JACK'S LANE WIND FARM:
Community Liaison Group Meeting on Noise

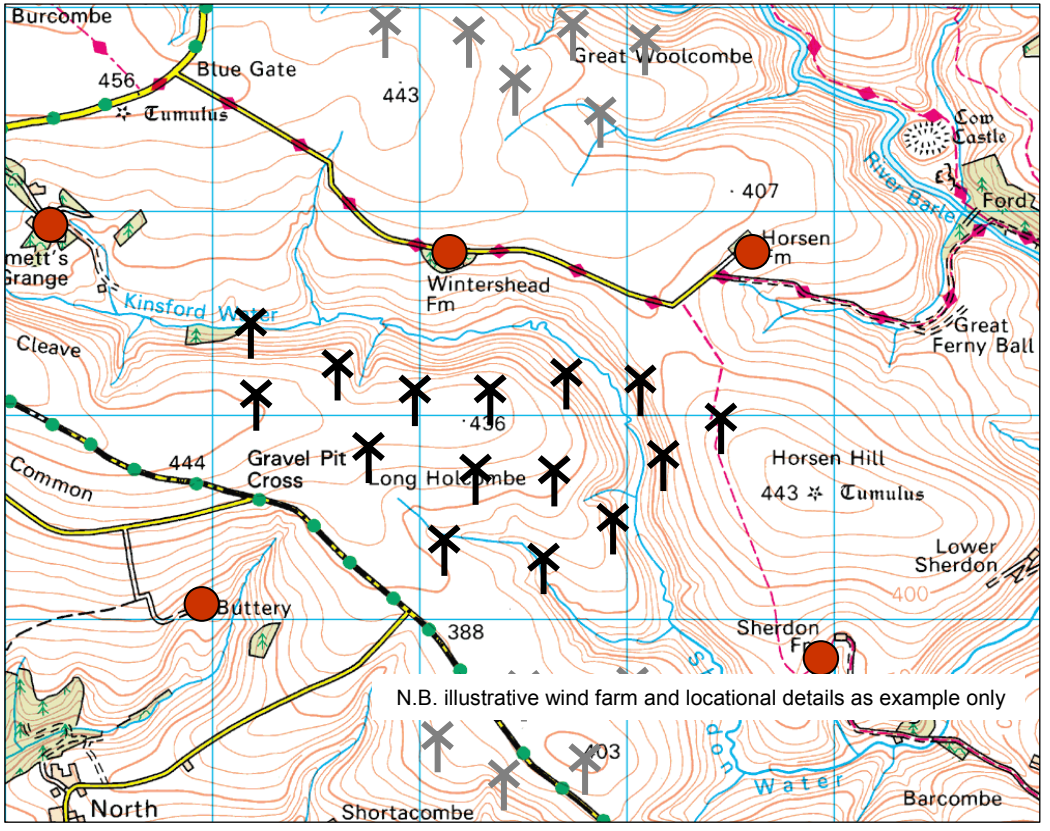
Dr Jeremy H Bass
SENIOR TECHNICAL MANAGER

14 April 2010, Syderstone Village Hall, Norfolk

0: TALK OVERVIEW:

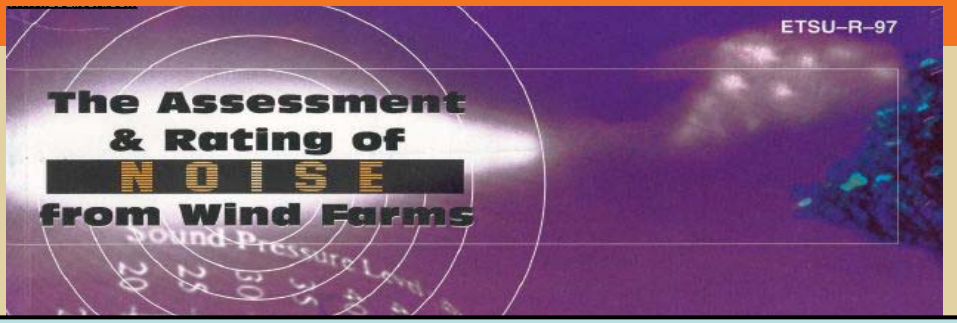
1. Wind Turbine Noise & the ETSU-R-97 Guidance
2. Jack's Lane Assessment
3. Jane Davis & AM
4. Nina Pierpont & Health
5. Whitehall Cover-up?
6. Questions?

