineers Ireland. For details of the Australian Administrative Appeals Tribunal Decision into the effects, if any, of ILFN on human health, please read the following document (PDF): **waubra-and-acnc-decision.** The section of the Australian decision that deals with Prof Alves-Pereira's testimony is on pages 123-124.

References:

[1] Dickinson P (2006). Changes and challenges in environmental noise measurement. Acoustics Australia, 34 (3), 125-129.

[2] Wikicommons (2017). Fletcher-Munson Curves.

https://commons.wikimedia.org/wiki/File:Lindos4.svg

[3] Dirac (2017). Dirac Delta Science & Engineering Encyclopedia, A-Weighting.

http://diracdelta.co.uk/wp/noise-and-vibration/a-weighting/

[4] Atkinson & Rapley Consulting Ltd (2017). Specification sheet for the SAM Scribe FS Mk 1. **www.smart-technologies.co.nz**

[5] Primo Co, Ltd. (Tokyo, Japan) (2017). Specification sheet for the electret condenser microphone, custom-made, model EM246ASS'Y.

http://www.primo.com.sg/japan-low-freq-micro

[6] Bakker HHC, Rapley BI, Summers SR, Alves-Pereira M, Dickinson PJ (2017). An affordable recording instrument for the acoustical characterisation of human environments. ICBEN 2017, Zurich, Switzerland, No. 3654, 12 pages.

[7] Cooper S (2014). The Results of an Acoustic Testing Program Cape Bridgewater Wind Farm. Prepared for Energy Pacific (Vic) Pty Ltd, Melbourne, Australia.

http://www.pacifichydro.com.au/files/2015/01/Cape-Bridgewater-Acoustic-Report.pdf

[8] Alves-Pereira M (1999). Noise-induced extra aural pathology. A review and commentary. Aviation, Space and Environmental Medicine, 70 (3, Suppl.): A7-A21.

[9] Torres R, Tirado G, Roman A, Ramirez R, Colon H, Araujo A, Pais F, Lopo Tuna JMC, Castelo Branco MSNAA, Alves-Pereira M, Castelo Branco NAA (2001). Vibroacoustic disease induced by long-term exposure to sonic booms. Internoise2001, The Hague, Holland, 2001: 1095-98. (ISBN: 9080655422)

[10] Araujo A, Alves-Pereira M, Joanaz de Melo J, Castelo Branco NAA (2004). Vibroacoustic disease in a ten-year-old male. Internoise2004. Prague, Czech Republic, 2004; No. 634, 7 pages. (ISBN: 80-01-03055-5)

[11] Alves-Pereira M, Castelo Branco, NAA (2007). In-home wind turbine noise is conducive to vibroacoustic disease. Second International Meeting on Wind Turbine Noise, Lyon, France, Sep 20-21, Paper No. 3, 11 pages.

[12] Castelo Branco NAA, Costa e Curto T, Mendes Jorge L, Cavaco Faísca J, Amaral Dias L, Oliveira P, Martins dos Santos J, Alves-Pereira M (2010). Family with wind turbines in close proximity to home: follow-up of the case presented in 2007. 14th International Meeting on Low Frequency Noise, Vibration and Its Control. Aalborg, Denmark, 9-11 June, 2010, 31-40.

[13] Lian J, Wang X, Zhang W, Ma B, Liu D (2017). Multi-source generation mechanisms for low frequency noise induced by flood discharge and energy dissipation from a high dam with a ski-jump type spillway. International Journal of Environmental Research and Public Health, 14 (12): 1482.

[14] Rapley BI, Bakker HHC, Alves-Pereira M, Summers SR (2017). Case Report: Cross-sensitisation to infrasound and low frequency noise. ICBEN 2017, Zurich, Switzerland (Paper No. 3872).

Hierna is er nog een zeer uitvoerige discussie, zie op de website
http://www.engineersjournal.ie/2018/01/23/ilfn-infrasound-low-frequency-noise-turbine-health/

Tot 2 april 2018:

145 Comments Already

Dick Bowdler - January 23rd, 2018 at 1:25 pm

No one who is familiar with acoustics will be the least bit surprised by this. Infrasound is all round us and turbines are but one of the sources. What is missing from the article is that these infrasound levels are way below the threshold of perception. The highest level of just under 70dB at 1.6Hz compares with a threshold of about 120dB. Even moving out of the infrasound region into LF, at 20Hz the level of under 50dB is 25dB below the human threshold.

REPLY

Rita Holmes - January 24th, 2018 at 5:17 am

From your comment, I don`t think you understand the points being made in this article..Either you have no understanding of the medical aspects of exposure to infrasound and the need for regulatory control or you just feel the need to illogically criticise. Perhaps you could make your point clearer.

REPLY

Dick Bowdler -January 24th, 2018 at 4:20 pm

You are right Rita, I don't understand. I've already asked in a comment below for someone to explain. I just want to know what is the mechanism that makes these tiny fluctuations of air damage our bodies? The particles of air are travelling at (I havent worked it out exactly but) about one tenth of a millimetre a second. You could get hit by a bus at that speed and not suffer damage – so I just want to know how the damage is caused by the air. Will no-one explain?

REPLY

Agnes Doolan -January 24th, 2018 at 4:46 pm

Mr.Bowdler will find a thorough explanation of the mechanism by which ILFN impacts the body in this paper by Dr.Mariana Alves Pereira and Dr. Nuno Castelo Branco from Lusofona University , Lisbon.https://l.facebook.com/l.php?u=https%3A%2F%2Fcdn.fbsbx.com%2Fv%2Ft59.2708-21%2F26763123_10159864168250164_7139936736469057536_n.pdf%2F2007-Prog-Biophys-Molec-Biol-vol-93-pp256-79-VAD-Biol-effects-of-ILFN-explained-by-mechanotransduction-cellular-signalling.pdf%3Foh%3D0fb02df46632efb5887364d19977d5de%26oe%3D5A6AD0B4%26dl%3D1&h=ATMdRM33gTe_e-amC_z4PCSctS0mUvWVJbDtPWSLm2R5q8waifTo9wmxtfHXd3KsG4x8xVluRtzJdXsr85ljtqJDVfaxN-b0tfMug7o23jVU5V4sDtwRuJITPMH2qG2RQ7gJBQd_EsEdqD8G5pJdbHt-&s=1&enc=AZNg6UUMQvvFrhozRzBneMuvEyYxyzN66T1YbLHySWqN9d2Ogu9XUAfBJ9C8r6GcSlCYg1JbaiXOAGQTeedFwg1hSwnYYfzae6er0Nap_qoPVg

REPLY

Agnes Doolan -January 27th, 2018 at 3:39 pm

Do you doubt the work of Neil Kelley for NASA back in the 80s? And could you kndly get even the dBA right? I employed you twice Dick over the Cloghan wind farm through an Irish consultant planner.Then I recommended you to the community of Garbally who were faced with the Meenwaun wind farm. You submitted a noise Critique and the developed said you were WRONG and up goes the wind farm. So the wind industry which you are so quick to defend don't think you can do a proper Noise Critique. Any comment on that?

REPLY

Agnes Doolan-January 27th, 2018 at 3:41 pm

Correction; "developed" should read "Developer"

Aileen Jackson-January 27th, 2018 at 3:55 pm

I think you have just shown yourself in a very bad light Agnes – if people don't agree with you, you get personal. Dear oh dear.

Dick Bowdler-January 27th, 2018 at 5:46 pm

Kelley's conclusion to his research on the MOD-2 Turbine (in full) says "We determined from our analysis of both the high- and low-frequency-range acoustic data that annoyance to the community from the 1983 configuration of the MOD-2 turbine can be considered very unlikely at distances greater than 1 km (0.6 mile) from the rotor plane".

D H Telford - January 24th, 2018 at 4:38 pm

The Chairman of the Institute of Acoustics is on record as stating that acousticians, including Dick Bowdler, are not qualified or competent to comment on the effect of infrasound on human health. There is recent case law from Eire where a wind energy company (Enercon) has admitted in open Court that their wind turbines damaged the human health of nearby residents.

REPLY

Aileen Jackson -January 24th, 2018 at 5:35 pm

However the NHS and Health Protection Scotland are qualified to comment David and were consulted by the Reporter before making his decision on the Hunterston turbines.http://www.dpea.scotland.gov.uk/CaseDetails.aspx?id=118142

REPLY

D H Telford - January 25th, 2018 at 4:57 pm

If you read all of the papers Aileen you will see ithat the Reporter misrepresented both HPS and the NHS by selective quotation and deliberate omission. This appeal was granted for the political dogma of the current Scottish Government and for no other reason. The three month delay in reporting was occasioned by extensive consultation between the DPEA and the SG's lawyers. They will have known that to grant the appeal would not stand up to the Precautionary Principle and / or Judicial Review but have obviouusly gambled that JR will not be pursued. Perhaps they are right.

REPLY

Aileen Jackson -January 25th, 2018 at 6:57 pm

I think you need to read the decision again David, including the explanation from the case officer regarding the delay. If you were a frequent visitor to the DPEA website you would understand target dates are rarely met. A JR can only be pursued on a point of law. I'm no lawyer but I don' believe you would be successful in this case.

REPLY

D H Telford-January 26th, 2018 at 8:05 am

I note Aileen that, like the Reporter, you have conveniently forgotten to mention the outcome of the class action in the Shivnen Family and others against Enercon Wind Farm Services Limited.

Aileen Jackson-January 26th, 2018 at 8:15 am

No I didn't forget David. They complained about audible noise.

Aileen Jackson-January 26th, 2018 at 8:39 am

To clarify David, there are a number of similar nuisance cases on going at the moment in Scotland.

Sarah Laurie - January 27th, 2018 at 8:48 pm

Steven Cooper has recently demonstrated in a double blind, case control, provocation study that people who have become sensitised to dynamically pulsing amplitude modulated sound will reliably (with 100% accuracy) react directly to that sound whereas those not sensitised via prior exposure are much less likely to perceive the sound. The sound file Steven used was taken from a bedroom at Cape Bridgewater and the levels of sound were inaudible but still perceptible to the noise sensitised study participants. In some instances the short exposure induced severe acute symptoms such that the exposure had to be immediately terminated. The frequencies in the WAV file recording played back in the laboratory did not include infrasound, but rather were between 30 – 1200 Hz. Because these frequencies are inaudible at the levels in the experiment, it is conceivable and indeed understandable that noise sensitised people who can sense them refer to them as "infrasound". This is why full spectrum acoustic monitoring inside noise sensitised people's homes with sufficient detail in the time domain to detect the pulsing which shows exactly what they are exposed to at the time they are experiencing the distressing symptoms is so important. Steven's paper is now published on the POMA website here http://asa.scitation.org/doi/pdf/10.1121/2.0000653

REPLY

2.

