

**ALL-S4-POE-07**

**The Mid Wales (Powys) Conjoined Public Inquiry into 5 Windfarm  
Proposals and a 132kV overhead Electric Line Connection**

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**Session Four**  
**Alliance Proof of Evidence**  
**Dr Sarah Myhill**  
**Noise and Health**

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## Health impacts of wind turbines with particular reference to noise, amplitude modulation and infrasound

1. I am Dr Sarah Myhill. I have worked full time in NHS General Practice from 1982-2000 and in Private General Practice from 2000 to date<sup>1</sup>. I have a special interest in environmental medicine. This means I look for the causes of disease. This interest means I advise many patients with environmentally triggered diseases such as farmers with sheep dip flu, Gulf War veterans, Aerotoxic pilots and 9/11 firemen. Many of these patients present with a chronic fatigue syndrome.
2. I have published original research in the peer reviewed Journal Int J Clin Exp Med in 2009, 2012 and most recently January 2013<sup>2</sup>. I have two books that have been accepted for publication by Hammersmith book publishing company which will become available in March and May 2014 respectively<sup>3</sup>. Some of my views are cutting edge and may challenge Establishment thinking.
3. I have seen several patients with ill health, which they ascribed to living close to wind farms. This prompted a search of the medical literature where I found other doctors who had similar clinical experiences with patients and had published in the scientific literature. I shall refer to these works, because they closely tally with my own clinical experience and have been extensively researched and referenced. I find these reports so intellectually satisfying and biologically plausible that I believe there is a compelling case for the precautionary principle being applied to wind farm developments and their proximity to human habitation.

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<sup>1</sup> [http://drmyhill.co.uk/wiki/Main\\_Page](http://drmyhill.co.uk/wiki/Main_Page)

<sup>2</sup> <http://www.ijcem.com/files/IJCEM812001.pdf> ; <http://www.ijcem.com/files/IJCEM1204005.pdf> and <http://www.ijcem.com/files/IJCEM1207003.pdf>

<sup>3</sup> "Chronic Fatigue Syndrome – it's mitochondria not hypochondria" and "Sustainable Medicine for the 21<sup>st</sup> Century – whistle blowing on the Medical Profession"

4. The clinical reports to which I refer are:
- i) Dr Amanda Harry who published in 2007 her findings on the health effects of living near wind turbines<sup>4</sup>.
  - ii) Dr Nina Pierpont who has published in peer reviewed journals and further summarised her work in a book<sup>5</sup>.
  - iii) Dr Sarah Elizabeth Laurie, CEO of the Waubra Foundation<sup>6</sup>. The foundation was established in March 2010, by the former chairman of the National Stroke Foundation, Mr Peter Mitchell, AM, after he recognised the need for urgent research to investigate the reported adverse health effects being experienced and reported to Victorian Health authorities by residents near wind turbines at Waubra. Their website contains a wealth of contemporary evidence concerning the health effects of turbines<sup>7</sup>. Dr Laurie also wrote a detailed personal statement about the health effects of wind turbines<sup>8</sup>.
  - iv) A paper by Robert Thorne titled *Wind Farms in a Rural Environment and Potential for Serious Harm to Human Health due to Noise*<sup>9</sup>.
  - v) An essential and well-referenced review of the scientific literature titled *Noise Radiation from Wind Turbines installed near homes: Effects on health*.<sup>10</sup>

5. **Evidence of health impacts of wind turbine noise emissions.**

The mechanism by which any damage to human health from infrasound is inflicted is detailed at length in Frey and Hadden's 2007 report<sup>11</sup>. It explains how different body cavities have different resonant frequencies, within the infrasound spectrum, and the symptoms that arise when these frequencies

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<sup>4</sup> Dr Amanda Harry MB ChB PG Dip ENT, Wind Turbines, Noise and Health, February 2007

<sup>5</sup> Wind Turbine Syndrome, published 2009

<sup>6</sup> Postal address is PO Box 7112 Banyule LPO, Victoria 3804

<sup>7</sup> <http://waubrafoundation.org.au/>

<sup>8</sup> Dated January 2013

<sup>9</sup> Submission to the Senate Community Affairs Committee, 'Inquiry into the social and economic impacts of rural wind farms', Robert Thorne, 30 January 2011 rev1 <http://waubrafoundation.org.au/wp-content/uploads/2013/07/No-112-Robert-Thorne-Acoustician.pdf>

<sup>10</sup> Barbara J Frey BA MA and Peter J Hadden BSc FRICS, February 2007

<sup>11</sup> Noise Radiation from Wind Turbines installed near homes: Effects on health, Barbara J Frey BA MA and Peter J Hadden BSc FRICS, February 2007, section 5.0, pages 60-87

are applied. The scientific paper by Rasmusen is quoted in the report. This states the following frequencies associated with the symptoms:

- i) General feeling of discomfort 4-9Hz
- ii) Head symptoms 13-20Hz
- iii) Influence on speech 13-20Hz
- iv) Lump in throat 12-18 Hz
- v) Chest pain 5-7Hz
- vi) Abdominal pains 4-10Hz
- vii) Urge to urinate 10-18Hz
- viii) Influence on breathing movements 4-8Hz

See also the previous evidence on AM presented to this Inquiry by Mr Weller <sup>12</sup>.