1.1: Wind Farm Noise – The Basic Aims…



- demonstrate acceptable wind farm noise impact at the planning stage
- achieve this acceptable noise impact in practice

Setting acceptable noise limits at receptors ….

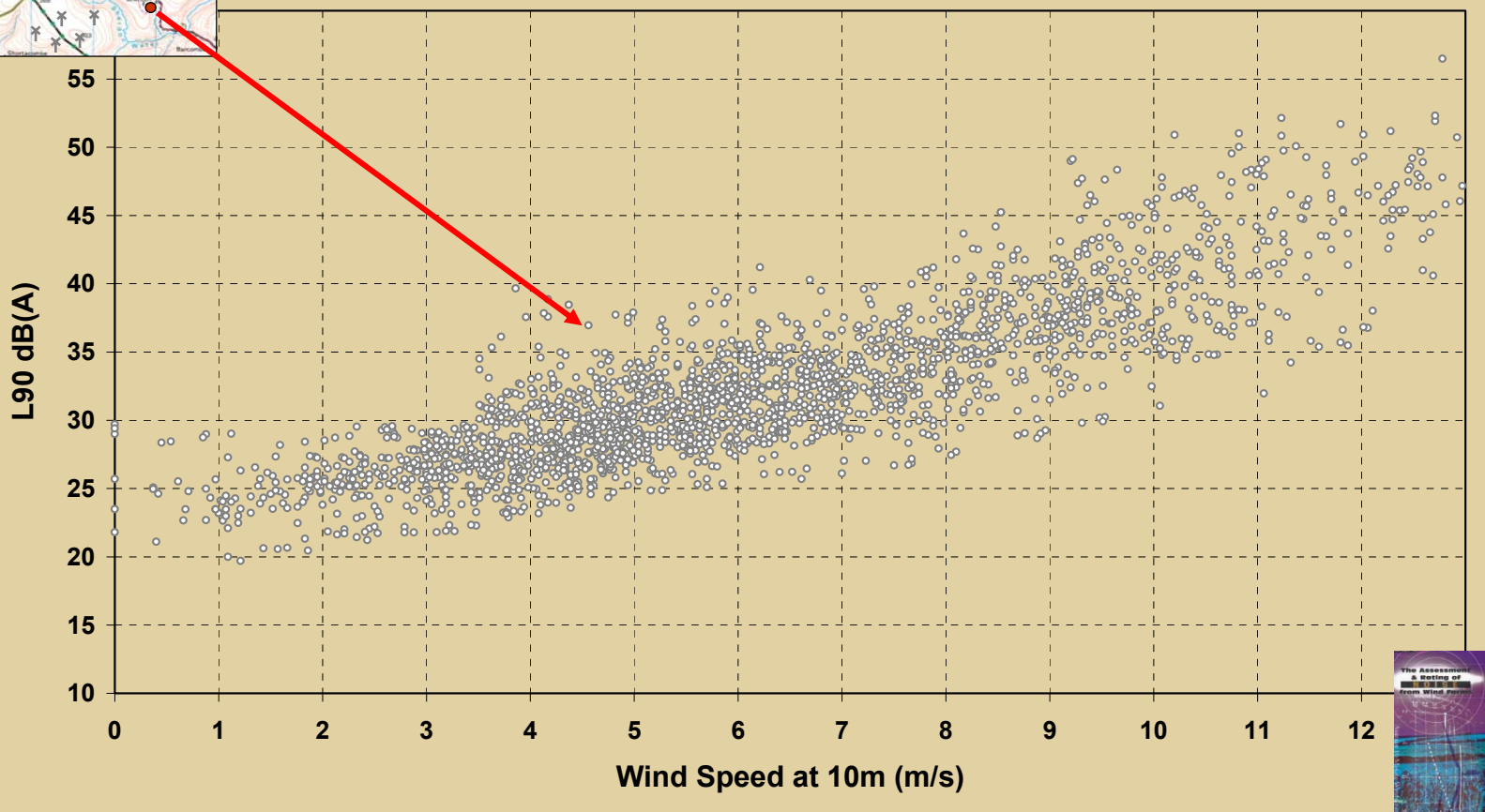


The basic aim of ETSU-R-97, in arriving at the recommendations contained within the report, is the intention to provide:

"Indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or local authorities."