Kevin T Ryan - January 23rd, 2018 at 6:05 pm

In response to DB above (appropriate initials!)
What is your point? The article refers to ‘infrasound’ which seems to mean inaudible to humans but the issue, seems to this non expert, to be the potential health damage of high levels of ILFN. Are you saying there is no such issue or that the issue is already well known?

REPLY

Robin MILLETT - January 23rd, 2018 at 10:51 pm

I too was amazed hat DB could make such comment. A non-technical person like me had perfectly understood the beginning of the article that we are talking about those frequencies which are NOT audible but in many research projects has been found to be the cause of a variety of disabling symptoms for humans and to affect animals in negative ways as well.
Totally unrecognized by any health regulations, the low frequency sound produced by wind turbines will one day become a serious health issue for those unfortunate enough to be in range of such large u=industrial machines 200m high and 500m from dwellings as is possible in France.

REPLY

Ronald Gilchrist -January 24th, 2018 at 2:38 pm

I totally agree, Robin … and this is only talking about those who suffer acute symptoms. What is even more worrying is that, from toxicology we know that perhaps everyone is suffering chronic symptoms resulting from long term nexposure to this radiation but this will not be known for years or a decade to come!

REPLY

3.

D'ALESSANDRO - January 23rd, 2018 at 6:50 pm

Bonjour , j’ai besoin de savoir votre avis,vous en tant que spécialistes, à quelle distance mettriez vous des éoliennes ? Moi en tant qu’anti-eolien confirmé,je dirais le mieux c’est de ne pas en mettre du tout ! Cordialement D’ALESSANDRO Marco

REPLY

Agnes Doolan - January 23rd, 2018 at 10:44 pm

Infrasound travels 50 km. approximately. Nobody knows what a safe distance is for today’s 3 MW, 170 metre turbine. I believe that modern wind turbines should be nowhere near people, farm animals or pets. Why put them anywhere? They don’t work except to reap subsidies. J’espere que vous comprennez!

REPLY

4.

Philip J Dickinson - January 23rd, 2018 at 7:47 pm

Bowdler seems to be unaware that “perception” by hearing is not necessarily related to perception by other bodily organs. Has he never felt the presence of a vibration without hearing it? Various organs of the body go into resonance at frequencies way below those perceived by the ear. Military interrogators know this very well, but apparently not Bowdler.

REPLY

Agnes Doolan - January 23rd, 2018 at 10:57 pm

Mr.Bowdler is an acoustician. He is only interested in audible noise. He has stated previously that introducing ILFN into the picture only confuses the issue and he is dismissive of the claim that human health is negatively impacted by exposure to ILFN from any source. Let him work away with his dBA scale but as Mariana shows clearly above he is excluding an awful lot of acoustic energy from the picture. He is not measuring the noise that is actually present. Also Mr.Bowdler seems to think that we only perceive the audible component of the acoustic spectrum (through our ears) Again that is only half the picture. ILFN is perceived by the whole body and impacts the whole body.

REPLY

5.

Dick Bowdler - January 24th, 2018 at 7:47 am

As engineers, we know that 70dB of infrasound represents the tiniest fluctuations of sound pressure in the air of around one tenth of a pascal. Thats fluctuations in air movement that are less than the tiniest breeze through an open window. Perhaps just enough visibly to move a candle flame but probably not. This is what our bodies are being "bombarded" with. Will somebody tell me what part of the human body perceives or reacts to these tiny forces in such a way as to cause ill health. What is the mechanism please?

REPLY

David - January 24th, 2018 at 2:09 pm

Altered cortical and subcortical connectivity due to infrasound administered near the hearing threshold – Evidence from fMRI. Weichenberger et al., 2017.http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0174420

REPLY

6.

Matthew Cand - January 24th, 2018 at 9:07 am

Mr Dickinson: vibration is different to noise, which is one of the many consistent source of confusion in the infrasound debate. And just because you can measure something (with sensitive instruments) doesn't mean that it is significant or affects health: you may be jumping to conclusions based on prejudice.

REPLY

Rita Holmes - January 24th, 2018 at 1:44 pm

Mr Cand, the infrasound debate till very recently has been dominated by those like yourself and Mr Bowdler who are determined to stifle genuine research into infrasound and health effects. What are you so afraid of ? We need regulations governing infrasound .. It was shown as early as the seventies that infrasound could to disrupt the locomotory system in animals , and showing dopamine depletion. You can find reference to this in the AGNIR literature. Get over your fears and blind support for the wind developers and back some further valid research like Professor Pereira`s instead of trying to cover the problem up.

REPLY

7.

Dick Bowdlelr - January 24th, 2018 at 1:28 pm

No, I'm not using dBA. I would like someone to answer the question that I have already posed. What is the mechanism by which the tiniest air movements that are infrasound (not weighted in any way) affect the body and produce the symptoms some people describe. Thats all I want to know.

REPLY

Agnes Doolan - January 24th, 2018 at 7:54 pm

As a former chemistry and biology teacher I was perfectly well able to comprehend the mechanisms as explained by Dr.Alves Pereira and colleagues in the paper: Vibro-acoustic Disease; Biological Effects of Infrasound and Low Frequency Noise Explained by Mechano-transduction Cellular Signalling. Progress Biophysics and Molecular Biology 2007:93;256-279. I suggest respectfully that you need to read that paper with an open mind.

REPLY

Agnes Doolan - January 29th, 2018 at 2:25 pm

Tiniest air movements?? Ah come on! A 169 metre turbine of rotor diameter 120 metres as we have at the Meenwaun wind farm will produce very significant air movements or pressure pulsations as Robert Rand calls them. The acoustic signature of such a turbine can be picked up some 20 miles away.

REPLY

8.

Agnes Doolan - January 24th, 2018 at 5:32 pm

Mr.Bowdler and others might find this article helpful.http://en.friends-against-wind.org/doc/Transcript_of_Dr_Herb_Coussons_15Feb2017.pdf
Dr.Coussons makes the interesting point that the wind industry has no randomised independent studies which show that their product is safe. We all know how quick the wind industry is to tell us who object to turbines that we have no conclusive studies showing that wind turbine noise and infrasound harm people. But then we didn't need randomised studies to prove that cigarette smoking causes lung cancer!

REPLY

9.

Malcolm Hayes - January 24th, 2018 at 5:42 pm

Rita Holmes makes reference to the AGNIR Report and it makes sense to consider this first.

In the summary from the AGNIR Report it states the following:

"One group has suggested that long-term occupational exposure to large pressure amplitude and low frequency noise may cause a diverse pathology, termed vibroacoustic disease (VAD), that is claimed to involve neurological, respiratory and cardiovascular disturbances. While those working in very high levels of audible noise may suffer some adverse consequences, and the prolonged use of hand-held vibrating tools may cause ill-health, there is no evidence that infrasound at levels normally encountered in the environment will lead to the development of VAD. Further, this disease itself has not gained clinical recognition. The few other case studies are not particularly informative regarding risks to health.

Overall, there is a paucity of useful information regarding the potential of infrasound to cause health effects."

Health Effects of Exposure to Ultrasound and infrasound: RCE-14. AGNIR

Alves-Pereira original work related to workers exposed to high levels of sound (> 120 dB) for an extended period (>20 years) and therefore something may have been found although it is appropriate to note that VAD is not a recognised disease outside the research group headed by Alves-Pereira.

The giant leap of faith which has been made is to suppose that ever decreasing levels of infrasound can be identified as the cause of symptoms which Alves-Pereira has identified for the unrecognised disease. If the levels which are purported to give rise to VAD are taken at face value then every single person who uses any form of transport (and that includes walking) for more than 5 minutes will experience a dose value higher than 24 hours of wind turbine noise in the infrasound region.

One of the few peer reviewed investigations into an assertion of VAD symptoms which related to fishermen subjected to high levels of sound from a neighbouring military firing range stated: "The well-executed PSM study does not support the existence of cardiac pathology among Vieques fishermen. Because of the inability of trans-thoracic echocardiography to measure reliably the small differences found, the differences reported are likely due to measurement error (intrinsic to the technique, not the scientists who used it). "

Alves & Co indicated that the PSM study was in error as the control group had experienced IFLN. The point is that everyone experiences ILFN and the levels that are suggested to cause VAD in the general population are achieved even where there is no exposure to an ILFN source. ILFN forms part of the natural noise environment.

As Mr Bowdler has indicated elsewhere, misdirection to this issue is perhaps failing people with real noise problems.

REPLY

Agnes Doolan - January 25th, 2018 at 10:03 am

I beg to point out that VAD is a recognised disease. Read the following;en.friends-against-wind.org/health/medical-testimony-of-dr-coussons

The US recognises VAD in their CMS Guidelines. and have a code for it. CMS = Centres for Medical Services.

REPLY

Agnes Doolan -January 25th, 2018 at 10:24 am

I live in Ireland and am actively involved in the campaign to secure better set-backs from IWTs. Current set-back = 500m. I have a friend who lives near the Mount Lucas Wind farm in the centre of Ireland, 28 Siemens turbines 2.5 MW, and she has been unwell almost from the time the turbines went up. But she has found a doctor in Dublin who is familiar with VAD and is competent to carry out the diagnostic tests for VAD as outlined here.https://www.researchgate.net/publication/290444965_Clinical_Protocol_for_Evaluating_Pathology_Induced_by_Low_Frequency_Noise_Exposure

REPLY

Agnes Doolan -January 25th, 2018 at 10:36 am

The correct link to Dr.Coussons sworn statement is given above in one of my other comments. Apologies

REPLY

Malcolm Hayes -January 25th, 2018 at 10:57 am

You have read your link? It doesn't relate to VAD. So what does you link suggest? It says that infrasound may result in vertigo (T75.23R42). The section T75 actually relates to the effects of vibration. If we look at the AGNIR Report again there is nothing specific relating infrasound to vertigo but what was presented was as follows:

"Takigawa et al (1988) suggested exposure to infrasound could result in very subtle changes in vestibular function. Exposure to 16 Hz at 95 dB(A) for 5 minutes resulted in an inhibition of the body sway normally produced by closing the eyes. This effect was not seen with 5 Hz or using wide octave band noise. Teanaka (1989) found that exposure to 10 – 15 Hz at 130 – 135 dB for 30 minutes did not result in changes in auditory or vestibular function."

