

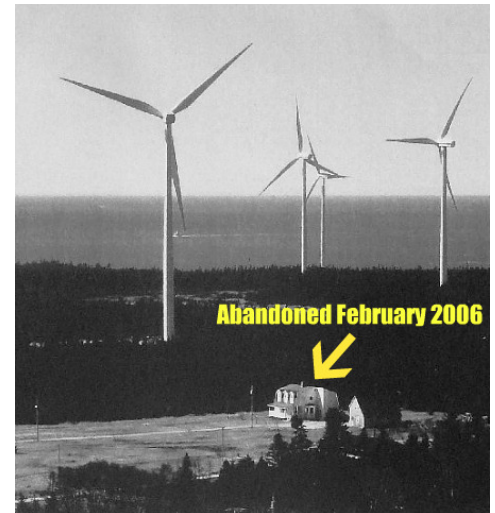
G. Leventhall, PhD

## The Strange Case of Dr. Geoff Leventhall

by

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There is a man named Dr. Geoff Leventhall from the United Kingdom who hires himself out to wind energy companies as a noise consultant—the noise being from industrial wind turbines.

The interesting thing about this Leventhall is that he insists, in the face of clear evidence to the contrary, that industrial wind turbines produce no low frequency noise (basically, infrasound) of consequence. So he wrote in the *Malone (New York, USA) Telegram* this past autumn, "I have always said . . . there is no problem of infrasound from wind turbines" (p. 4). Earlier this month (February 2006) he was quoted in the *Hawke's Bay Today (New Zealand)* newspaper as saying, "'I can state quite categorically that there is no significant infrasound from current designs of wind turbines.'"

Dr. Leventhall doesn't seem to know what he thinks. For when we turn to his May 2003 DEFRA (UK) "Review of Published Research on Low Frequency Noise and Its Effects," he writes: "Infrasound . . . is common in urban environments, and as an emission from many artificial sources . . . including wind turbines." Oops! Leventhall goes on: "*The effects of infrasound or low frequency noise are of particular concern because of its pervasiveness due to numerous sources, efficient propagation, and reduced efficiency of many structures (dwellings, walls, and hearing protection) in attenuating low frequency noise compared with other noise*" (p. 54, emphasis added). (Turn to the footnote back on p. 53 of the "Review" and we're told this section was "contributed by" Dr. P.L. Pelmear. This does not let Leventhall off the authorial or ethical hook, however; as lead author he must take full responsibility for everything in his report.)

Like I say, Leventhall doesn't seem to know what he thinks. For that matter, it's not clear he and his co-authors do the thinking they take credit for. When we turn to Dr. Birgitta Berglund's "Sources and Effects of Low-Frequency Noise" in the *Journal of the Acoustical Society of America* (May 1996), we find that the entire paragraph, above, appears to be lifted virtually verbatim from Berglund's article (compare the two paragraphs, below).



Hmmmm. Pelmear/Leventhall fail to acknowledge Berglund as their (apparent) source, nor do they put quotation marks around their text. A double infraction. (When I was a university professor, I gave students a failing grade for copying someone else's material without credit; indeed I had a colleague who was de-tenured and fired for publishing other people's text without credit.)

At a minimum, Leventhall appears to be careless. He also appears to be indecisive. Mostly, however, given the growing body of research on low frequency noise from industrial wind turbines (see GP van den Berg's scholarly articles, along with Dr. O. Soysal's noise measurements at the Meyersdale, PA, USA, windplant, and Dr. DMJP Manley's research), Leventhall seems to be a man representing, above all, the agenda of the wind energy companies (like Noble Environmental, LLC) that employ his services.