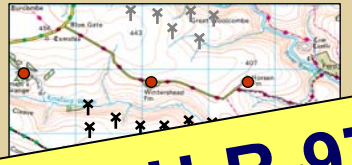
ETSU-R-97

1.4: Measure the Existing Background Noise



1.5: Calculate the 'Average' Background Level

1.6: Set Noise Limit Relative to Background



ETSU-R-97 sets an ABSOLUTE noise limit not to be breached

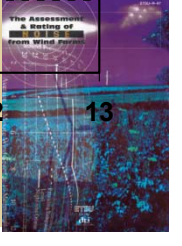
-time Periods

L90 dB(A)

10 15 20 25 30 35 40

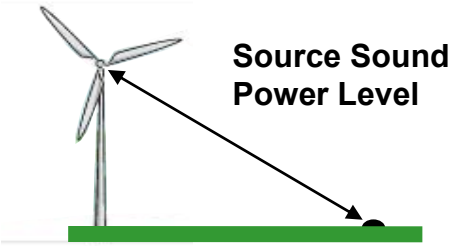
0 1 2 3 4 5 6 7 8 9 10 11 12 13

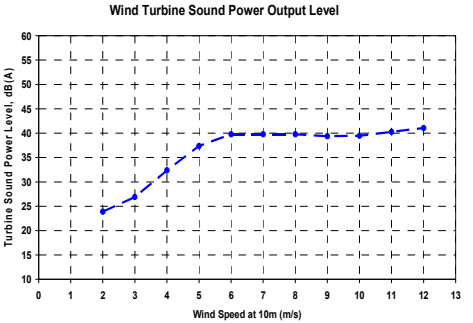
Wind Speed at 10m (m/s)



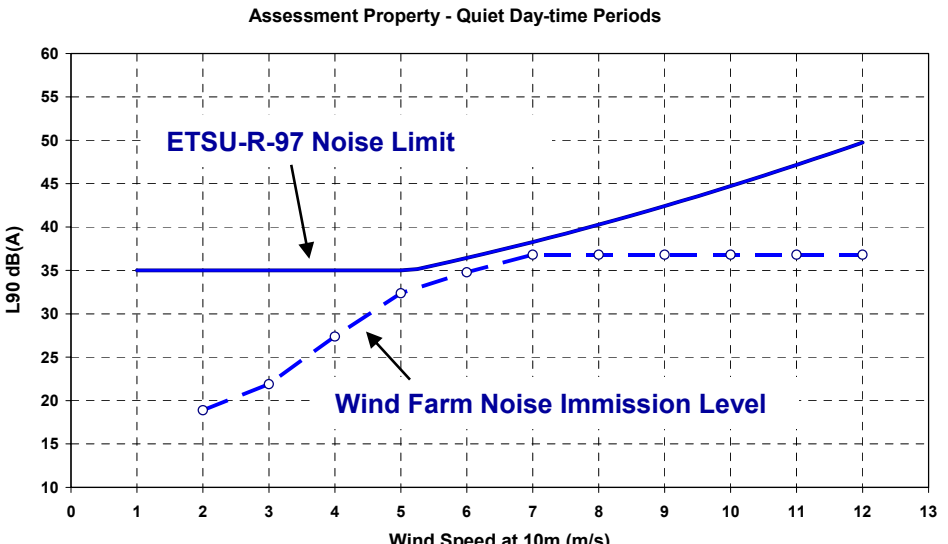
Calculating noise immission levels at receptors ….