So we have one experiment which suggests high levels of audible infrasound may have reduced body sway when one's eyes are shut and another which sees no effect. These levels are much higher than are experienced from a wind farm.

In Salt's paper: Responses of the ear to low frequency sounds, infrasound and wind turbines, he states the following:

"While there have been many studies of vestibular responses to physiologic stimuli (i.e. head accelerations, rotations, etc) comprising of infrasonic frequency components, we are unaware of any studies that have directly investigated vestibular responses to airborne infrasound of similar frequency composition. As people do not become unsteady and the visual field does not blur when exposed to high level infrasound, it can be concluded that sensitivity is extremely low."

He does suggested that for some persons ".. pathologic conditions, coupling of external infrasound may be greater." But this would imply there is something wrong with the person rather than a problem for the general population.

REPLY

Agnes Doolan -January 29th, 2018 at 2:35 pm

Dr.Coussons mentions VAD at least 6 times here.http://en.friends-against-wind.org/doc/Transcript_of_Dr_Herb_Coussons_15Feb2017.pdf

REPLY

10.

Andy McKenzie - January 25th, 2018 at 10:48 am

No-one denies that infrasound from wind turbines, at blade passing frequency and its harmonics, can be detected by appropriate measurement equipment. The only important issue to consider is, however, its magnitude in the context of what may or may not be significant. This is a standard scientific approach.

In 2016, a German company called LUBW (www.lubw.baden-wuerttemberg.de/startseite) published the results of a study entitled 'Low-Frequency Noise incl. Infrasound from Wind Turbines and Other Sources. The company does not appear to have any connection with the wind turbine industry and was carrying out this work for the Ministry of Environment, Climate and Energy at the State Government of Baden-Wuerttemberg, South-West Germany.

The LUBW web-site describes LUBW as 'the competence center of the state of Baden-Württemberg in matters of environmental and nature protection, technical occupational safety, radiation protection and product safety'. It states that 'as an independent state institution, it advises politics and administration in Baden Württemberg on a variety of technical topics, such as climate change and adaptation, wind power and species protection, and flood and low water forecasting, to name but a few. To accomplish these diverse tasks, it captures data with extensive nationwide measurement networks and mapping. These data provide a solid basis for assessing the development of environmental quality in Baden-Württemberg'.

The report, which is in English, can be found at www4.lubw.baden-wuerttemberg.de/servlet/is/262445/. It concludes that 'Infrasound is caused by a large number of different natural and technical sources. It is an everyday part of our environ¬ment that can be found everywhere. Wind turbines make no considerable contribution to it. The infrasound levels generated by them lie clearly below the limits of human perception. There is no scientifically proven evidence of adverse effects in this level range'.

Table 2-1 within the report summarises the results of measurements of wind turbines; road traffic; the urban environment; noise sources in residential buildings (washing machines, heating systems, and refrigerators); the rural environment (open field, forestry); and the sea.

REPLY

Agnes Doolan - January 29th, 2018 at 7:08 pm

We can find studies to support anything under the sun. We are all aware of Germany's Energiwende programme which is costing trillions but failing to reduce CO2. The target is 50,000 turbines.They have been forced to re-open lignite mines as backup when the wind doesn't blow and the sun don't shine.

REPLY

Agnes Doolan - January 30th, 2018 at 5:20 pm

I have a good friend Gerti in Germany. She tells me that LUBW like so many other organisations are trying to prove that infrasound does not harm people. But many doctors and citizens groups are fighting back. She quoted many examples eg this study which shows that infrasound from wind turbines travels more than 20 km;https://l.facebook.com/l.php?u=http%3A%2F%2Fwww.bgr.bund.de%2FDE%2FThemen%2FErdbeben-Gefaehrdungsanalysen%2FSeismologie%2FKernwaffenteststopp%2FProjekte%2Fabgeschlossen%2Fhufe_wka.html%3Fnn%3D1558740&h=ATN-OWF980-EOAnembXPdnqfwWkW_fVHPGVXAfX5pL6QJ1Fd7k_5C8PE40wcyfVM-e3IFeznobp7pQmPtM4aueyIrvl6zvOwh1K3oWHgLc8IRg_yS845Z0pIfDJyoNcLHEe7z0rQdTRtuvbZ

REPLY

11.

Sean O' Dubhlaoigh - January 25th, 2018 at 12:36 pm

"Our experience with the low-frequency noise emissions from a single, 2-MW MOD-I wind turbine demonstrated that, under the right circumstances, it was possible to cause annoyance within homes in the surrounding com- munity with relatively low levels of LF-range acoustic noise. An extensive investigation of the MOD-I situation [1,2] revealed that this annoyance was the result of a coupling of the turbine'S impulsive LF acoustic energy into the structures of some of the surrounding homes. This often created an annoyance environment that was fre- quently confined to within the home itself."
ND kELLEY
November 1987.

REPLY

Rita Holmes - January 30th, 2018 at 1:18 pm

Sean, I fully understand this "annoyance" created within homes. Imagine what it is like for some of us at Hunterston with two 193.8M high offshore wind turbines of 6/7MW My neighbour and I simultaneously experienced coordination and breathing problems which made us leave and seek medical help.. The only relief from symptoms is when they are not turning or when we leave the area. However, although the "annoyance" is worse within our homes, it is also felt/ experienced outside They most certainly cause what is ludicrously termed "annoyance". I find it very "annoying" that I cannot walk or talk properly when the WT`s are on, that I feel my chest is being compressed and every breath is an effort. I have my own theories about mechanisms involved in the detriment to health having actually experienced the effects. There are AGNIR papers on past research to support some of these., but of course, whilst debate like this goes on, our homes are still being rendered unlivable in whilst the turbines turn. I

REPLY

12.

Agnes Doolan - January 25th, 2018 at 3:22 pm

The WHO in its International Classification of Diseases (ICD-10) lists the pathology caused by exposure to ILFN;http://apps.who.int/classifications/icd10/browse/2010/en#/W20-W49. (The ILFN produced by Nature is very different from the ILFN produced by machines)
Chapter XX- External Causes of Morbidity and Mortality
-items W20-W49-Exposure to inanimate mechanical force
W42- Exposure to noise (including sound waves and supersonic waves)
W43- Exposure to vibration (including infrasound waves).
Dr.Alves Pereira and colleagues tell us that ILFN is a mechanical agent of disease leading to the proliferation of collagen between the cells. This leads to a whole body pathology called Vibro-acoustic Disease.

REPLY

Andy McKenzie - January 25th, 2018 at 4:16 pm

To be fair, Agnes, what the WHO list is 'External Causes of Morbidity and Mortality', as you point out, but it includes 'contact with nonpowered handtools', This does not mean that nonpowered handtools are dangerous per se just as infrasound is not dangerous if it is at very low levels as are encountered in most environments.

The LUBW report included human-generated as well as natural sources of infrasound in its comparison study.

Dr.Alves Pereira does not specifiy her pathology in terms of dose-response – merely that she has found it where levels of infrasound are very low such as occur in everyday environments.

REPLY

Agnes Doolan -January 25th, 2018 at 5:55 pm

Her research group have found it in post mortems of people such as the aircraft technicians in Portugal and also by tissue analysis of Wistar rats in the laboratory.The aircraft technicians were exposed to high levels of occupational ILFN. Hence for example 10 % of them developed late onset epilepsy. In the rest of the population just 0.2% develop late onset epilepsy .And Dr.Alves Pereira does not have an agenda against the wind industry. High levels of ILFN occur at coal mines, in public transportation, grain silos, jet aircraft etc.

REPLY

Andy McKenzie- January 25th, 2018 at 8:20 pm

Agnes, I do not disagree with you except that I am confused as to why Mariana is as focussed as she is on the low levels of infrasound, which everyone is exposed to, without any consideration of its magnitude in comparison to that of the high levels which you speak of.

REPLY

Agnes Doolan -January 29th, 2018 at 7:10 pm

Beg your pardon but she found it where levels were high e.g jet aircraft, coal mines, wind farms,grain silos. etc.

REPLY

Andy McKenzie- February 4th, 2018 at 11:10 am

Agnes, I wonder if you have looked at the Table in the LUBW report which compares infra-sound from wind turbines with that from more commonly occurring sources?

REPLY

13.

Agnes Doolan - January 25th, 2018 at 3:34 pm

The International Standards Organisation have acknowledged that Motion Sickness can occur at frequencies below 1 Hertz. It's ISO 9996; 1996 http://www.na-paw.org/Pierpont-ISO-9996.php

REPLY

Andy McKenzie - January 25th, 2018 at 4:17 pm

That is true Agnes. Those kinds of frequencies occur with the rocking of a ship on the sea – hence sea-sickness.

REPLY

Agnes Doolan -January 25th, 2018 at 6:04 pm

Prolonged sea-sickness is no joke.I live on an Island and have endured some unpleasant 22hr sailings from Rosslare to Le Harve. Some people living near wind farms experience a type of nausea like sea-sickness and for someone in the home 24 hrs a day this is not fun. I might point out that 5 turbines of tip height 169 metres, GE 2.75MW were recently constructed about 5 km from my home. Our set-back distance is just 500 metres. There are 22 homes within 1.2 km of turbines. I expect home abandonments in the next few years. Try not to sneer at this Andy.

REPLY

Andy McKenzie- January 25th, 2018 at 8:15 pm

Agnes, I was agreeing with what you and ISO9996 say about motion sickness.

REPLY

Pat Spence-January 27th, 2018 at 12:09 pm

I am surrounded by 184 very large turbines all within a 5 – 6 km radius of my house..I can clearly distinguish the regular thump of the turbines from all other noise and vibration sources – the odd farm bike or tractor, farm animals etc, the wind & rain. This is my experience during 24 hours from Wednesday 24th at about 2 pm. The pains in my ears began intermittently during Wednesday afternoon in the office and became worse during the evening. I went to bed at about midnight and had to lie flat on my back without turning my head to avoid the sharp jabbing pain in both ears and the nausea. I did not sleep until some time after 6 am. When I got up at about 9.30 am every bone in my head seemed to have a neuralgia like pain which continued till I left the house early in the afternoon. The constant thumping of the turbines was not audibly loud but was always an unavoidable presence throughout this 24 hour period. By the time I arrived in Ayr for a 7.30 pm rehearsal, I had recovered and was feeling completely normal and enjoyed the rehearsal. Today, in the office my ears are not so sore as yesterday. Today is a much quieter day wind wise – hardly any – and I could only see about 13 of the 30 turbines visible from here at Kilgallioch turning slowly – as were the Mark Hill ones.
Any comment such as yours that this is some minor inconvenience is insulting. The infrasound from these 184 turbines has ruined my entire life. The amenity of my home, also my work place, has been completely destroyed. I have lived here for 30 years and, as a professional musician, I know every nuance of sound here both before and since the arrival of the turbines.