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**I have always said**, and am now backed up by recent work from others, **that there is no problem of infrasound from wind turbines.**

— Geoffrey Leventhall, *Malone (New York, USA) Telegram*, **9-12-05**, p. 4

**Dr Geoff Leventhall, a noise vibration and acoustics expert from the UK who looked into infrasound at the request of Genesis Power, says "I can state quite categorically that there is no significant infrasound from current designs of wind turbines".**

— Geoffrey Leventhall, *Hawke's Bay Today (New Zealand)*, **2-18-06**

Infrasound exposure is ubiquitous in modern life. It is generated by natural sources such as earthquakes and wind. It is common **in urban environments, and as an emission from many artificial sources: automobiles, ... aircraft, industrial machinery, artillery and mining explosions, air movement machinery including wind turbines, compressors, and ventilation or air-conditioning**



**units.... The effects of infrasound or low frequency noise are of particular concern because of its pervasiveness due to numerous sources, efficient propagation, and reduced efficiency of many structures (dwellings, walls, and hearing protection) in attenuating low frequency noise compared with other noise.**

- Geoffrey Leventhall, "A Review of Published Research on Low Frequency Noise and Its Effects," Report for DEFRA (United Kingdom) by Dr. Geoff Leventhall, Assisted by Dr. Peter Pelmeare and Dr. Stephen Benton, **May 2003**, p. 54.

Low-frequency noise is common as background noise **in urban environments, and as an emission from many artificial sources: road vehicles, aircraft, industrial machinery, artillery and mining explosions, and air movement machinery including wind turbines, compressors, and ventilation or air-conditioning units. The effects of low-frequency noise are of particular concern because of its pervasiveness due to numerous sources, efficient propagation, and reduced efficacy of many structures (dwellings, walls, and hearing protection) in attenuating low-frequency noise compared with other noise.**

- B. Berglund, P. Hassmen, and RF Job, "Sources and Effects of Low-Frequency Noise," Journal of the Acoustical Society of America, vol. 99, no. 5 (**May 1996**):2985-3002, Abstract.



## Letters to the editor

### Not 'employee of Noble'

#### To the editor:

I am accustomed to having my views misrepresented by both sides of the wind farm debate, but in her letter published on August 30th, Kaye Johnson is going a bit too far. I believe that she has impugned my ethics, morality and scientific integrity. Although it would probably be futile to ask her for an apology, I expect you, as a party to this, to publish some facts.

I am not "an employee of Noble," a term which implies dependence on them for my income. I am an independent noise and vibration consultant and Noble is one of my many clients, contributing a very small part of my turnover.

I have never "provided the scientific community with hard evidence about the severity of the noise problem around industrial wind turbines." That is one of the many misrepresentations by objector groups. I am known internationally for my work on infrasound and low frequency noise, which is the area for which Noble retained me, as it is in these areas that I have made statements about wind turbine noise. I have been consistent in my views and am not now "singing a different song."

I have always said, and am now backed up by recent work from others, that there is no problem of infrasound from wind turbines.

Low frequency noise arises from the mechanical systems in wind turbines and from particular inflow air conditions. Mechanical noise is not a problem in modern wind turbines. Turbulent air inflow may increase levels of low frequency noise due to the interaction of the blades with the turbu-

lence. This is normally an occasional occurrence for a turbine, if at all.

The regular swish - swish from wind turbines is not low frequency noise, but a change in level of a high frequency. This is an important point as, over the years, infrasound and low frequency noise have attracted a lot of negative baggage, which has been applied, incorrectly and without justification, to wind turbines. My advice to objector groups in this connection has been that, by squandering their energies on infrasound and low frequency noise, they are losing credibility and not giving sufficient attention to other factors, such as optimum siting of the turbines.

I am organising an International Conference on Wind Turbine Noise to be held in Berlin, Germany 17/18 October 2005 - see [www.windturbine-noise2005.org](http://www.windturbine-noise2005.org) - where it is hoped that delegates from all sides of the debate will be present.

**Dr. Geoff Leventhall  
Ashted, Surrey, UK**

## **“And the beat goes on . . .and on and on”**

*Hawke's Bay Today* (New Zealand), February 18, 2006

### **KATHY WEBB**

They call it the train that never arrives. It's a low, rumbling sound that goes on and on ... and on.

Sometimes, in a stiff easterly, the rumbling develops into a roar, like a stormy ocean.