1.9: Calculating Wind Farm Noise at Receptors





Noise Propagation Calculation Algorithm



INTERNATIONAL STANDARD

IEC 61400-11

Second edition
2002-12

Wind turbine generator systems –

Part 11: Acoustic noise measurement techniques

Aérogénérateurs –

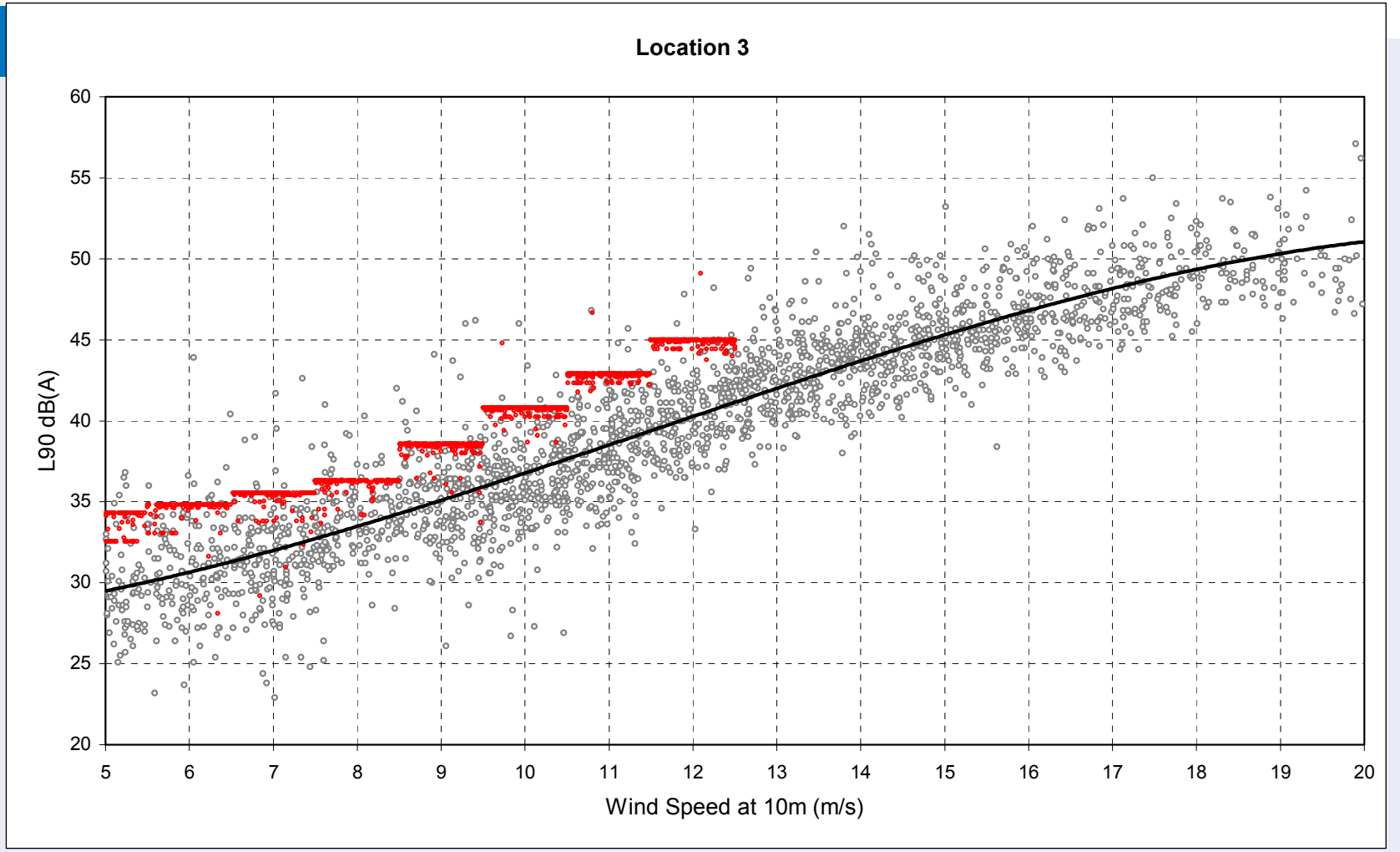
Partie 11:
Techniques de mesure du bruit acoustique

Reference number
IEC 61400-11:2002(E)

1.10: NOISE PROPAGATION MODELLING

Current RES Approach to noise propagation modelling:

1. Use ISO 9613 Part 2 (as implemented by Cadna/A)
   - Mixed ground (G=0.5)
   - Receiver height of 4 m
   - Used ‘warranted’ sound power levels
   - Ignore any ‘barrier’ effects
   - Compensate for propagation in ‘free’ space
2. Approach based on fundamental research conducted by RES and others in 1995. Determined that ISO 9613 Part 2 model was most appropriate for wind farm planning during UK/EEC funded research project:
   - ‘A Critical Appraisal of Wind Farm Noise Propagation Prediction Models’