14.

Sean O'Dubhlaoigh - January 25th, 2018 at 8:01 pm

"Michigan State University noise engineers explain that "Inaudible components [ILFN] can induce resonant vibration in liquids, gases and solids … bodily tissues and cavities – potentially harmful to humans." A subject in the groundbreaking Cooper study describes how the resonance shows up in a glass of water on her kitchen table, and in the toilet bowl, and how she feels it in her body."
https://wattsupwiththat.com/2017/03/08/science-deniers-in-the-wind-industry/

REPLY

15.

Tom - January 26th, 2018 at 10:26 am

Enough said from the end of the article as below, #fake news:

“The opinions expressed in this article are the authors’ own and do not represent the views of Engineers Ireland. For details of the Australian Administrative Appeals Tribunal Decision into the effects, if any, of ILFN on human health, please read the following document (PDF): waubra-and-acnc-decision. The section of the Australian decision that deals with Prof Alves-Pereira’s testimony is on pages 123-124.

Professor Mariana Alves-Pereira

398. Professor Alves-Pereira provided a written report, dated 28 April 2016,
278 and also gave oral evidence during the hearing.

399. We found the evidence of Professor Alves-Pereira to be of limited assistance except to the extent that it was consistent with that of other experts. However, her evidence sharply diverged from that of the other experts in two key respects.

400. Based on very limited studies, she postulated the existence of a phenomena known as “vibroacoustic disease” due to exposure to low-frequency noise, the “hallmark” of which was the thickening of the pericardium. She expressed the opinion that this thickening could only be detected through the use of forms of investigation such as echocardiography or ultrasound imaging.

401. As she acknowledged, Professor Alves-Pereira is not a medical doctor and her opinion as to the existence of this disease and its cause was not supported by any of the other experts, including those with medical qualifications. In these circumstances, we do not accept her evidence as to the existence of vibroacoustic disease being potentially related
to the emissions of wind farms.

402. Professor Alves-Pereira also postulated that the phenomenon of noise annoyance was attributable to prior excessive exposure to infrasound and low-frequency noise resulting in a fusing of the cochlear cilia. Again, this theory was not supported by any of other experts and, indeed, Professor Alves-Pereira conceded that it could only be proved through extensive autopsies combined with detailed histories of the deceased’s lifetime noise
exposure.

403. On the evidence before us, we do not accept that the phenomena of noise annoyance is explained, in whole or in part, by prior excessive exposure to infrasound and/or low frequency noise.

404. Having regard to these and other matters, we are not prepared to attach much weight to the evidence of Professor Alves-Pereira.”

How is this “doctor” getting so much attention, guess the NIMBY / anti-progress brigade really will back anything these days!

REPLY

Agnes Doolan - January 30th, 2018 at 5:30 pm

Thanks Tom. We can all read and have read that for ourselves long ago. You hadn’t the guts to add your surname. So kindly tell us about you and what your professional qualifications are. It’s obvious that some people are feeling very threatened by Mariana’s research. and will go to any length to destroy her reputation. so they go digging up dirt . They won’t succeed! Eventually the lies of the wind industry and its supporters will be exposed. they are fairly well exposed already. However corrupt Governments like our own in Eire have been bought out by the wind industry.

REPLY

Agnes Doolan - January 30th, 2018 at 5:53 pm

Dr.Mariana Alves Pereira is not a medical doctor and never claimed to be such. She has a BSc in Physics, a Masters in Biomedical Engineering and a PhD in Environmental Science. She describes herself as a scientist. Next time she comes to Ireland I will invite you to her lecture if you wish to throw off your cloak of anonymity!!

REPLY

Arthur - January 30th, 2018 at 9:06 pm

Tom,
Tom, Have you read Steve Coopers evidence from the same document.

So we can have a dose-response curve for aircraft that sets a noise level that will protect 90 per cent of the people 90 per cent of the time. We have a dose-response curve for road traffic, which is a different number to aircraft, still to protect 90 per cent of the people 90 per cent of the time. We have a similar curve for rail traffic, again a different number, and so you have different dose-response curves. Work done by Moller in Germany in relation to two surveys that were done in Sweden showed that the dose-response curve for wind farms occurs at a much lower level. So if you use a dose-response curve for general community or road traffic noise, it’s not the same as using it – you can’t use that dose response curve for wind farms until such time as you develop a proper dose-response
curve.

At it's most basic, more research is needed.
And shock horror, Mariana is saying this. She's not the first and she won't be the last.

REPLY

16.

Mike Hulme - January 27th, 2018 at 11:20 am

Having for more than 10 years been at the cutting edge with efforts to gain proper and effective controls for curbing excessive amplitude modulated wind turbine noise (EAM) we are now, sadly, seeing similar attempts at burying the ILFN debate from the very same acoustic firms that have dishonourably obstructed implementation of effective AM controls for so long.

Moreover, one of those firms, Hayes McKenzie Partnership (HMP), two of whose leading members have commented above, are currently 'advising' the local planning authority that the notorious Den Brook wind farm is operating in compliance with its noise limits.

However, in order to achieve this deception, HMP have averaged their measured noise data over, believe it or not, all wind directions. This, of course, flies directly in the face of the Institute of Acoustics' so called Best Practice Guidance which clearly states that such averaging be undertaken with just the downwind data (para 2.4.5). Little surprise then that when assessed in line with IoA Good Practice, the Den Brook turbines are in fact exceeding their noise limits.

So, when HMP are pulling stunts such as the one briefly outlined above, what should we be making of their claims and assertions with regards to ILFN from wind turbines? Can such 'expert' advice be trusted?

It is a very dangerous world indeed when politics & money trump science and engineering facts.

REPLY

Agnes Doolan - January 30th, 2018 at 5:32 pm

Very interesting mike. Thank you.

REPLY

Arthur - January 30th, 2018 at 6:24 pm

It seems HMP are not alone; here in their response to the Institute of Acoustics,
"Supplementary Guidance Notes to A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise" which relies on "Wind Farm Noise
Predictions and Comparison with Measurements by A. Bullmore, J. Adcock, M. Jiggins, M.Cand, the Renewable Energy Foundation find HLA use an incorrect data set; use only a tiny subset of the data; and make false claim:
http://www.ref.org.uk/attachments/article/305/REFIoAConsultation2014.02.07v2.pdf
"3.17 Using the correct set of data completely reverses the results. The following table
summarises the data. From this we can see that whereas Figure 3b in the Hoare Lea paper
suggests that 69% of the predicted points using G=0 are greater than the measured noise
levels, once corrected for wake effects and using their own data, the result, in fact, is that 73% of the measured noise levels are greater than the predicted levels using G=0.

"3.19 A further problem is that the conclusions are based on a tiny subset of the data collected. In spite of collecting data for 57 days, only 26 ten minute data points (0.3%) are used in the key graphs 3b and 3d. Thus, only 4 hours of data out of 57 days' worth inform the conclusions."

REPLY

Aileen Jackson - January 31st, 2018 at 8:29 am

I live in East Renfrewshire which has the highest density of wind turbines per square km. in the UK. It is also host to Whitelee windfarm which I am sure you are all aware of. I am well known throughout East Ren. and further afield as a long term objector due to my experience of living with turbine noise. High levels of infrasound have been measured in my home with no ill effects to me, my family, or neighbours who live even closer to the windfarm in question – 850m . I'm well known throught East Renfrewshire, including those living beside and in the middle of Whitelee but no-one has ever complained to me, our commu nity councils or to our local papers of health effects from turbines other than sleep disturbance from audible noise and that has only been from people living less than 2 km from the turbines – myself included. The population of East Renfrewshire is 100,000! Mike Hulme has visited our area and lived with friends at Whitelee without any ill effect or even being aware of any audible noise. For every person living beside turbines who believe their ill health is due to infrasound, there are millions living beside turbines who really don't have a clue what you're talking about and don't want to get involved in discussions such as this.

REPLY

Agnes Doolan -January 31st, 2018 at 3:31 pm

I would suggest the most of the general public never heard of infrasound.

REPLY

Aileen Jackson -January 31st, 2018 at 3:46 pm

I would suggest they do if they live close to turbines and in East Renfrewshire for the reasons given above, most do!

REPLY

Agnes Doolan-January 31st, 2018 at 5:16 pm

But they don't get sick from ILFN in East Ren. you tell us so why would they hear of infrasound?

Aileen Jackson-February 2nd, 2018 at 10:56 am

Due to the well known fact we have more turbines than anywhere else in the Uk, they are well informed. Pupils from our high schools are required to visit Whitelee and debate the pros and cons of wind energy. My own children included.

Aileen Jackson-February 2nd, 2018 at 1:01 pm

Despite the ridiculous number of turbines, East Renfrewshire is the most sought after place to live in Scotland for young families due to the education record in this small local authority area.https://www.glasgowlive.co.uk/news/glasgow-news/east-renfrewshire-pupils-top-class-13446303

Andy McKenzie - January 31st, 2018 at 9:47 am

See my response on this point elsewhere

REPLY

17.

Philip Hunt - January 27th, 2018 at 2:27 pm

Living 850m from the wind farm in the report i can assure you all i suffer from vertigo, headaches, tinnitus, inner ear feel swollen, heart palpitations plus more and i am certain the wind farm is the cause, i can go away for a week and symptoms ease off on returning home after a while they are back

REPLY

18.

Pat Spence - January 27th, 2018 at 4:21 pm

My home, also my main place of work is surrounded by 184 giant wind turbines all within a 5 – 6 km radius. The following is a description of my experience during 24 hours from Wednesday 24th January: The pains in my ears began intermittently during Wednesday afternoon in the office and became worse during the evening. I went to bed at about midnight and had to lie flat on my back without turning my head to avoid the sharp jabbing pain in both ears and the nausea. I did not sleep until some time after 6 am. When I got up at about 9.30 am every bone in my head seemed to have a neuralgia like pain which continued till I left the house early in the afternoon. The constant thumping of the turbines was not audibly loud but was always an unavoidable presence throughout this 24 hour period. By the time I arrived in Ayr for a 7.30 pm rehearsal, I had recovered and was feeling completely normal and enjoyed the rehearsal. Today, in the office my ears are not so sore as yesterday. Today is a much quieter day wind wise – hardly any – and I could only see about 13 of the 30 turbines visible from here at Kilgallioch turning slowly – as were the Mark Hill ones.
I have lived here for 30 years – so have extensive experience of every nuance of sound/infrasound both before and since the arrival of the 3 wind farms. The level of my experiences corresponds directly to the level of turbine activity. There is no other activity anywhere in the vicinity except farming and forestry which have consistently produced the same noise levels throughout the 30 years. I have also owned the same number of fridges, washing machines etc. during that time. The reality is totally different from the

reporrt you are misguidedly promoting. The standard scientific approach would seem to be lacking in veracity whilst loyally supporting the cause of the wind farm operators.