6. Definition of infrasound

*"Infrasound is sound waves with frequencies ranging from 0. 0001Hz to 20Hz. It widely exists in the environment where people live. It is created both in natural phenomena and in human activities. Infrasound is neither visible nor audible. However it has noticeable features such as powerful capability of piercing through objects with little attenuation in transmission. ..."*<sup>13</sup>. *'At high levels, infrasound can harm the human body due to resonance. When exposed to infrasound, a person can feel ill with various symptoms such as dizziness, headache, nausea, fidget, diarrhoea, fatigue, being scatterbrained, etc. "*

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<sup>12</sup> Inquiry document OBJ-772-NOISE-POE-WELLER-SSA-C

<sup>13</sup> [http://en.cnki.com.cn/Article\\_en/CJFDTOTAL-SXJS200303020.htm](http://en.cnki.com.cn/Article_en/CJFDTOTAL-SXJS200303020.htm)

7. **Wind turbine syndrome - a clinical entity with characteristic symptoms and serious health consequences.**

A detailed clinical description of wind turbine syndrome can be seen in Dr Laurie's 2012 submission to the Australian Senate Inquiry into "Excessive noise from Wind farms Bill" <sup>14</sup>.

8. Dr Nina Pierpont describes the clinical presentation <sup>15</sup>. The core symptoms of wind turbine syndrome are common and widely described, closely linked in time and space to turbine exposure and amenable to diagnosis by medical history. They include:

- i) Sleep disturbance
- ii) Headache
- iii) Tinnitus and other hearing sensations
- iv) Disturbances to balance and equilibrium
- v) Nausea
- vi) Anxiety
- vii) Irritability
- viii) Energy loss
- ix) Motivation loss
- x) Disturbances to memory and concentration
- xi) VVVD (Visceral, Vibratory, Vestibular Disturbance) – a new symptom, not previously described but apparently typical of wind turbine syndrome. Sufferers struggle to describe this but physical sensations including quivering, jitteriness, and pulsation accompanied by acute anxiety, fearfulness, agitation, irritability, sleep disturbance and tachycardia accompany exposure to turbine activity.

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<sup>14</sup> Re: List of symptoms and medical problems, submission by Dr Sarah Laurie to the Australian Senate Inquiry into "Excessive noise from Wind farms Bill", 22<sup>nd</sup> November 2012

<sup>15</sup> Wind Turbine Syndrome, page 48

Dr Pierpoint gives a detailed and thoroughly evidenced clinical description<sup>16</sup>. The clinical description is accompanied by a compelling pathophysiological explanation describing how symptoms result. She also details a study by Dr Robyn Phipps, which described people experiencing symptoms at exposures up to 15 km away from turbines<sup>17</sup>.

9. A further review of International literature corroborating these symptoms is provided in the Appendix. Although this material supports the concept of an identifiable syndrome, its name is unimportant in the context; what is of great concern is that some people have unwelcome health effects that seem to be directly attributable to living near windfarms.
10. Following a Freedom of Information request by the Den Brook Judicial Review Group the Information Commissioner released the draft versions of the 2006 Hayes McKenzie Report, “The Measurement of Low Frequency Noise at Three UK Wind Farms”, commissioned by the DTI<sup>18</sup>.

It was seen that the acousticians had recommended that night time wind turbine noise limit should be reduced from 43dB to 38dB. In the event that turbine noise has a discernible beating character, the limit should be further reduced to 33dB.

11. There are currently 63 wind turbine noise complaints that are being investigated<sup>19</sup>. Dr Nina Pierpont’s study was of 38 people living in ten houses within 1.5 km of wind turbines. At the time of publication eight out of ten families had moved away because of turbine associated symptoms; the ninth could not afford to; the tenth was struggling to remain in their home<sup>20</sup>.

Further examples of families affected by wind turbine noise are given in the Appendix.