But worst of all is the beat. An insidious, low-frequency vibration that's more a sensation than a noise. It defeats double-glazing and ear plugs, coming up through the ground, or through the floors of houses, and manifesting itself as a ripple up the spine, a thump on the chest or a throbbing in the ears. Those who feel it say it's particularly bad at night. It wakes them up or stops them getting to sleep.

Wendy Brock says staff from Meridian Energy promised her the wind turbines at Te Apiti, 2.5km [1.6 miles] from her Ashhurst home in southern Hawke's Bay, would be no noisier than waves swishing on a seashore.

"They stood in my lounge and told me that."

But during a strong easterly, the noise emitted by the triffid-like structures waving their arms along the skyline and down the slopes behind the Brock family's lifestyle block is more like a thundering, stormy ocean. Sometimes it goes on for days. And when the air is still, there's the beat - rhythmic and relentless, "like the boom box in a teenager's car".

"It comes up through the floor of our house. You can't stop it."

Mrs Brock says she can feel it rippling along her spine when she's lying in bed at night. Blocking her ears makes no difference.

"It irritates you, night after night. Imagine you've done your day's work, then you go to bed, and there's this bass beat coming up through the floor and you can't go to sleep. You can't even put headphones on and get away from it.

"My older son sometimes gets woken up by the noise. He gets up and prowls around the house."

She tells of other Ashhurst residents who "feel" the sound hitting their chests in the Ashhurst Domain 3km [1.9 miles] from the turbines. She says one woman is so distressed by the sensation she has put her home on the market.

Not everyone in the village hears the infrasound – Mrs Brock reels off the names of residents wondering what the fuss is all about - but says those who do feel the sound are distressed by it and have nowhere to turn for redress.

There's little point complaining to the Tararua District Council because all it does is record each complaint and forward it to Meridian, and nothing ever happens.

"What are they (the council) going to do to Meridian - fine them, or shut down the

turbines?" asks Mrs Brock.

Meridian is dismissive of complaints about noise from Te Apiti.

"Infrasound is just not an issue with modern turbines," insists spokesman Alan Seay.

"We take it very seriously. We have looked into it seriously, but the advice we are getting from eminently qualified people is that it is just not an issue."

Many people claiming to be putting forward scientific argument about noise from turbines "are not qualified in this area of expertise. I have a problem with some of their statements", Mr Seay said.

He asked Hawke's Bay Today for the names of those complaining about noise from Te Apiti.

Asked why he wanted the names, he replied: "There is a group of people there. They are opposed to wind farms per se".

Asked why he thought they were opposed, Mr Seay said "I don't want to speculate. They just are. Possibly for the visual impact."

Meridian had complied with all legal requirements for sound emissions from Te Apiti, and "the people of Ashhurst are very happy to have those turbines there. They have become an icon," Mr Seay said.

Meridian is currently appealing noise restrictions placed on its proposed 70-turbine wind farm at Makara, near Wellington, where some houses will be about 1km [0.6 miles] away, and downwind of, the turbines.

John Napier lives on the Woodville side of the Te Apiti turbines, about 2km [1.24 miles] from the nearest one.

When they first began operating, he couldn't believe the roaring noise they made.

"We can hear it in our bedroom at night."

One night, about 2am, he got out of bed to check whether the bedroom windows were vibrating, and about five times since, he has been woken up and thought "they're making a racket tonight".

He doesn't hear the infrasound beat so much. It's mainly "a roar like a train going through a tunnel or over a bridge, but it never stops".

He complained to Meridian about the noise, and the company put a noise meter on his property for a couple of weeks, but wouldn't tell him the results.

"Wind farm companies say noise from turbines is not an issue, but it is an issue all right. I would be very concerned if I lived in Karori (near Makara, in Wellington)," Mr Napier said.

Harvey Jones, who lives in a valley 3km [1.9 miles] from Te Apiti, says there is an easterly wind blowing across the wind farm about 10 percent of the time. The wind

goes across the top of the hill, but the noise from the turbines rolls down the valley. It sounds like a train constantly passing by, and the stronger the wind, the louder the noise. When there's a westerly blowing, he can even hear the turbines in Woodville, 6-7km [3.7 to 4.3 miles] away.