REPLY

19.

Aileen Jackson - January 27th, 2018 at 4:44 pm

Maybe you should ask Mariana if she approves of your behaviour!

REPLY

20.

Mike Hulme - January 27th, 2018 at 5:21 pm

Having for more than 10 years been at the cutting edge with efforts to gain proper and effective controls for curbing excessive amplitude modulated wind turbine noise (EAM) we are now, sadly, seeing similar attempts at burying the ILFN debate from the very same acoustic firms that have dishonourably obstructed implementation of effective AM controls for so long.

Moreover, one of those firms, Hayes McKenzie Partnership (HMP), two of whose leading members have commented above, are currently 'advising' the local planning authority that the notorious Den Brook wind farm is operating in compliance with its noise limits.

However, in order to achieve this deception, HMP have averaged their measured noise data over, believe it or not, all wind directions. This, of course, flies directly in the face of the Institute of Acoustics' so called Best Practice Guidance which clearly states that such averaging be undertaken with just the downwind data (para 2.4.5). Little surprise then that when assessed in line with IoA Good Practice, the Den Brook turbines are in fact exceeding their noise limits.

So, when HMP are pulling stunts such as the one briefly outlined above, what should we be making of their claims and assertions with regards to ILFN from wind turbines? Can such 'expert' advice be trusted?

It is a very dangerous world indeed when politics & money trump science and engineering facts.

REPLY

21.

Arthur - January 27th, 2018 at 6:48 pm

Aileen, Agnes is simply making an exuberant observation about Engineers Ireland. Agnes is not Mariana's responsibility. Mariana's work stands on it 's own merits and it seems has induced rapid response from a cluster of noise consultants who seem to think they have to understand the mechanism by which ILFN and LFN impact health before they'll do anything. Crikey if we had to wait until we understood the mechanism behind every symptom before we did anything, many of us would be long gone.
as should Mr Bowdlersis not inions stands independently irana, all be it rather exuberantly.

REPLY

Aileen Jackson - January 31st, 2018 at 9:22 am

Well Arthur, I am not a noise consultant but as a long term objector and campaigner who has had one noisy turbine removed and has now proved, thanks to the planning authority's investigations that a nearby windfarm is breaching it's conditions by 9dB, I am happy to confess that in this case, I agree with the noise consultants and I believe that the vast majority of people with or without noise problems, certainly in Scotland will agree with me. Probably one of the reasons the seminar in Glasgow was poorly attended. Most people prefer to ignore rather than argue.

REPLY

22.

Daniel Kane - January 27th, 2018 at 7:03 pm

I am surprised at some of the comments made by the professional acousticians here.

Firstly, have they forgotten already the mistakes of the past? To name just a few:

Excess Amplitude Modulation

Following the Bryn Llewelyn appeal in October 2013 Dr Jeremy Bass of RES, said:

"foolishly … we went along the industry line that amplitude modulation is rare".
Excess AM is now shown to be neither rare nor only causing minor effects

Wake Turbulence

Turbulence, like low frequency noise, occurs naturally. But in certain conditions turbine wake turbulence can exceed it. No account of this excess noise is included in any noise regulation.

Masking Noise

The use of masking noise to justify an increase of the noise limit with wind speed was laid to rest by the pioneering work of van den Berg in 2004. The turbine can be generating power and noise while at ground level there is insufficient wind to generate masking noise.

Secondly, if low frequency noise is so benign, then why did the Danish EPA decide to add low frequency criteria to their wind turbine noise regulations, the same used for general industry. And why did they conclude that larger utility scale wind turbines shift sound energy downward and increase the potential effect of low frequency noise on people inside their homes. And why did the CEO of Vestas write in 2011 to the Minister of Environment for Denmark's DoE stating:

in future low frequency noise will dictate and increase the distance requirements to neighbours for close to half of the projects that we are already aware of…".

Thirdly, if low frequency noise is so benign then what is the problem about including it's measurement in any assessment of impacts? All that will be required is instrumentation to capture the full range of frequencies.

Fourthly, governments continue to rely on acoustic engineers to prepare official guidance both on exposure to wind turbine noise, including the upper limits of dosage and duration, and on separation distances, despite the availability of experts on noise and health. In this, acousticians routinely exceed their area of competence and a lack of physiological expertise is a major methodological flaw rendering any conclusions unreliable.

Fifthly, There is no routine testing for compliance post construction and therefore no feedback on the planning of future wind farms. In cases where complaints have led to noise audits revealing noncompliance, the receptors have sometimes been compensated but no feedback has informed the compliance process.

Finally, there is no mechanism for the collection of information on impacts on nearby residents. An independent academic, epidemiological clinical study of the effects of wind turbine noise on host communities, is urgently required.

In short, this informative article reveals a fundamental reason why regulatory authorities are unable to understand why people complain. To an absence of compliance testing, regulatory review and a mechanism for complaint, should be added Nelson's proverbial 'blind eye' – use of a measurement scale that will not reveal the problem.

REPLY

23.

Agnes Doolan - January 27th, 2018 at 7:16 pm

Some people(!) can actually see infrasound.https://windfarmaction.wordpress.com/2014/07/03/now-you-can-see-infrasound/

REPLY

Andy McKenzie - January 29th, 2018 at 3:14 pm

I'm sorry to be such a pain Agnes, and I really don't want you to think me smug or sneering, but you can see the effects of snow flakes, or even rainfall, being blown by the wind when it is windy. This is the same thing and not something to be concerned about.

REPLY

Arthur - January 31st, 2018 at 8:40 am

Mr McKenzie, we all understand that the action of the wind can be seen in the way it moves falling snow (or rain).

The first question regarding the video, is whether or not the "pulsing" pattern seen in the falling snow is a consequence of the moving turbine blades next to it i.e. if the turbine wasn't there, would the clear pulsing pattern (like giant tadpoles) in the falling snow still be there.
https://www.youtube.com/watch?v=OHl_0s4qqUY
Eolos researchers presumably think not as they are using it to demonstrate the ability to visualize large scale turbulent structures.
What do you think.

REPLY

Andy McKenzie- January 31st, 2018 at 9:27 am

Of course it is a consequence of the moving blades. They are moving the air as you can see by the pattern s in the falling snow.

REPLY

24.

Mike Hulme - January 27th, 2018 at 9:00 pm

Having for more than 10 years been at the cutting edge with efforts to gain proper and effective controls for curbing excessive amplitude modulated wind turbine noise (EAM) we are now, sadly, seeing similar attempts at burying the ILFN debate from the very same acoustic firms that have obstructed implementation of effective AM controls for so long.

One of those firms, Hayes McKenzie Partnership (HMP), two of whose leading members have commented above, are currently 'advising' the local planning authority that the Den Brook wind farm is operating in compliance with its noise limits. To achieve this deception, HMP have averaged their measured noise data over all wind directions; an approach that flies directly in the face of the Institute of Acoustics' so called Best Practice Guidance which clearly states that such averaging be undertaken with just the downwind data (para 2.4.5). Little surprise then that when assessed in line with IoA Good Practice, the Den Brook turbines are in fact exceeding their noise limits.

So, when HMP are pulling stunts such as the one briefly outlined above, what should we be making of their claims and assertions with regards to ILFN from wind turbines? Can such 'expert' advice be trusted?

It is a very dangerous world indeed when politics & money trump science and engineering facts.

REPLY

Andy McKenzie - January 31st, 2018 at 9:33 am

For the record, and for the general readership here, we were obliged to carry out the analysis in this way by a previously agreed protocol which was itself required by the planning conditions.

REPLY

Arthur - February 1st, 2018 at 11:58 pm

Weren't noise consultants present at the Appeal session on Conditions? Why didn't they raise it?
And there was nothing stopping you from highlighting this matter is your compliance report so that the council could, if they wished, raise it with the developer; a responsible developer would likely engage in addressing the problem.

As matters stand, we've got GPG and Supplementaries that contradict ETSU; and for some developments, protocols that contradict ETSU and its GPG and Supplementaries; and even protocols that contradict the planing conditions.
One thing is for sure, there were noise consultants involved every step of the way in this tangled web. Fortunately there are many other noise consultants who seek acoustic excellence.

REPLY

Andy McKenzie- February 3rd, 2018 at 8:32 am

Thank you for your observations Arthur and I wonder if you have read our report? In this case the council and the developer were both aware of the situation as they had specifically agreed it beforehand. So, as said, we were obliged to carry out our work in line with this. If you have an issue with this then the council should be the first port of call.

REPLY

Arthur-February 4th, 2018 at 9:53 am

I'm not sure your obligations under the protocol,quite cut it.

IOA Code of Conduct: A2.3 Members shall raise a concern about a danger, risk, malpractice or wrongdoing which affects others

25.

Agnes Doolan - January 28th, 2018 at 10:12 am

Mariana's research group in Lisbon describe infra-sound as an inanimate mechanical force which causes the build-up of a protein called collagen between the cells leading to a pathology known as Vibro-acoustic disease. In the course of her lecture in Ireland last year Mariana mentioned a chap called Ingber from Harvard. I looked him up and he is a fascinating fellow. He founded and runs the Wyss Institute for Biologically Inspired Engineering;https://wyss.harvard.edu/team/executive-team/donald-ingber/ We think of cells as if they were bricks in a wall just sitting there beside each other with no interaction. Ingber says this is not true. Cells communicate biochemically and mechanically. Ingber has come up with models of how the cells change shape when they are subjected to an inanimate mechanical force! He is part engineer, part biologist and part artist. He coined the term "Tensegrity! (tension and integrity) for the way the cells interact with each other.He says there is Continuous Tension and Discontinuous Compression between the cells. If we are to understand how infrasound affects the cells I believe we need a combination of biology and physics such as is found in Mariana's group in Lisbon.