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<sup>16</sup> Wind Turbine Syndrome, pages 26 to 192

<sup>17</sup> Wind Turbine Syndrome, page 32

<sup>18</sup> The full Fol material is available on the Den Brook Judicial Review Group website [http://www.denbrookvalley.co.uk/resources/FOI\\_Hayes-MacKenzie+Report+-+2nd+Draft.pdf](http://www.denbrookvalley.co.uk/resources/FOI_Hayes-MacKenzie+Report+-+2nd+Draft.pdf)

<sup>19</sup> List of windfarms with current complaints regarding noise

<sup>20</sup> Wind Turbine Syndrome p21/22

## 12. Conclusions drawn from scientific evidence and previous rulings

- i) Wind turbines produce at least three types of disturbance namely broadband noise, Amplitude Modulation (AM) (sometimes called OAM) and infrasound.
- ii) Broadband noise, AM and infrasound can cause intolerable distress and damage to human health. The health effects of turbines result from their emission of broadband noise, AM and infrasound. The larger the wind turbine, the more broadband noise, AM and infrasound is produced with potential for damaging health effects which can, in certain topographical situations, extend to several kilometres from turbines.
- iii) Characteristic symptoms and potentially serious health consequences are a reality for some people who live near windfarms. Witness statements and video links are referenced.
- iv) Expert advice to lower wind turbine noise limits and protect residents has been provided to Government <sup>21</sup>.
- v) Some turbines have had to be taken down or switched off because of noise impacting on local people and some of those living close to turbines have been forced to leave their homes. Where they have been able to find a buyer people have suffered a significant loss in property value.
- vi) The potential effects of turbines are causing recommendations to be made on increasing separation distances between turbines and homes. Both variations in topography and turbine height have to be taken into account.
- vii) A growing number of health practitioners, researchers and acousticians have publicly expressed concern regarding wind turbines and health.

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<sup>21</sup> "New Evidence Shows that Government Suppressed Expert Advice to Lower Wind Turbine Noise Limits Intended to Protect Residents":  
[http://www.denbrookvalley.co.uk/resources/FOI+Commentary\\_+HMP+Draft+Reports+-7+Dec+09-2.pdf](http://www.denbrookvalley.co.uk/resources/FOI+Commentary_+HMP+Draft+Reports+-7+Dec+09-2.pdf)

13. Taking into account the increasing body of clinical evidence, and for avoidance of future adverse effects, the Alliance believes that should approval for any of the windfarms before this Inquiry be recommended, it should only be given subject to conditions for AM which are similar to those used in the Den Brook Decision, which drew up protective criteria. The permanent noise monitoring exercise method of Cotton Farm is established and should be used to ensure compliance (see Appendix paragraph 17).
14. The Den Brook Amplitude Modulation (AM) noise condition criteria were designed to ensure:
  - i) Modulation of the noise level as identified within ETSU-R-07 as typical of wind turbines (a peak to trough of 3dB); that occurs for a period of no more than 10 seconds in any 1 minute period; and more than 6 times in an hour (i.e. a total of 1 minute exposure in an hour) is considered a breach of the condition.
  - ii) The normally applied ETSU derived noise limits are replaced by using a firm scientific basis for assessing claims of unreasonable, unacceptable and intolerable noise impacts from windfarm developments throughout the UK.

The practical objective of the Den Brook AM condition was to give all parties clarity, as well as sparing neighbours and developers the trouble, expense, and uncertainty of private nuisance actions<sup>22</sup>.

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<sup>22</sup> <http://www.ref.org.uk/publications/242-the-den-brook-amplitude-modulation-noise-condition>

### Further information and evidence about the health impacts of wind turbines with particular reference to noise, amplitude modulation and infrasound

1. A study<sup>23</sup>, which is the first controlled study of the effects of Industrial Wind Turbine noise on sleep and health, shows that some of those living within 1.4 km of IWT have suffered sleep disruption, which is sufficiently severe as to affect their daytime functioning and mental health. The effects of sleep loss and daytime sleepiness on cognitive function, accident rate and mental health are well established (WHO 2009) and it must be concluded that at least some of the residents living near the Vinalhaven and Mars Hill IWT installations have suffered serious harm to their sleep and health.
2. The graphs that detail sleep quality by night, sleepiness by day and mental component scores are particularly interesting. The closer to the turbines the subjects lived, the worse their symptoms. Although the control groups were people living up to 7 km from turbines, one can see that even these people were suffering effects<sup>24</sup>.
3. Another study (from New Zealand<sup>25</sup>) reported a cross-sectional study comparing the Health-Related Quality of Life (HRQOL) of individuals residing in the proximity of a wind farm to those residing in a demographically matched area sufficiently displaced from wind turbines. The study employed a non-equivalent comparison group post-test-only design. Self-administered questionnaires, which included the brief version of the World Health Organization quality of life scale, were delivered to residents in two adjacent areas in semirural New Zealand. Participants were also asked to identify annoying noises, indicate their degree of noise sensitivity, and rate amenity. Statistically significant differences were noted in some HRQOL domain scores, with residents living within 2 km of a turbine installation reporting lower

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<sup>23</sup> International Congress on Noise as a Public Health Problem (ICBEN) 2011, London: Adverse health effects of industrial wind turbines: a Preliminary Report, Michael Nissenbaum MD, Jeff Aramini PhD, Chris Hanning MD

<sup>24</sup> <http://www.icben.org/2011/pdf/ICBEN2011.pdf#page=651>

<sup>25</sup> Noise and Health September October 2011 Volume 13 Issue 34: Evaluating the impact of wind turbine noise on health related quality of life: Daniel Shepherd, David McBride, David Welch, Kim N. Dirks, Erin M. Hill

overall quality of life, physical quality of life, and environmental quality of life. Those exposed to turbine noise also reported significantly lower sleep quality, and rated their environment as less restful. The data suggests that wind farm noise can negatively impact facets of HRQOL.