"Once you get tuned in to it you can easily pick it up," he says.

Mr Jones says the amount of noise generated by the Te Apiti turbines was unexpected, and landowners prepared to put turbines on their land at Te Pohue should think very carefully about the possibility of a repeat scenario.

He predicts disaster for the residents of Makara and Karori.

"They're going to get hammered, but they don't realise."

Steve Griffin, of Te Pohue, is secretary of the Outstanding Natural Landscape Protection Society, formed to oppose two windfarms proposed for his area on the Napier-Taupo road.

Lines company Unison has resource consent to put up about 50 turbines, and Hawke's Bay Windfarms plans to erect 75 turbines nearby.

The landscape protection society is appealing all the consents in the Environment Court.

Mr Griffin, who is "sick to death of wind farms", says the prospect of 128 giant industrial turbines visually disrupting pristine skyline and covering more than 16km [10 miles] of prominent mountain range near Te Pohue is bad enough. But he and other residents are worried sick about the noise potential – both normal-range and infrasound – from the turbines. Each turbine will have an 80m tower and three 45m blades. They will be 125m high and 90m wide, each taking up the equivalent of 1.5 rugby fields.

They will encircle Te Pohue village and its school, in a valley downwind of the turbines in prevailing winds – and nobody in authority seems to care, he says.

The Government has thrown the doors wide open to wind farm developers, in a bid to meet its Kyoto commitments; there are no national guidelines specific to wind turbines. That stance is unbalanced and unfair, Mr Griffin says.

"Our view is that while wind farms are part of our energy solution, sites must be selected in a socially responsible manner.

"They should not be placed within 5km [3 miles] of schools, hospitals, rest homes, or the private homes of those not involved with a wind farm development."

They should also be kept out of coastal, and recreation areas, and those with high scenic value, he says.

The landscape protection society wants the Government to establish national guidelines for wind farms, and review noise-testing standards to include measurement of low-frequency sound.

Low-frequency sound – sometimes called infrasound – is controversial.

Dr Geoff Leventhall, a noise vibration and acoustics expert from the UK who looked into infrasound at the request of Genesis Power, says “I can state quite categorically that there is no significant infrasound from current designs of wind turbines”.

He says “the ear is the most sensitive receptor in the body, so if you cannot hear it you cannot feel it”. Engineer Ken Mosley, of Silverstream, has an entirely different view.

The foundations of modern turbines create vibrations in the ground when they are moving, and also sometimes when they are not moving, Dr Mosley says.

“This vibration is transmitted seismically through the ground in a similar manner to earthquake shocks and roughly at similar frequencies.

“Generally, the vibrations cannot be heard until they cause the structure of a house to vibrate in sympathy, and then only inside the house. The effects inside appear as noise and vibrations in certain parts of a room. Outside these areas, little is heard or felt.

“However, the low frequency components of the noise and vibration can cause very unpleasant effects which eventually cause the health of people to deteriorate to an extent where living in the property can become impossible.”

Dr Mosley says that wherever wind farms are built close to houses, people complain about noise and vibration.

He quotes a scientist in South West Wales, David Manley, who has been researching noise and vibration phenomena associated with turbines since 1994.

An acoustician and engineer, Dr Manley writes “it is found that people living within 8.2km [5 miles] of a wind farm cluster can be affected and if they are sensitive to low frequencies they may be disturbed”.

Two GPs in the UK have researched the health effects of noise and vibrations from turbines. Amanda Harry documented complaints of headaches, migraines, nausea, dizziness, palpitations, sleep disturbance, stress, anxiety and depression. People suffered flow-on effects of being irritable, unable to concentrate during the day, losing the ability to cope.

Bridget Osborne, of Moel Maelogan, a village in North Wales, where three turbines were erected in 2002, is reported as saying “there is a public perception that wind power is ‘green’ and has no detrimental effect on the environment, but these turbines make low-frequency noises that can be as damaging as high-frequency noises.