REPLY

Dick Bowdler - January 29th, 2018 at 7:08 am

Agnes, the reason I'm so concerned about this is twofold. First that there are people near wind farms who are ill. Every person's illness is individual and needs to be individually diagnosed by a doctor. If people insist their illness is caused by infrasound they are in danger of not being properly diagnosed. Second, there are wind farm applications that are totally unacceptable from the point of view of audible noise. They are in danger of going ahead if the audible noise argument is obscured by infrasound. If you want to fight unacceptable wind farm developments you need to do it on terms that the decision makers will understand.

REPLY

Agnes Doolan -January 29th, 2018 at 4:34 pm

If someone near a wind farm is getting ill how can you be absolutely sure that ILFN is not a factor? Please don't quote that old Massachusetts Report or Australia's NHMRC which I see displayed at so-called Public Consultations for Wind Farms. And if you have so much faith in audible noise assessment how come Enfonics who who prepared the Noise Report on Meenwaun differ totally from you in your Noise Critique.? Both of you can't be correct. One of you is wrong but I can't say which one as I am not an acoustician! They implied that you were wrong and the Inspector took their word for it.You don't want ILFN messing up your dBA data so why can't you all agree on a Noise Assessment for a wind farm? You are using ETSU-R-97 as your guidance which many people believe is totally outdated?

REPLY

Arthur - January 30th, 2018 at 8:36 pm

Mr Bowdler, what's a doctor's likely diagnosis when a patient reports that their symptoms started when the wind turbines started operating; and that their symptoms stop when they are away from home …

One way to fight unacceptable developments is to demand further research so that decision makers have the correct tools to do the job. ETSU isn't that tool.

REPLY

Dick Bowdler -January 30th, 2018 at 10:23 pm

Of course, Arthur. That is exactly my point. The doctor may well conclude under those circumstances that it is the turbines. But why would the doctor conclude that its infrasound? Ive been arguing for five years that people who are ill near wind farms should be properly treated – so why are you disagreeing with me?

REPLY

26.

Guy Glencross - January 28th, 2018 at 12:48 pm

I think it right to point out that the acousticians commenting on this research are very happy to use ETSU the noise criteria for wind farms. Their own institution the IOA is riven on this subject. Acousticians can give macro detail on Marianas research whilst using a noise criteria that is 20 years old and barely changed despite review. ETSU is not fit for purpose yet acousticians will still take your money for a flogged horse. Mike Stigwood is a acoustician who is more open to health issues. Physician heal thyself before shredding research from others.

REPLY

Matthew Cand - January 31st, 2018 at 9:01 am

I guess a few people here don't know that Dick has been arguing against ETSU-R-97 for years!
Online debate encourages tribalism: if someone expresses a point of view slightly different to yours then this doesn't mean they are the devil, and maybe you should be trying to understand what they are saying…
In terms of your point, we have known for many years that audible noise (and not just from turbines) is associated with health effects.

REPLY

Arthur - January 31st, 2018 at 9:22 am

And where do you stand on ETSU-R-97 and its GPG and supplementaries Mr Cand

REPLY

Aileen Jackson -January 31st, 2018 at 11:56 am

You and I might not always have a lot in common Matt but in this case I couldn't agree more. Thankfully most Scots at least are sensible, do their research properly (I emphasize this comes in many forms) and hopefully come to the right conclusion. They also appreciate everything Dick has done and many will be indebted to him for life for his professional attitude and kindness..

REPLY

Agnes Doolan -January 31st, 2018 at 12:57 pm

Not much kindness evident in Mr.Bowdler's post on the pages of Scotland against Spin re two English gentlemen following on from Mariana's lecture in Glasgow.. You Aileen are Admin for that Facebook page ,are you not?

REPLY

Aileen Jackson-January 31st, 2018 at 2:06 pm

No Agnes, I don't do Facebook. Never have.

Arthur - February 1st, 2018 at 10:39 pm

guess a few people here don't know that Dick has been arguing against ETSU-R-97 for years!

Mr Cand, indeed he has:
https://www.dickbowdler.co.uk/content/publications/ETSU-R-97_-_The_Alternative_-_Incl_figures.pdf
And he makes some valid points including:
"After more than a decade of insisting that ETSU-R-97 is fit for purpose DECC has asked the IOA carry out a review of the document. However, this review is not a proper independent review by the IOA as does not include the limits which, we are told, "are government policy". If ETSU-R-97 is government policy then the whole document is government policy, not just the noise limits. In any case there is nothing to stop the IOA setting up an independent working group to look at any aspect of government policy it feels needs looking at. So the review is not able to tackle the real problems of the assessment of wind farm noise. Indeed, it will not be truly independent because, as we heard

from the chair of the group at the Wind Farm meeting in January, the work of the group "would be in vain if government did not feel they could endorse it at the end of the day"."

However he makes light of tonals and low frequency noise; two particularly awkward aspects of wind turbine noise for the industry to address and two particularly nasty aspects for residents.

And by chastising folks for raising the matter of infrasound, he is detracting from the fact that some of the symptoms reported by people living near wind turbines are those of low frequency noise exposure. See Sarah Laurie's post on this thread.

And he puts forward the idea that "evidence suggests that illness has not been caused by anything peculiar to wind turbine noise or anything mysterious that we cannot hear or we cannot measure"; and that actually "transparency and involvement" at the planning stage of a wind turbine development might lead to less illness. The idea that transparency and involvement at the planning stage of a wind turbine development would make the disgusting pulsing buzz (like a mild electric shock) inside someones chest or in the back of their head, somehow disappear or be tolerable, is preposterous and dangerous.
https://www.dickbowdler.co.uk/content/publications/AcousticsApril2012_BOWDLER.pdf
You write Mr Cand, that we have known for many years that audible noise (and not just from turbines) is associated with health effects.
We have also known for many years that low frequency noise (audible to some and inaudible to others) is associated with health effects.

REPLY

Arthur - February 2nd, 2018 at 12:12 am

Mr Cand, indeed Mr Bowdler has:
https://www.dickbowdler.co.uk/content/publications/ETSU-R-97_-_The_Alternative_-_Incl_figures.pdf
And he makes some valid points including:
"After more than a decade of insisting that ETSU-R-97 is fit for purpose DECC has asked the IOA carry out a review of the document. However, this review is not a proper independent review by the IOA as does not include the limits which, we are told, "are government policy". If ETSU-R-97 is government policy then the whole document is government policy, not just the noise limits. In any case there is nothing to stop the IOA setting up an independent working group to look at any aspect of government policy it feels needs looking at. So the review is not able to tackle the real problems of the assessment of wind farm noise. Indeed, it will not be truly independent because, as we heard from the chair of the group at the Wind Farm meeting in January, the work of the group "would be in vain if government did not feel they could endorse it at the end of the day"."

However he makes light of tonals and low frequency noise; two particularly awkward aspects of wind turbine noise for the industry to address and two particularly nasty aspects for residents.

And by chastising folks for raising the matter of infrasound, he is detracting from the fact that some of the symptoms reported by people living near wind turbines are those of low frequency noise exposure. See Sarah Laurie's post on this thread.

And he puts forward the idea that "evidence suggests that illness has not been caused by anything peculiar to wind turbine noise or anything mysterious that we cannot hear or we cannot measure"; and that actually "transparency and involvement" at the planning stage of a wind turbine development might lead to less illness. The idea that transparency and involvement at the planning stage of a wind turbine development would make the disgusting pulsing buzz (like a mild electric shock) inside someones chest or in the back of their head, somehow disappear or be tolerable, is preposterous and dangerous.
https://www.dickbowdler.co.uk/content/publications/AcousticsApril2012_BOWDLER.pdf
You write Mr Cand, that we have known for many years that audible noise (and not just from turbines) is associated with health effects.
We have also known for many years that low frequency noise (audible to some and inaudible to others) is associated with health effects.

REPLY

Andy McKenzie - January 31st, 2018 at 10:02 am

Andrew Bullmore, from Hoare Lea, and myself contributed a paper to the Acoustics 2016 Institute of Acoustics (IoA) conference exploring alternatives to ETSU-R-97. The readership here might find this interesting and can find it on the Hayes McKenzie web site together with a presentation of the same material which I made at a one day IoA conference on wind turbine noise.

REPLY

Arthur - February 1st, 2018 at 11:19 pm

Published paper for 2016 not readily apparent on HMP website, although power point presentation is and this references 2015 presentation which is on the website.

It seems that you and Mr Bullmore would like to remove the little protection ETSU-R-97 offers residents and replace it with – basically nothing.

"The discussion presented in the paper points to the possibility that a new assessment methodology would likely not have a simple pass/fail assessment criterion based on set noise limits. Rather, it would more likely aim to provide an assessment of likely impact in line with various noise impact effect levels that form the basis of current planning policy and guidance. The significance of these noise effect levels would then feed into the planning decision making process to be evaluated alongside all other relevant merits and/or adverse impacts of the proposed development.

The discussions also consider the possibility that any newly developed assessment methodology for wind turbine noise should not necessarily be based on a 'relative-to- background' approach. This debate has partly been based on changes in the noise output characteristics of wind turbines as a function of wind speed (which has fundamentally changed since ETSU-R-97 was written), and partly in recognition of the problems associated with agreeing the acceptability of background noise curves on which to base noise limits, and on testing compliance with such limits once a wind farm becomes operational.

A number of alternative possibilities for the setting of noise limits which don't involve the measurement of existing wind speed dependent baseline noise levels are discussed. These include the adoption of fixed absolute noise limits, or noise limits set relative to non-wind related baseline noise levels or agreed generic background noise curves and noise 'dose' related limits.

Possibility is also raised of compliance with the chosen limits being established on the basis of measurements of sound power output on a sample of the installed turbines, coupled with the use of an approved noise prediction methodology to establish noise immission levels at wind farm neighbours, rather than requiring the actual measurement of noise immissions at those neighbouring properties."

REPLY

Andy McKenzie- February 3rd, 2018 at 8:38 am

Thanks also for your comments here Arthur. I'm sorry for the confusion over dates. One of the criticisms of ETSU-R-97 has been its pass/fail criterion which was one of the things we sought to address as it is unusual in EIA terms. Irrespective of how it is addressed in the ES, any consented wind farm would invariably be controlled by planning conditions.

REPLY

Arthur - February 4th, 2018 at 7:05 pm

Mr McKenzie.

The criticism of ETSU-R-97's pass/fail criterion is it's failure to protect the public.

Please provide studies of wind farm noise that identify the noise level (in any relevant acoustic index) that would protect the acoustic amenity of residents in proximity to wind farms and that will not give rise to sleep disturbance.