#### 4. **Effects of industrial wind turbine noise on sleep and health**

4.1 Report Number 122412-1 21-18-12 FINAL (3).pdf, is a recent report on a field study concerning investigation of wind turbine noise near a wind farm in Wisconsin, USA. The field study was independently reported on by 4 different acoustic firms. The primary conclusion of the study is:

*"The four investigating firms are of the opinion that enough evidence and hypotheses have been developed given to classify LFN (low frequency noise) and infrasound as a serious issue, possibly affecting the future of the industry. It should be addressed beyond present practise of showing that wind turbine levels are magnitudes below the threshold of hearing at low frequencies."* <sup>26</sup>

4.2 *High levels of infrasound and low frequency sounds generated by wind turbines pose a potentially serious threat to communities near wind farms. Wind energy companies remain largely dismissive, claiming that wind turbine noise is sub-audible, undetectable by humans, and therefore presents minimal risk to human health. However, various cochlear microphonic, distortion product otoacoustic emission, and fMRI studies have demonstrated the detection of infrasound by the human inner ear and auditory cortex. Additional psychosomatic stress and disorders, including the "wind turbine syndrome" and paranormal experiences, are also linked to infrasound exposures. With wind turbines generating substantial levels of infrasound and low frequency sound, modifications and regulations to wind farm engineering plans and geographical placements are necessary to minimize community exposure and potential human health risks.*<sup>27</sup>

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<sup>26</sup> <http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2012;volume=14;issue=60;spage=237;epage=243;aualast=Nissenbaum>

<sup>27</sup> Wind Turbines and Ghost Stories: The Effects of Infrasound on the Human Auditory System. Hsuan-hsiu Annie Chen and Peter Narins

4.3 *The evidence for adequate sleep as a prerequisite for human health, particularly child health, is overwhelming. Governments have recently paid much attention to the effects of environmental noise on sleep duration and quality, and to how to reduce such noise. However, governments have also imposed noise from industrial wind turbines on large swathes of peaceful countryside. The impact of road, rail, and aircraft noise on sleep and daytime functioning (sleepiness and cognitive function) is well established. Shortly after wind turbines began to be erected close to housing, complaints emerged of adverse effects on health. Sleep disturbance was the main complaint. Such reports have been dismissed as being subjective and anecdotal, but experts contend that the quantity, consistency, and ubiquity of the complaints constitute epidemiological evidence of a strong link between wind turbine noise, ill health, and disruption of sleep<sup>28</sup>.*

4.4 The following is the abstract of a keynote address by Pierpont (November 15, 2010) before the ‘First International Symposium on the Global Wind Industry and Adverse Health Effects: Loss of Social Justice?’<sup>29</sup>

*“The latest research, as discussed below, suggests the following mechanism for Wind Turbine Syndrome: air-borne or body-borne low-frequency sound directly stimulates the inner ear, with physiologic responses of both cochlea (hearing organ) and otolith organs (sacculle and utricle—organs of balance and motion detection). Research has now proved conclusively that physiologic responses in the cochlea suppress the hearing response to low-frequency sound but still send signals to the brain, signals whose function is, at present, mostly unknown. The physiologic response of the cochlea to turbine noise is also a trigger for tinnitus and the brain-cell-level reorganization that tinnitus represents—reorganization that can have an impact on language*

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<sup>28</sup> Wind turbine noise Seems to affect health adversely and an independent review of evidence is needed, Christopher D Hanning honorary consultant in sleep medicine, Alun Evans Professor Emeritus. Sleep Disorders Service, University Hospitals of Leicester,. *BMJ* 2012;344:e1527 doi: 10.1136/bmj.e1527 (Published 8 March 2012)

<sup>29</sup> Picton, Ontario, Canada, October 30, 2010. It is followed by a discussion of several other relevant talks at the symposium by Drs. Alec Salt, Michael Nissenbaum, Christopher Hanning, and Mr. Richard James.