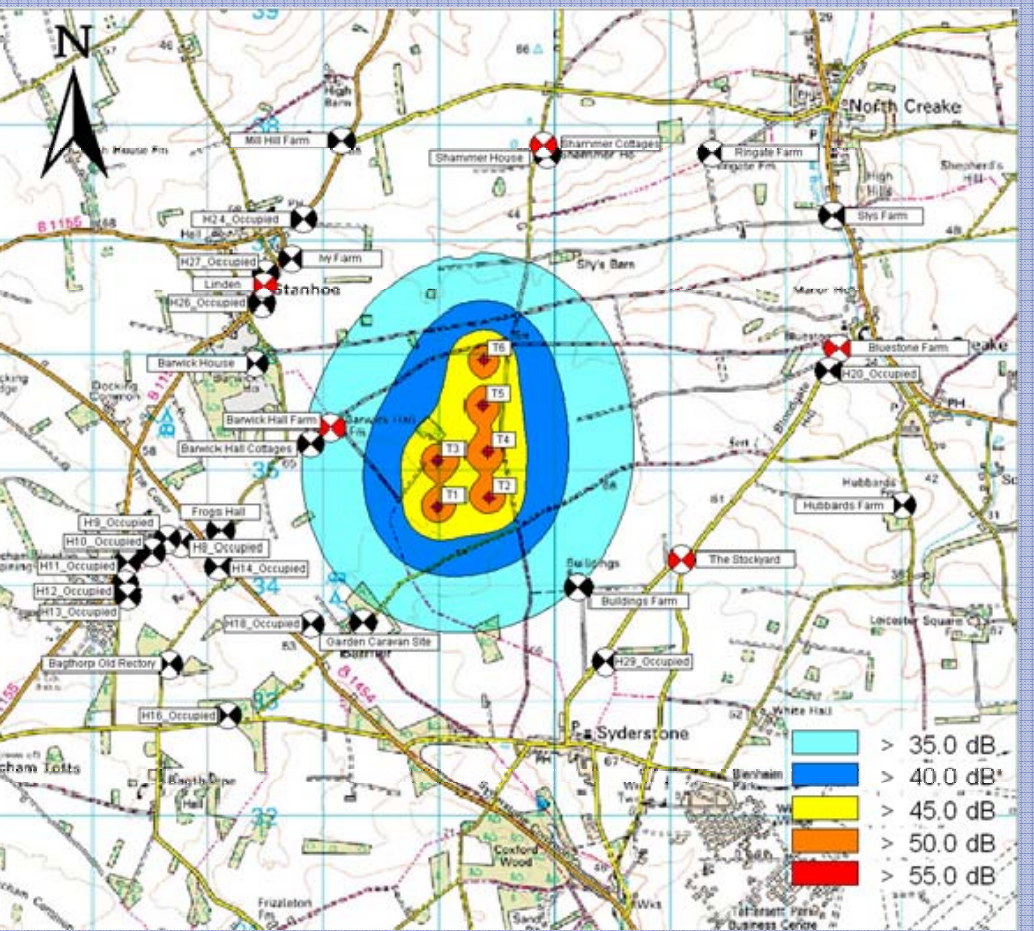
Location 3 at approximately 920m from the closest located turbine:

Calculated noise immission levels (red lines) based on ISO9613-2 with G=0.5

2.0: TALK OVERVIEW:

1. Wind Turbine Noise & the ETSU-R-97 Guidance
2. **Jack's Lane Noise Assessment**
3. Jane Davis & AM
4. Nina Pierpont & Health
5. Whitehall Cover-up?
6. Questions?

2.1: JACK'S LANE NOISE ASSESSMEMENT: Overview



- proposed wind farm comprises 6, 2 MW class wind turbines, e.g. Siemens SWT-2.3-93
- hub height is 80 m
- NB: noise footprint assumes all directions simultaneously downwind – not possible!
- prevailing wind direction is SW

2.2: JACK'S LANE NOISE ASSESSMEMENT: Background Noise Survey

- Background noise measurements at 5 properties:
  - Barwick Hall Farm
  - Bluestone Farm
  - Linden (extended to 22 May due to extraneous noise)
  - Shammer Cottages
  - The Stockyard
- Measurements ran from 3 March – 15 April 2009: 43 days

2.4: JACK'S LANE NOISE ASSESSMENT: Summary

All properties:

- minimum margin of predicted noise levels below derived noise limits, for all wind speeds considered, during quiet waking hours, is -0.8 dB(A)
- similarly the minimum margin during night time periods, for all wind speeds considered, is -6.3 dB(A)

Non-landowner properties:

- minimum margin of predicted noise levels below derived noise limits, for all wind speeds considered, during quiet waking hours, is -2.6 dB(A)
- similarly the minimum margin during night time periods, for all wind speeds considered, is -8.1 dB(A)

3.0: TALK OVERVIEW:

1. Wind Turbine Noise & the ETSU-R-97 Guidance
2. Jack's Lane Noise Assessment
3. **Jane Davis & AM**
4. Nina Pierpont & Health
5. Whitehall Cover-up?
6. Questions?