REPLY

Andy McKenzie- February 5th, 2018 at 3:56 pm

I don't believe that any definitive studies have been carried out. Moreover the word 'protect' is rather subjective unless you are talking inaudibility which rather goes beyond what is required by planning in almost all jurisdictions. Hayes McKenzie have been lobbying for a large scale 'acceptibility' study to be carried out in the UK for almost 20 years and a project was almost started at the Institute of Sound and Vibration Research at Southampton University but it fell through.

REPLY

Arthur - February 7th, 2018 at 8:36 pm

Mr McKenzie, you write that you don't believe any definitive studies have been carried out that identify the noise level (in any relevant acoustic index) that would protect the acoustic amenity of residents in proximity to wind farms and that will not give rise to sleep disturbance.
What then are you basing your review of ETSU-R-97 on? I see no reference to the experience of residents or to the studies (definitive or otherwise) that have looked at this. Without establishing a dose/response relationship you cannot establish an assessment method meriting attention.

You find the word 'protective' subjective; in this scenario, why not start with, 'protective such that people don't have to go to court so that thev can sleep at night.' In terms of PPG Noise Effect Levels, this is an Unacceptable Adverse Effect.
PPG also states, "The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected." PPG goes on to say this depends on the absolute level of the noise together with the time it occurs, its spectral content, and its characteristics. Wind turbine noise is loud, it is continuous i.e. 24/7, 365 days of the year, for 25 years; it has low frequency and infrasound content, it has tonals, and it is amplitude modulated across the noise spectrum.

You raise ‘inaudibilty’: – inaudible to who? – inaudible based on what? https://docs.wind-watch.org/Swinbanks-NASA-Langley-noise-research.pdf“Finally, they [NASA] measured in practice the low-frequency threshold of hearing under laboratory conditions, for persons subjected to impulsive wind-turbine noise, and showed this could be almost 20dB lower (i.e. more sensitive) than the conventionally accepted noise threshold for less obtrusive sounds (1982, [3]).”
You write that inaudibility “rather goes beyond what is required by planning in almost all jurisdictions.” What are you saying, if somethings inaudible, its not a problem? If somethings a problem, its a problem whether its audible or inaudible e.g. radon, water pollutants etc

Why did the ‘acceptability’ study fall through?

Until dose response studies are done, wind turbine developments should cease and the only thing you need to worry about is how to help the people whose homes and lives you’ve damaged through the production of a noise method assessment that was, in effect, plucked out of thin air.

REPLY

27.

Andy McKenzie - January 29th, 2018 at 10:19 am

I do not feel in the slight bit threatened Agnes and I doubt that anyone else in the acoustics industry does. What we all care about quite passionately is cause and effect. And where there is cause without effect (i.e. high levels of infra-sound in, say, passenger cars) and effect without cause (.ie. people feeling ill due to levels of infra-sound akin to background noise) we have to be careful about claiming any relationship between the two.

As for what you call the ‘wind farm gravy train’, this sort of thing actually generates work for those working in the industry – or against it.

And I don’t feel smug in the slightest.

REPLY

Agnes Doolan - January 29th, 2018 at 11:08 am

Cause; Exposure to ILFN from ANY source; Effect; Proliferation of collages between cells as shown by 38 yrs of research by the Portuguese group.

REPLY

Andy McKenzie -January 29th, 2018 at 11:34 am

Well this goes to the route of my confusion Agnes. The LUBW report which I refer to in an earlier comment notes the extent of infrasound from road traffic; the urban environment; noise sources in residential buildings (washing machines, heating systems, and refrigerators); the rural environment (open field, forestry); and the sea. These are clearly not a cause for concern and yet they all generate infra-sound.

REPLY

28.

Philip Hunt - January 29th, 2018 at 12:11 pm

Living 850m away from the wind farm in this report i can truthfully say i am affected by infrasound, testing has been done here, my symptoms include vertigo, headaches, ears feel swollen/full, to name just a couple, i know the wind farm is the cause, i can go away for a week and the symptoms ease up on return back home after a while the symptoms return again, this is my blog on living by a wind farm http://windfarmtorture.blogspot.ie/

REPLY

29.

Arthur - January 31st, 2018 at 12:39 am

Response to Dick Bowdler's post of Jan 30th 10.23
Mr Bowdler, I raise issue with your posts because you appear to be focused on obviously audible noise yet this ignores the symptoms causing complaint around the world that are described as a sensation or feeling e.g. pressure on ears; popping ears; an intermittent buzz/pulse in the head or chest etc. When the onset of these symptoms coincided with the start of turbine operation and when the symptoms cease when the complainant is away from the turbines, what is the proper treatment you are arguing they should receive?

REPLY

30.

Agnes Doolan - January 31st, 2018 at 2:54 pm

Aileen Jackson Have you any connection to this site?https://scotlandagainstspin.org/2017/10/a-note-on-infrasound-and-wind-turbines-dick-bowdler/ You come across as an enthusiastic supporter of Mr.Bowdler's professional expertise. and be very glad that you do not suffer any unpleasant health impacts from wind turbines. We have all known for many years that SOME people suffer debilitating symptoms in the vicinity of wind turbines. Our own DCMO in the Dept. of Health, Dr.Colette Bonner stated that in a famous letter a few years ago. She also stated that these people should be treated sensitively.

REPLY

Aileen Jackson - January 31st, 2018 at 3:19 pm

That is not a Facebook page Agnes, it is a website. The only connection I have to the website is posting some news articles. I am not a webmaster/ administrator as you can see from the home page. You keep veering off at a tangent BTW.

REPLY

Arthur - February 1st, 2018 at 11:32 pm

Agnes and Aileen,

Remember the source of both of your problems is the same i.e. wind turbine noise immissions!

And I'm quite sure Aileen that Mr Bowdler is perfectly capable of presenting his case in the decision making process without it being damaged by those who want to raise the matter of low frequency noise and infrasound.

REPLY

Aileen Jackson -February 2nd, 2018 at 8:02 am

I wasn't aware Agnes was suffering from a problem with wind turbine noise immissions, Arthur. As for your other point, Mr Bowdler has commented elsewhere as you already know.

REPLY

Arthur-February 2nd, 2018 at 8:23 pm

I'm not aware I said whether she was or wasn't 'suffering'

Aileen Jackson-February 5th, 2018 at 2:33 pm

You said "Remember the source of both of your problems is the same i.e. wind turbine noise immissions!" If she had that problem she would be suffering! She hasn't mentioned she has a problem with immissions.

Arthur -February 5th, 2018 at 7:58 pm

Aileen, I have no idea about Agnes' situation but has it occurred to you that there are many good people out there supporting those suffering the impact of wind turbine noise, who may not themselves be impacted.

REPLY

31.

Agnes Doolan - January 31st, 2018 at 3:16 pm

Noise Sensitization; Sarah Laurie, Bob Thorne and Steven Cooper presented this excellent summary of our knowledge to date at a conference in New Orleans , December 2017http://waubrafoundation.org.au/resources/laurie-thorne-cooper-startle-reflex-sensitisation/

REPLY

Agnes Doolan - January 31st, 2018 at 3:21 pm

The correct link on Noise Sensitisation by Sarah Laurie, Bob Thorne and Steven Cooper; http://waubrafoundation.org.au/resources/laurie-thorne-cooper-startle-reflex-sensitisation/

REPLY

Dick Bowdler -February 2nd, 2018 at 6:54 am

The word "Infrasound" occurs once in that article in the phrase "The sound did not include infrasound". So what relevance does it have to the infrasound discussion?

REPLY

Arthur -February 2nd, 2018 at 10:05 am

Mr Bowler and Eileen, is it alright with you two if people bring up the matter of LFN (rather than infrasound) with the decision makers?

REPLY

Aileen Jackson-February 2nd, 2018 at 10:31 am

It's certainly not up to me to tell people what they can bring up with decision makers, Arthur but in my opinion the two should not be lumped together and I believe they were discussed separately at last years international noise conference. However Mr Bowdler will know more about that than me.

32.

Agnes Doolan - January 31st, 2018 at 5:11 pm

My Finnish friend Kurikka Karajavouri whom I follow on Twitter (@karajavuori) tells me that the Finns have developed an instrument for measuring infrasound from wind turbines;http://www.auniogroup.com/wp-content/uploads/2017/10/InfrasoundAunioGroupKauppaSuomiwk342017.jpg. The instrument is relatively cheap and they have about 20 of the instruments to give out on loan to families living near wind turbines some of which are very large, over 200 metres. At present the Finns are doing a Pilot Study on infrasound from turbines.

REPLY

Dick Bowdler - February 2nd, 2018 at 7:02 am

Yes, this is a businessman who sees a lucrative market in selling and hiring infrasound meters to people who believe infrasound is a problem. Its the same businessman who sells ear buds that shine a light into your ear to brighten up your mind.

REPLY

Agnes Doolan -February 3rd, 2018 at 5:28 pm

Cheap comment Dick. The wind industry is providing a lucrative market for you and your fellow acousticians who measure only one part of the sound spectrum.

REPLY

Agnes Doolan -February 3rd, 2018 at 9:16 pm

€217 per month sounds reasonable to me.https://t.co/r8GVoewLLa

REPLY

Aileen Jackson -February 4th, 2018 at 7:57 am

You must be in a very fortunate financial position Agnes.

REPLY

Agnes Doolan-February 4th, 2018 at 12:41 pm

Far from it.But if a community shares the cost of hiring the equipment they can spread the cost.

Aileen Jackson-February 4th, 2018 at 2:46 pm

Slightly misleading Agnes. To get it for that price per month you need to hire it for a minimum of 6 months costing you 1300 and then pay extra for analysis.
Price list

The table below shows the prices for individuals. Prices include VAT (24%). For companies and institutions we have different pricing. The customer will have access to what the measuring device is measuring and the data can be loaded to ones own computer. With extra fee we will go through the detailed measurement data with the customer or deliver a detailed written report to the customer.
Rental Period
€ / m
a total of €
1 months
508
508
2 months
332,8
665
3 months
274,9
825
6 months
217
1300

33.

Arthur - February 2nd, 2018 at 8:21 pm

Aileen in your post, February 2nd, 2018 at 10:31 am you write
It's certainly not up to me to tell people what they can bring up with decision makers, Arthur but in my opinion the two should not be lumped together and I believe they were discussed separately at last years international noise conference. However Mr Bowdler will know more about that than me.