*processing and the profound learning processes related to language processing. New research also demonstrates that the “motion-detecting” otolith organs of mammals also respond to air-borne low-frequency sound. Physiologic responses and signals from the otolith organs are known to generate a wide range of brain responses, including dizziness and nausea (seasickness, even without the movement), fear and alerting (startle, wakefulness), and difficulties with visually-based problem-solving. Increased alerting in the presence of wind turbine noise disturbs sleep, even when people do not recall being awakened. A population-level survey in Maine now shows clear disturbances of sleep and mental well-being out to 1400 m (4600 ft) from turbines, with diminishing effects out to 5 km (3 miles).”*

**5. One mechanism by which infrasound may result in ill health effects has been explained by three UK consultant ENT surgeons:**

- i) *“Objective: Symptoms, including tinnitus, ear pain and vertigo, have been reported following exposure to wind turbine noise. This review addresses the effects of infrasound and low frequency noise and questions the existence of ‘wind turbine syndrome’.*
- ii) *Design: This review is based on a search for articles published within the last 10 years, conducted using the PubMed database and Google Scholar search engine, which included in their title or abstract the terms ‘wind turbine’, ‘infrasound’ or ‘low frequency noise’.*
- iii) *Results: There is evidence that infrasound has a physiological effect on the ear. Until this effect is fully understood, it is impossible to conclude that wind turbine noise does not cause any of the symptoms described. However, many believe that these symptoms are related largely to the stress caused by unwanted noise exposure.*

*Conclusion: There is some evidence of symptoms in patients exposed to wind turbine noise. The effects of infrasound require further investigation.”<sup>30</sup>*

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<sup>30</sup> <http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=8853239>

6. Below is a link to a U tube video which shows a family severely affected by wind turbine syndrome

<http://www.youtube.com/watch?v=IFNJ2MDGMP4#t=368>

7. **VCAT Commissioners confirm evidence of damage to sleep and health from operating wind turbines.**

“Victorian Civil Administrative Tribunal Commissioners, Mr M Wright QC and Mr A Liston have made the following remarks in orders given on 4th April, 2013.1 Paragraphs 116 -118 of their orders state the following:

- i) Para 116; *“There is evidence before the Tribunal that a number of people living close to wind farms suffer deleterious health effects. The evidence is both direct and anecdotal. There is a uniformity of description of these effects across a number of wind farms, both in southeast Australia and North America. Residents complain of suffering sleep disturbance, feelings of anxiety upon awakening, headaches, pressure at the base of the neck and in the head and ears, nausea and loss of balance.”*
- ii) Para 117: *“In some cases the impacts have been of such gravity that residents have been forced to abandon their homes.”*
- iii) Para 118 *“On the basis of this evidence it is clear that some residents who live in close proximity to a wind farm experience the symptoms described, and that the experience is not simply imagined”.*<sup>31</sup>

8. Mr Amir Farboud, one of the authors of the review paper who is an ear, nose and throat specialist at Bodewyddan Hospital Wales, said: *‘We believe there is evidence of symptoms in patients exposed to wind turbine noise, but some maintain that the effects of Wind Turbine Syndrome are just examples of the well-known stress effects of exposure to noise.*

*‘However, there is an increasing body of evidence to suggest that there are physiological effects of infrasound and low frequency noise on the ear. Until these effects are fully understood it is impossible to say that exposure to wind turbine noise does not cause any of the symptoms described.*

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<sup>31</sup> Media release VCAT confirm damage to sleep and health Contact: CEO Dr Sarah Laurie

*'We believe that more research needs to be done, as many more people are set to be exposed to this type of low frequency noise as wind farm numbers grow.'*<sup>32</sup>

Statements from a number of families and individuals are in the reference documents and other witness statements can be seen at:

<http://waubrafoundation.org.au/library/section/resident-impact-videos/>

9. **Email From:** Dr Sarah Laurie Sunday, 24 November 2013, 21:32  
**Subject:** Important evidence from the Cherry Tree case in Victoria, Australia, presented last week

*Dear All*

*Witness statements from residents and the extract of Les Huson's expert opinion are now up as documents on the [waubrafoundation.org.au](http://waubrafoundation.org.au) website for people to use as they see fit to educate others.*

*In a nutshell Les Huson has found a remarkable correlation (86% of the time) between Gus Gardner's symptoms as recorded in his diary of "bolts of pressure" and transient pressure pulses of infrasound detected by Les's infrasound pressure monitor from the Macarthur wind turbines. Gus was blinded to the acoustic data at the time he recorded his symptoms. Thus the evidence to support our hypothesis of a direct causal link between wind turbine generated infrasound pressure pulses and specific symptoms is mounting.*

*There have been numerous other rural residents in Australia living or working near large wind turbines who have reported similar sudden pressure "bolt" sensations - dropping fit farmers to their knees (not easily done), or "thumps in the chest" and then feeling very unwell. I would be very interested to hear from anyone with a history of symptoms like this.*

*This is the first time to my knowledge that we have captured any acoustic data capturing these pressure peaks at a time when someone was experiencing these sudden intense symptoms. Acousticians I have discussed this symptom complex with previously think it may be caused by summation of*

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<sup>32</sup> A Farboud, R Crunkhorn, A Trinidad – "Wind Turbine Syndrome': fact or fiction?" is published online in *The Journal of Laryngology & Otology*, 22nd January 2013, doi: 10.1017/S0022215112002964. Ref: <http://www.cambridge.org/about-us/media/press-releases/wind-turbine-syndrome-fact-or-fiction/> 22 January 2013 / Cambridge Journals United Kingdom.