“When wind farm developers do surveys to assess the suitability of a site they measure the audible range of noise but never the infrasound measurement – the low-frequency noise that causes vibrations that you can feel through your feet and chest.

“This frequency resonates with the human body, their effect being dependent on body shape. There are those on whom there is virtually no effect, but others for whom it is incredibly disturbing.”



Dr Mosley says wind-power generators in New Zealand are aware of such literature on turbine noise and infrasound from all around the world.

“Are they therefore just ignoring what is happening in the rest of the world in the hope that once turbines are up and running, people will quietly endure, or when the noise/vibration situation really starts to damage their health, the community will cut their losses, leave their homes and quietly fade away? Of course, wherever they end up, they must still pay their electricity bills, which is rather like paying the landlord who has evicted you.”

The New Zealand Wind Energy Association, which did not return calls from Hawke’s Bay Today, acknowledges that turbines produce infrasound, but insists it is so minimal from modern turbines that human beings cannot perceive it. Its website says “there is no evidence to indicate that low frequency sound or infrasound from current models of wind turbine should cause concern.”

Infrasound was more of a problem with older turbines, which had their blades downwind of the turbine tower, the association says.

“That caused a low frequency thump each time a blade passed behind the tower.”

In contrast, modern turbines “have their blades upwind of the tower, thus reducing the level of this type of noise to below the threshold of human perception, thereby minimising any possible effect on human health or wellbeing”.

The association has published excerpts of a report by Dr Leventhall, who suggests that infrasound is a concept that could be classified as pop-science, seized upon by emotionally-overwrought wind farm opponents.

“When a group of residents decides to object to a development, they often support each other with strong emotions, which can sometimes lead them astray. The emphasis on low-frequency noise is an example of this. Over the past 30 years there has been a great deal of confusion and misinformation about low frequency noise, mainly in the popular media. Much of it can best be described as “hot air” but complainants’ uncritical acceptance of what they read in unreliable sources has two unfortunate effects:

- It detracts from those people who have genuine low-frequency noise problems, often from industrial exhaust fans, compressors and similar.
- It undermines the credibility of the complainants, who may be harming their own cause in their apparent ‘grasping at straws’ approach.”

Dr Leventhall goes on to say “the rational study of low frequency noise, its effects and criteria for control, has been bedeviled by exaggerations, half-truths and misrepresentations, much of it fomented by media stories over the last 35 years. The result in the UK, and it is probably similar in other countries, is that an incorrect concept – ‘low frequency noise is a hazard’ – has taken root in the national psyche, where it lies dormant waiting for a trigger to arouse it. The current trigger is wind turbines.”

Dr Leventhall says:

- High levels of low-frequency noise are needed before people can perceive it, and the levels must increase as frequency reduces.
- The ear is the most sensitive receptor in the body, so if you cannot hear it you cannot feel it.
- When there are problems with predominantly low-frequency noise, that is because assessment methods do not cater for it. That leads to the noises being dismissed as not being a nuisance, which in turn leaves unhappy complainants in a distressed state.

Up on the Napier-Taupo road, the printer in Steve Griffin's office is working overtime in preparation for an Environment Court battle. It might be a David and Goliath confrontation, but there's too much at stake to sit back and take it quietly, he says.

Note: "*Hawkes Bay Today* is the regional daily newspaper for Hawkes Bay. Our circulation area ranges from Mahia in north to Dannevirke in the South and to the central ranges in the west. We are also the youngest newspaper in New Zealand, launched on May 3, 1999."

See:

<http://www.hbtoday.co.nz/localnews/storydisplay.cfm?storyid=3673106&thesection=localnews&thesubsection=&thesecondsubsection>

# **A Review of Published Research on Low Frequency Noise and its Effects**

**Report for Defra by Dr Geoff Leventhall  
Assisted by Dr Peter Pelmear and Dr Stephen Benton**

**May 2003**

many parameters measured was an insignificant ( $< 1.5$  mm Hg) increase in the minimal arterial blood pressure. However, Borredon also reported that several of his subjects felt drowsy after the infrasound exposure.