Questions raised by public to RES:

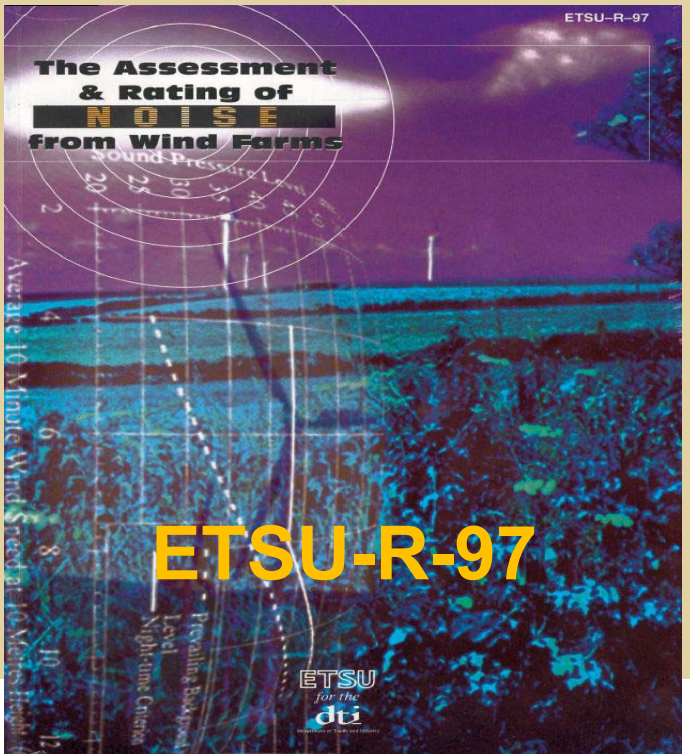
Are Julian and Jane Davis promulgating a myth or did turbine noise actually drive them out of their home?

If it's a myth, what is the detailed, scientific counter argument?

If noise did actually drive them out, why is that type of noise not going to bother us or the inhabitants of Stanhoe or Syderstone?

A noise associated with wind turbines, commonly referred to as ‘blade swish’, is the modulation of aerodynamic noise produced at blade passing frequency (the frequency at which a blade passes a fixed point)

This noise character is acknowledged by, and accounted for, in ETSU-R-97



3.2: WHAT DOES ETSU-R-97 SAY ABOUT BLADE SWISH

1. *"The noise levels recommended in this report take into account the character of noise described as blade swish. Given that all turbines exhibit blade swish to a certain extent we feel this is a common-sense approach given the current level of knowledge."*

2. *"This modulation of blade noise may result in a variation of the overall A-weighted noise level by as much as 3 dB(A) (peak to trough) when measured close to a wind turbine."*

3. *"...it has been found that positions close to reflective surfaces may result in an increase in the modulation depth perceived at a receiver position remote from a site. If there are more than two hard, reflective surfaces, then the increase in modulation depth may be as much as 6 dB(A) (peak to trough)."*

3.3: HOW WIDESPREAD & SEVERE IS THE 'AM' PROBLEM?

Key findings:

- 27 of 133 have had noise complaints at some point
- 239 complaints in total, with 152 from single site (Askam)
- 81 complainants in total
- only 1 wind farm designated 'statutory nuisance' (Askam)
- AM a factor at 4 sites
- complaints subsided at 3 of these due to remedial action
- occurs 7 – 15 % of time at 'problem' sites
- very low incidence

BERR, August 2007:
"…the Government does not consider there to be a compelling case for further work into AM and will not carry out any further research at this time."

3.4: WHAT CAUSES AM (or EAM) – BEST GUESS

Most likely theory (Oerlemans):

- combination of directivity of aero-acoustic noise sources ..
- ...and Doppler (convective) amplification
- up & downwind, AM decreases with distance to 1 - 2 dB
- crosswind, AM can persist into far field up to 5 dB (low level)