*pressure peaks from multiple wind turbines i.e. a cumulative effect, and these people are just in the "wrong place" when those pressure peaks from multiple wind turbines combine. We have never previously captured the measurements of pressure at the time the symptoms were occurring.*

*Les Huson's data seems to support that hypothesis, but more work needs to be done to confirm it including replicating these pressures in a laboratory situation.*

*Les also found that the infrasound from the wind turbines at Leonards Hill travelled over 30 km and the attenuation followed the pattern of the NASA experiments in the 1980's i.e. attenuated at 3 dB per doubling (audible sound attenuates at a much faster rate of 6 dB per doubling).*

*However the infrasound generated by 140 turbines at Macarthur does not attenuate in the same way when it is measured within 6.4 km of the nearest wind turbine. **His measurements showed that there was effectively NO attenuation at all between 1.8 and 6.4 km.** In some instances the pressure peaks measured were even greater at 6.4 km than inside homes closer to the wind turbines.*

*Les is preparing his data for publication, so cannot share the full report submitted to the Tribunal, however he has given permission for the extract of his expert opinion to be circulated. He is also actively sharing the information with colleagues in Australia and internationally, and with state based bureaucracies with a direct interest in this issue.*

*Most importantly he stated that **"I find it entirely plausible that infrasound can cause nuisance and disturbed sleep in communities surrounding wind farm developments similar to the Macarthur and Leonards Hill developments."***<sup>33</sup>

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<sup>33</sup> <http://waubrafoundation.org.au/resources/huson-l-expert-evidence-at-vcat-cherry-tree-hearing/> (Les Huson's expert witness statement extract summarising his findings). <http://waubrafoundation.org.au/resources/gardner-statement-vcat-cherry-tree-hearing/> (resident who experiences the pressure bolts). <http://waubrafoundation.org.au/resources/hetherington-j-witness-statement-vcat-cherry-tree-tribunal/> (resident who lives 3 km away). <http://waubrafoundation.org.au/resources/linke-m-witness-statement-vcat-cherry-tree-hearing/> (resident who lives 5 km away and cannot see the turbines).



William Mulvaney, Superintendent  
Darren Loschen, Principal

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Dear Chairman Weinard,

My name is Bill Mulvaney and I am the Superintendent of Schools for Armstrong Township High School and Armstrong-Ellis CUD #61. I also served on the wind panel that met to try and give direction to the county board on wind turbine ordinances. Our panel did not come up with any recommended changes, but I would like to share a few thoughts with you.

I have noticed that we have some children in our district that appear to be having some medical issues related to the wind turbines. Headaches, lack of sleep and jaw issues seem to be the most common. The students also complain about not being able to sleep or not getting a full night's sleep due to sound issues.

We have also been advised that we will be losing a couple of families because the wind turbines were placed close to homes and the families can no longer handle the flicker and noise issues.

While these issues were brought up at our panel discussions, I was not fully aware of the impact that the wind turbines would have to my school districts. It is never a good thing when children have health issues or families have to leave their homes to get away from the turbines. The revenue generated by the turbines is a blessing to our schools, but the unintended consequences are real.

I hope this letter sheds some light on real issues that affect districts that house wind farms. I also hope that when ordinances are discussed in the future, that these issues are considered.

Sincerely,

A handwritten signature in black ink, appearing to read "William C. Mulvaney".

William C. Mulvaney  
Superintendent  
Armstrong Schools

10. **Waterloo Case Series Preliminary Report Demonstrates Direct Correlation Between Symptoms and Operating Wind Turbines**

Mrs Mary Morris has compiled this preliminary case series, utilising data from residents from Waterloo affected by wind turbine noise and vibration, living out to 8 km from the nearest wind turbine. *The case series specifically focuses on what the residents have observed when the turbines are operating compared*

to times when they are away from the turbines, or the turbines have been off. There is specific reference to a week in July 2013 just after the South Australian EPA acoustic survey concluded, where a “cabling fault” meant that the turbines did not operate for a week. This is extremely valuable data, because people are their own “controls” — the only variable which changes is exposure to operating wind turbines.<sup>34</sup>

11. A recent publication by Nottingham University was completely misrepresented in the press. The National Press stated that the malign effects of turbines only manifest in people who had high levels of anxiety. This was a misrepresentation of the study as declared by Dr Lawrence in a personal letter to Dr Hugh Jones as detailed below:

Claire Lawrence is joint author of the paper: **From: Claire Lawrence**

**Subject: Re: Disturbance from small wind turbine noise.**

**Date: 22 March 2013 14:20:55 GMT**

**To: Christine Hugh-Jones**

*Dear Dr Hugh-Jones*

*Thanks for getting in touch. **The article – as I'm sure you would be able to glean from its style and wording was not a good reflection of the paper – at all. The same goes for the reporter's use of graphics (incorrect) and the claim that the turbines involved were 30meters high. They were much, much smaller than that – most were micro turbines attached to people houses in residential areas.***

*I'll try and answer the points below. The work, incidentally had nothing to do with the University's own wind turbine activities – rather it was an approach from a PhD student and her supervisor who work specifically in issues to do with turbine noise and wanted a Psychological perspective.*

*The software used was DataKustik CadnaA software package. This uses the ISO 9613-1 (ISO, 1993) and ISO 9613-2 (ISO, 1996) standards to map how sound from a noise source attenuates over a site based on its topography by calculating the sound pressure level at receiver positions located on a 1 m*

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<sup>34</sup> <http://waubrafoundation.org.au/wp-content/uploads/2013/09/Waterloo-Case-Series-Preliminary-Report.pdf>

grid over the map area. Several measures were taken over a series of weather conditions. Nonetheless it is also possible that not every nuance of noise could be picked up.

***I'm aware that people can use this research to claim that the association between noise and symptoms is all imagined. This is NOT what the paper says, however, and so this would not do much good for people trying to use our work to support this idea. Rather we show that those who are reporting noise have increased symptoms – but this effect is only significant for those who are 1 standard deviation above the mean on certain personality types which are consistently associated with heightened stress responses. Neuroticism was only one of the measures we used. Also – as I was at pains to point out to the journalist, these personality traits are normally distributed– and so the effects for these people should not be ignored. Incidentally – the term neurotic is not used in the article – due to its inaccurate interpretations. We are talking here about the normal breadth of individuals who vary from being extremely calm and emotionally 'immovable' to those who are more prone to feel the effects of emotional upheaval. This is a very broad spectrum – and all within a typical range.***

*This work was funded by a National Environment Research Council (NERC) Grant issued by UK Energy Research Centre (UKERC) NER/S/R/2007/14440. Those people who hear uncontrollable wind turbine noise – are I'm sure very bothered by it – and there may be some impact on health. This study was examining how this might be moderated by personality factors. Best wishes*

*Claire*

*Dr Claire Lawrence*

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12. Open letter from Mike Stigwood, MAS Environmental. **Date:** November 26, 2013 at 7:15:58 EST

**Subject: Wind Farm - Amplitude Modulation controls finally accepted at 3dB**

*Recent research presented at three Planning Inquiries that were conducted in September, October and November (Starbold, Bryn Llewelyn and Shipdham - decisions awaited) have hopefully exposed the misconceived arguments made by the Industry's acousticians' which have successfully avoided controls over wind farm noise impact for many years.*

*After more than 4 years of smoke screens, obfuscation and erroneous objections raising unrealistic concerns and placing barriers in the way of necessary controls over the wind farm noise called "Excess Amplitude Modulation", industry acousticians have finally admitted a planning condition is "necessary" and "reasonable". Excess AM is now shown to be neither rare nor only causing minor effects as claimed over the last few years, arguments that have successfully blocked planning controls leaving many communities exposed to serious noise impact. Research by ourselves and the Japanese have exposed this as a common and serious problem.*

*Dr Matthew Cand of Hoare Lea is part of the Renewables UK research team on EAM who were due to report their findings over 2 years ago but have continuously deferred this. He finally admitted after 2 hours of cross-examination, when being questioned over the need for a condition at the Shipdham Inquiry last week, that one was both **necessary and reasonable**.*

*Dr Cand was also questioned over the Den Brook condition metric which was accepted in 2009 but rejected ever since and that was formulated by MAS Environmental with a 3dB(A) EAM limit. This has been subject to widespread industry attacks over the last four years, leading to its rejection by planning inspectors ever since the Den Brook decision. In response Dr Cand said "**If I had to pick a number I don't think 3dB(A) is a bad number**". In effect the Renewables UK research must support what we found four years ago.*

*These admissions follow years of unpublished work by Renewables UK, coupled with statements that no one knows the appropriate level. In September at the Starbold Inquiry arguments that the Den Brook condition was triggered by extraneous noise were dropped by the appellants and they*

accepted it was an incorrect argument. Following the Bryn Llewelyn appeal in October 2013 Dr Jeremy Bass of RES, the main opponent of the Den Brook condition said during a meeting:

**"foolishly ... we went along the industry line that amplitude modulation is rare".** He accepted the argument that it can be dealt with by statutory nuisance was wrong. He continued **"I think that argument is completely exploded by the weight of evidence presented by Mike Stigwood in particular .... we are in a difficult position now ... the landscape has changed and I suspect .... in the future developers will no longer try the argument that AM is rare".**