**13.2 Effects on humans.** Infrasound exposure is ubiquitous in modern life. It is generated by natural sources such as earthquakes and wind. It is common in urban environments, and as an emission from many artificial sources: automobiles, rail traffic, aircraft, industrial machinery, artillery and mining explosions, air movement machinery including wind turbines, compressors, and ventilation or air-conditioning units, household appliances such as washing machines, and some therapeutic devices. The effects of infrasound or low frequency noise are of particular concern because of its pervasiveness due to numerous sources, efficient propagation, and reduced efficiency of many structures (dwellings, walls, and hearing protection) in attenuating low-frequency noise compared with other noise.

In humans the effects studied have been on the cardiovascular and nervous systems, eye structure, hearing and vestibular function, and the endocrine system. Special central nervous system (CNS) effects studied included annoyance, sleep and wakefulness, perception, evoked potentials, electroencephalographic changes, and cognition. Reduction in wakefulness during periods of infrasonic exposure above the hearing threshold has been identified through changes in EEG, blood pressure, respiration, hormonal production, performance and heart activity. Infrasound has been observed to affect the pattern of sleep minutely. Exposure to 6 and 16 Hz levels at 10 dB above the auditory threshold have been associated with a reduction in wakefulness (Landström and Byström, 1984). It has also been possible to confirm that the reduction on wakefulness is based on hearing perception since deaf subjects have an absence of weariness (Landström, 1987).

In moderate infrasonic exposures, the physiological effects observed in experimental studies often seem to reflect a general slowdown of the physiological and psychological state. The reduction in wakefulness and the correlated physiological responses are not isolated phenomena and the physiological changes are considered to be secondary reactions to a primary effect on the CNS. The effects of moderate infrasound exposure are thought to arise from a correlation between hearing perception and a following stimulation of the CNS. The participation of the reticular activating system (RAS) and the hypothalamus is thought to be of great importance. Taking this into account, changes in the physiological reactions are not just a question of whether the sound waves are above the hearing threshold. Furthermore reactions within the CNS, including RAS, hypothalamus, limbic system, and cortical regions are probably highly influenced by the quality of the sound. Some frequencies and characters of the noise are probably more effective than others for producing weariness.

A high degree of caution is necessary before ascribing the origin of physiological changes in working situations to infrasonic exposure because of their association. When analysing the factors promoting fatigue e.g. driving, many aspects have to be considered. The environment is usually a combination of many factors such as seat comfort, visibility, instrumentation,

## **Sources and effects of low-frequency noise.**

**Berglund B, Hassmen P, Job RF.**

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The sources of human exposure to low-frequency noise and its effects are reviewed. Low-frequency noise is common as background noise in urban environments, and as an emission from many artificial sources: road vehicles, aircraft, industrial machinery, artillery and mining explosions, and air movement machinery including wind turbines, compressors, and ventilation or air-conditioning units. The effects of low-frequency noise are of particular concern because of its pervasiveness due to numerous sources, efficient propagation, and reduced efficacy of many structures (dwellings, walls, and hearing protection) in attenuating low-frequency noise compared with other noise. Intense low-frequency noise appears to produce clear symptoms including respiratory impairment and aural pain. Although the effects of lower intensities of low-frequency noise are difficult to establish for methodological reasons, evidence suggests that a number of adverse effects of noise in general arise from exposure to low-frequency noise: Loudness judgments and annoyance reactions are sometimes reported to be greater for low-frequency noise than other noises for equal sound-pressure level; annoyance is exacerbated by rattle or vibration induced by low-frequency noise; speech intelligibility may be reduced more by low-frequency noise than other noises except those in the frequency range of speech itself, because of the upward spread of masking. On the other hand, it is also possible that low-frequency noise provides some protection against the effects of simultaneous higher frequency noise on hearing. Research needs and policy decisions, based on what is currently known, are considered.

Publication Types:

- Review

MeSH Terms:

- Auditory Threshold
- Blood Pressure
- Cognition
- Comparative Study
- Female
- Hearing
- Humans
- Loudness Perception
- Male