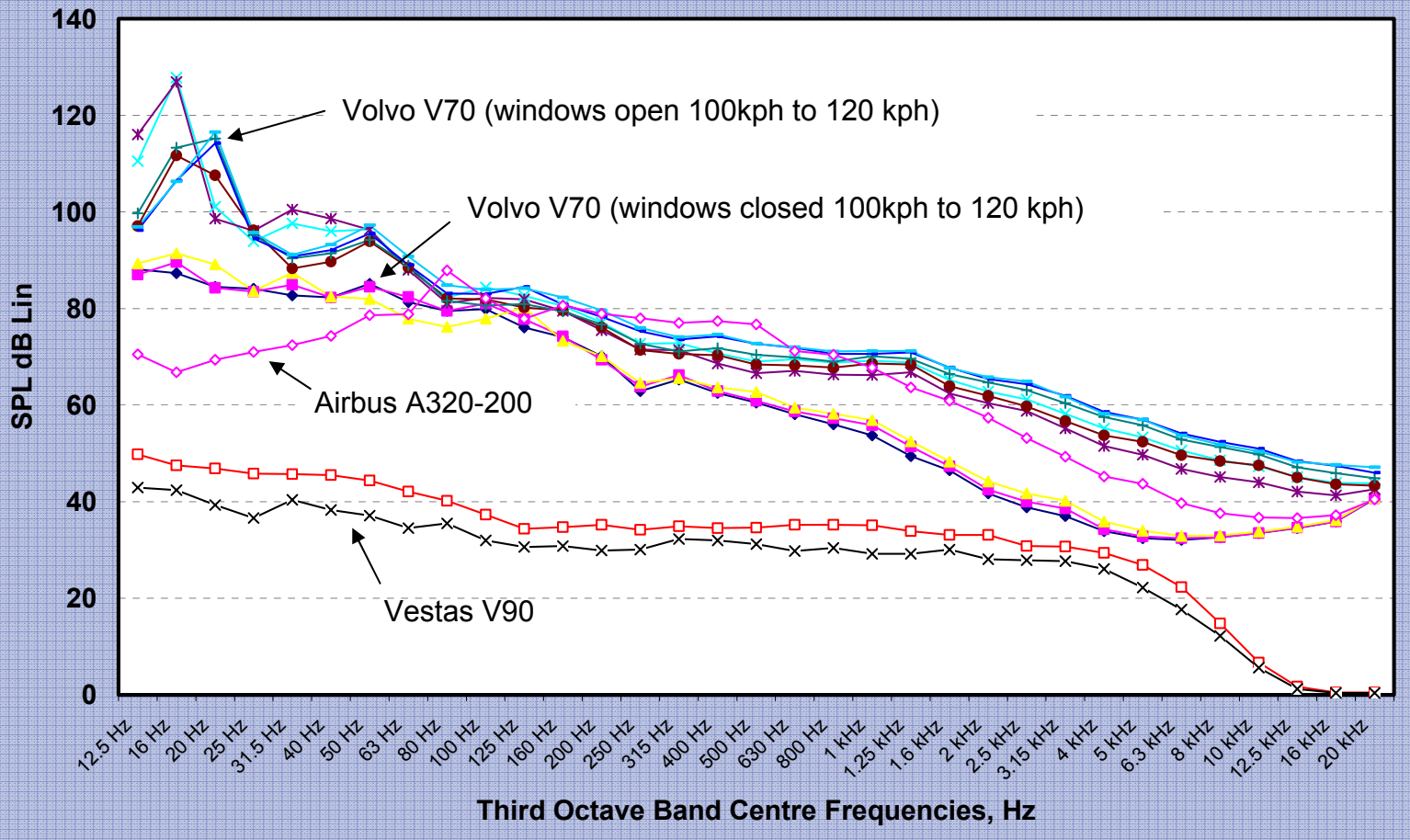
Note:

- *may* increase in high shear
- stable conditions *may* be associated with this due to SNR
- 'stumpy' towers may also contribute to higher AM!

3.5: AM CONCLUSIONS

- certain level of AM is fundamental to wind turbine noise
- typically 3 – 5 dB peak to peak
- likely results from trailing edge noise directivity & convective amplification
- more apparent in stable atmospheric conditions due to SNR?
- 'problem' cases of AM involve higher levels
- Davis case destined for legal review – can't comment!
- **AM noise condition has been developed for control of such noise, and is currently being assessed by LPAs and Planning Inspector's**
- **Mitigation possible via NRMS**