*It is hoped decision makers will no longer receive erroneous arguments about the control of EAM and that conditions following the Den Brook metric are now applied to all future consents. There also needs to be a mechanism developed by Government for applying it to existing wind farms. Emerging evidence from the Japanese studies suggests a stricter limit may arguably be necessary but at the present time it is safe to consider the Den Brook metric as a means of controlling wind farm noise.*

*We also hope decision makers will now exercise particular caution with respect to arguments made by wind industry acousticians and that those who raise concerns over wind farm noise, in the main, do so legitimately.*

*If anyone seeks further information on appropriate forms of control of this common noise problem they can visit our website at [www.masenv.co.uk](http://www.masenv.co.uk) for more information or email us direct.*

*Kind regards*

Mike Stigwood

13. Jane Davis and her family were forced to abandon their farm because of the noise from the windfarm. *Mr and Mrs Davis launched a High Court writ claiming £380,000 compensation from the owners of the 320ft turbines, the builders and the landowners. They claimed the constant 66-decibel hum - close to the sound a vacuum cleaner generates - was 'unbearable' even though they wore earplugs at night and installed double glazing at the*

*farmhouse in Deeping St Nicholas, Lincolnshire. The case was settled with a gagging clause.*<sup>35</sup>

14. A group of families in a north Cork village are suing a wind farm operator in a landmark case, claiming the huge turbines are adversely affecting their health. *The seven families from Banteer claim they have been severely impacted, particularly through noise pollution, since the turbines began operating in Nov 2011. If the action is successful, it is expected to lead to a number of others on similar grounds. Already, cases are being prepared by householders in Wexford and Roscommon. The Banteer action is being taken by the “Shivnen family and others”, and includes households where there are families with children, couples, and, in one case, a single occupant. The case is listed for the High Court and has already come before Judge Kevin Feeney. It is currently at the discovery phase, with a likely hearing date in the autumn.*<sup>36</sup>

15. On 6 June 2012 Lincolnshire County Council issued a press release calling a halt to the unrestrained construction of wind turbines across Lincolnshire. The full statement contains its own minimum distance:

Residential Amenity

*Amenity of existing residential occupants must be maintained at an acceptable level, therefore the following criteria shall be applied:-  
no wind turbine developments shall be constructed in close proximity of a residential property (the accepted distance for separation is 700 metres)  
however, noise and amplitude modulation issues can be present up to 2 km away. Therefore, unless through assessment, it can be demonstrated that there would be acceptable noise levels within the 2 km radius of a residential property, the minimum distance should be 2 km.*<sup>37</sup>

16. A growing number of health practitioners, researchers and acousticians are worried about wind turbines' effects on health, and have said so publicly.<sup>38</sup>

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<sup>35</sup> <http://www.dailymail.co.uk/news/article-1267250/Couple-sue-380k-driven-home-noise-wind-turbines.html#ixzz2Od79sOZy>

<sup>36</sup> <http://www.irishexaminer.com/ireland/families-bid-to-sue-wind-farm-operator-225867.html>

<sup>37</sup> Ref House of Commons library 5.7.12. Christopher Barclay

<sup>38</sup> <http://www.epaw.org/documents.php?lang=en&article=ns53>

### 17. Cotton Farm noise monitoring

*Condition 20: At the request of the local planning authority following the receipt of a complaint the wind farm operator shall, at its expense, employ a consultant approved by the local planning authority, to assess whether noise emissions at the complainant's dwelling are characterised by greater than expected amplitude modulation. Amplitude modulation is the modulation of the level of broadband noise emitted by a turbine at blade passing frequency. These will be deemed greater than expected if the following characteristics apply:*

- i) A change in the measured LA eq 125 millisecs turbine noise level of more than 3dB (represented as a rise and fall in sound energy levels each of more than 3dB) occurring within a 2 second period and*
- ii) the change identified in (a) above shall not occur less than five times in any one minute period provided the LA eq 1 min turbine sound energy level for that minute is not below 28dB and*
- iii) the changes identified in (a) and (b) above shall not occur for fewer than six minutes in any hour.*
- ii) Noise emissions at the complainant's dwelling shall be measured not further than 35m from the relevant building, and not closer than 3.5m of any reflective building or surface, or within 1.2m of the ground.*

*Condition 21: No wind turbine shall generate electricity to the grid until the local planning authority, as advised by a consultant approved by the local planning authority at the expense of the operator, has approved in writing a scheme submitted by the wind farm operator providing for the measurement of greater than expected amplitude modulation emissions generated by the wind turbines.*

- i) The objective of the scheme (which shall be implemented as approved) shall be to evaluate compliance with condition 20 in a range of wind speeds and directions and it shall terminate when compliance with condition 20 has been demonstrated to the satisfaction of and agreed in writing by the local planning authority.*