This is exactly my point; as you rightly point out, it's not up to you to tell people what they can bring up with decision makers; and neither is it up to Mr Bowdler . Yet in his article 'A note on infrasound' this is what he attempts to do.https://scotlandagainstspin.org/2017/10/a-note-on-infrasound-and-wind-turbines-dick-bowdler/
You do however suggest that LFN should be discussed separately as they were at last years international noise conference. On the same basis, surely people who wish to bring up infrasound with decision makers could do so separately from the obviously audible noise and from LFN. As such Mr Bowdler is perfectly capable of putting such an arrangement to decision makers and/of being clear that he is only dealing with obviously audible noise.
In his Note on infrasound, Mr Bowdler states that various government departments say there is no evidence of health effects arising from infrasound generated by wind turbines and asks us to consider who is right . This is a nonsense on two counts, firstly until the research is done, the fact there there is no evidence means little and 2) Mr Bowdler himself knows that government bodies can be wrong, indeed, he appears to take issue with the government's insistence that ETSU-R-97;
"No other standard anywhere in the world has a night time limit higher than a day time limit. After more than a decade of insisting that ETSU-R-97 is fit for purpose DECC has asked the IOA carry out a review of the document. However, this review is not a proper independent review by the IOA as [it] does not include the limits which, we are told, "are government policy". If ETSU-R-97 is government policy then the whole document is government policy, not just the noise limits. In any case there is nothing to stop the IOA setting up an independent working group to look at any aspect of government policy it feels needs looking at. So the review is not able to tackle the real problems of the assessment of wind farm noise."

https://www.dickbowdler.co.uk/content/publications/1508081412_ETSU-R-97_-_The_Alternative_-_Incl_figures.pdf
In this article, Mr Bowdler demands the evidence; how can anyone give him the evidence while the research is in its infancy.

REPLY

Aileen Jackson - February 3rd, 2018 at 1:50 pm

I have never told anyone what they can or cannot do Arthur and I absolutely disagree that Mr Bowdler is telling anyone what they should and should not bring up with decision makers in that article either. I'm not suggesting that LFN should be discussed separately, I am saying that in my humble opinion it should be and I believe it was. I can't answer on behalf of Mr Bowdler.

REPLY

Arthur - February 3rd, 2018 at 4:26 pm

Aileen, all I'm saying is that if LFN can be covered separately from obviously audible noise, then perhaps infrasound can too.

What do you think DB's message is in his 'Note on infrasound' article?

I completely agree with DB that in many cases wind turbine noise "is too loud and has a character that is objectionable"
However, supposing we get the obviously audible noise better controlled and find there are still problems. It's important that all aspects of the noise from wind turbines is understood and controlled and that includes LFN and infrasound and we need to be looking at all of these now and how they work in combination; there is no time to waste, people are losing their homes.
And you should not be going through what your going through to protect your home either.

DB's focus on infrasound unfortunately distracts somewhat from LFN; the title of this article refers to infrasound and low frequency noise. As Sarah Laurie suggests above, some people may describe low frequency noise as infrasound.

How come the turbines near you have been running as high as 9dB outside the noise limits – that's ridiculous, how did that happen?

REPLY

Aileen Jackson -February 3rd, 2018 at 6:35 pm

Suggest you read his last sentence in the article Arthur. As for our problems, Mr Bowdler advised our council four years ago, to undertake a thorough investigation before consenting any more turbines in the area as Conditions were already being breached but in their efforts to avoid expensive and time consuming appeals, they continued to do so. https://scotlandagainstspin.org/2017/09/noise-bulletin-septoctober-2017-by-kind-permission-of-jack-pease/

REPLY

Arthur-February 5th, 2018 at 8:11 pm

Aileen I asked you what do you think DB's message is in his 'Note on infrasound' article not what the last line of it said?
I really don't know why you're having a go at folks who want wind turbine noise controlled such that people don't end up in situations like the one you're in.

Aileen Jackson-February 5th, 2018 at 9:43 pm

Arthur< I don't have a clue what you're talking about. I may have had high levels of infrasound measured in my house but it does not affect me.

Aileen Jackson-February 5th, 2018 at 9:56 pm

And as for Mr Bowdler's message – I don't think he could make it any plainer, in that article or in his posts here.

Andy McKenzie- February 5th, 2018 at 10:21 am

Arthur, I agree with you although not with your comments about Dick Bowdler, who is specifically addressing the infrasound debate. If Mariana and others specifically addressed audible low frequency noise then that would be a very genuine issue even at low level because of the way the ear works. It was found to be an issue in the Cape Bridgewater study but completely ignored in preference to focussing on imperceptible infra-sound,

REPLY

Arthur - February 6th, 2018 at 8:45 pm

You agree with me on what exactly Mr McKenzie.

You write that "audible low frequency noise even at low levels is a very genuine issue", yet I see no mention of lfn in your work with Mr Bullmore on 'What would an alternative to ETSU-R-97 look like'.

You refer to 'audible' lfn; audible to who; the recent work by Mr Cooper finds subjects sensitised via prior exposure, could detect the operation of the inaudible test signal.

While on the subject of "the way the ear works", you know the ear doesn't hear average noise don't you i.e. the ear hears "quite – whoomp – quite – whoomp"; it doesn't hear half a whoomp; and it hears a pulsing hum, not half a pulsing hum.

As for your reference to "imperceptible" infrasound, note, it doesn't follow that because something is imperceptible, it has no effect e.g. bacteria can be imperceptible when you eat it but still make you ill. In other words, while infrasound itself may not be noticeable, it's effects may be. Indeed Persinger writes "Moderate strength correlations occur between the incidences of infrasound and reports of nausea, malaise, fatigue, aversion to the area, non-specific pain, and sleep disturbances when pressure levels exceed about 50 db for protracted periods. Experimental studies have verified these effects."

As for Cape Bridgewater, the trend was found in complaints versus infrasound.

"Based on the complaints we found certain wind speeds (power outputs) that gave rise to complaints. The challenge was then finding the sound levels that related to complaints. dBA doesn't work. We found it correlated well with the wind speed but not with the noise from the wind farm. We then tried 1/3 octave bands and various acoustic parameters that have been used for noise and wind farm investigations and still no trend. It was not until we tried the complaints versus the infrasound narrow band signature that we found a trend. And sensation came out as the major impact."

So It seems that what you might term 'imperceptible' infrasound, may not only effect people but also be be perceptible by some, possiibly those sensitised by prior exposure in the same manner as those sensitised to lfn by prior exposure.

REPLY

Arthur - February 7th, 2018 at 12:29 pm

PS
Bearing in mind Mr McKenzie, that you write "audible low frequency noise even at low levels is a very genuine issue", it is unfortunate that your report to the DTI in 2005 on lfn, concluded that the complaints were caused by by amplitude modulation of aerodynamic noise (AM) not lfn from the wind turbines. As such lfn remains unaddressed (as does AM).

REPLY

34.

Mike Hulme - February 3rd, 2018 at 7:00 pm

Dr Andy McKenzie is clearly adamant that his firm, HMP, were "obliged" to carry out the fatally flawed compliance assessment concluding that the Den Brook wind farm is operating within its specified noise limits when, in fact, it clearly is not (see his posts 31st January at 9:33 am and 3rd February at 8:32 am).

What Dr McKenzie fails to tell us however is that the Protocol which he claims obliged his firm to apply inappropriate procedures is vague and open to interpretation in respect of the particular aspect in question, i.e. wrongly averaging the measured noise over all wind directions rather than just the downwind direction.

Compounding the deception, and raising even deeper concerns is that Dr Jeremy Bass on behalf of the wind farm's operator, RES, devised the seemingly flawed Protocol which was then reviewed by Mr Bob Davis of Robert Davis Associates for the local planning authority. Mr Davis subsequently advised the LPA that the Protocol "is satisfactory and that the Council could reasonably approve it."

Not only might we expect the above mentioned professional acousticians to know better than devise, recommend or follow a flawed procedure but that they should be fully conversant with the Court of Appeal's ruling in the case of Den Brook, i.e. planning conditions are to be interpreted not just literally but in line with the Planning Inspector's intentions when imposing said conditions.

Obviously, the Inspector would not have intended neighbours to be impacted by greater levels of noise than permitted by the wind farm's noise limits. Whereas, Messrs Bass, Davis and McKenzie are clearly unwilling to respect the Inspector's intentions nor for that matter the Den Brook neighbours' amenity rights. Indeed, their combined and plainly unethical actions demonstrate contempt for both the wind farm's neighbours and the Government Planning Inspector.

REPLY

Arthur - February 4th, 2018 at 10:33 am

I'm not sure Mr McKenzies 'obligations under the protocol', quite cut it.

IOA Code of Conduct: "A2.3 Members shall raise a concern about a danger, risk, malpractice or wrongdoing which affects others"

REPLY

Arthur - February 7th, 2018 at 12:40 pm

From McKenzie and Bullmore, "What Would an Alternative to ETSU-R-97 Look Like?:

"Traditionally, demonstrating that a wind farm could meet its ETSU-R-97 derived noise limits was done on the basis of the calculated noise levels under worst case downwind propagation conditions."

But not so at Denbrook?

REPLY

35.

Aileen Jackson - February 3rd, 2018 at 10:00 pm

I hope we all know what to do when things get personal!

REPLY

36.

Dick Bowdler - February 4th, 2018 at 7:15 am

The discussion has gone well beyond my opening remark about infrasound into the problem of wind farms generally. For the record, I have been arguing against the ETSU-R-97 limits for nearly 20 years (2001) and I still am. The problem is that, if you are putting a case to the local authority or arguing at a public inquiry your argument has to be framed within planning policy and guidance because that's how planning decisions are made. So if you want to make your point against ETSU-R-97 or if you want to argue that infrasound from turbines makes people ill you have to do it outside the planning system. Agnes argues for better set-backs – I agree the Irish guidance is unacceptable – but you are wasting time and money if you argue it in the planning system. Lobby government. Give evidence to those drawing up planning guidance and so on. You won't change it overnight, that's not how politics works, you just have to keep chipping away.

REPLY

Arthur - February 4th, 2018 at 9:44 am

How do you suggest LFN should be tackled?

And what about the precautionary principle?

Anyway raising EAM / OAM during planning and appeal hearings eventually resulted in a planning condition (Denbrook) and then – well some noise consultants didn't like it ……

REPLY

37.

Agnes Doolan - February 4th, 2018 at 4:00 pm

Interview with Steven Cooper recorded just a few days ago;http://en.friends-against-wind.org/health/the-problem-of-wind-turbine-noise Here's an acoustician who seems to be genuinely interested in the experience of wind farm neighbours.

REPLY