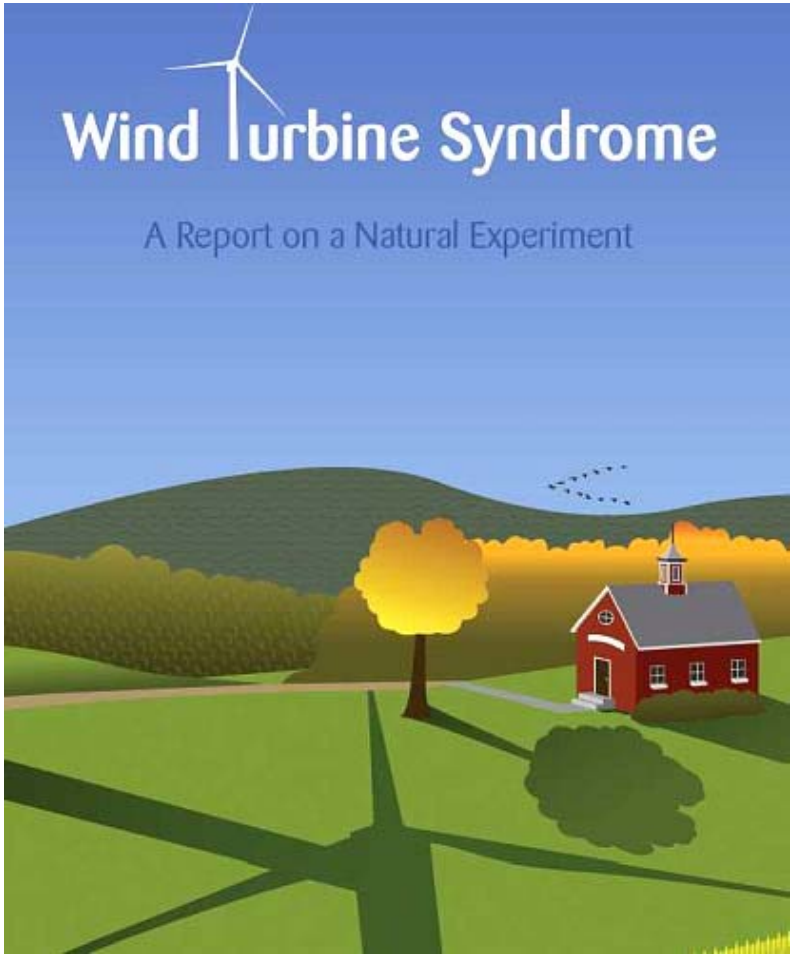
- Likelihood at Jack's Lane


Volvo V70 (windows open 100kph to 120 kph)
Volvo V70 (windows closed 100kph to 120 kph)
Airbus A320-200
Vestas V90
SPL dB Lin
140
120
100
80
60
40
20
0
12.5 Hz
16 Hz
20 Hz
25 Hz
31.5 Hz
40 Hz
50 Hz
63 Hz
80 Hz
100 Hz
125 Hz
160 Hz
200 Hz
250 Hz
315 Hz
400 Hz
500 Hz
630 Hz
800 Hz
1 kHz
1.25 kHz
1.6 kHz
2 kHz
2.5 kHz
3.15 kHz
4 kHz
5 kHz
6.3 kHz
8 kHz
10 kHz
12.5 kHz
16 kHz
20 kHz
Third Octave Band Centre Frequencies, Hz

4.0: TALK OVERVIEW:

1. Wind Turbine Noise & the ETSU-R-97 Guidance
2. Jack's Lane Noise Assessment
3. Jane Davis & AM
4. **Nina Pierpont & Health**
5. Whitehall Cover-up?
6. Questions?

4.1: NINA PIERPONT & HEALTH: The Claims



- Wind Turbine Syndrome (WTS) is an alleged condition proposed by paediatrician Dr Nina Pierpont
- she cites a range of physical sensations (tinnitus, headache etc.) and effects (sleeplessness, anxiety etc.) based on a series of interviews comprising of a study group of 10 self-selected families

4.2: NINA PIERPONT & HEALTH: Details of Approach

- study based on 10 self-selected families (inc. Jane Davis)
- 38 individuals in total, of which 23 interviewed by telephone
- no physical examinations or verifications of ‘symptoms’
- many of these individuals with serious pre-existing disorders, including: mental disorder; permanent hearing problems; tinnitus; concussions; industrial noise injuries etc
- 305 – 1.5 km to nearest turbine

4.3: NINA PIERPONT & HEALTH: Bigger Picture

- Dr Pierpoint is a known anti-wind campaigner in North America
- this is a self published report, not a proper epidemiological study, and none of this 'research' has been peer reviewed
- some residents simply exposed to high levels of noise which would not be acceptable in UK – this mostly likely explains their complaints
- re-discovery of 'noise annoyance'
- classic example of 'bad science', which is not only misleading but causing unnecessary alarm

4.4: NINA PIERPONT & HEALTH: What do other people think?

The NHS Knowledge Service concluded that:

- **"there is no conclusive evidence that wind turbines have an effect on health or are causing the symptoms described as 'WTS'**
- the study had no control group
- no information was presented on how individuals selected or which countries they were from
- the study may be a 'pre-cursor' to a larger test, but is not in itself a valid epidemiological test

NHS choices
Your health, your choices

Are wind farms a health risk?

Behind the Headlines
Brought to you by the NHS Knowledge Service

Monday August 3 2009

There is no conclusive evidence that wind turbines affect health

"Living too close to wind turbines can cause heart disease, tinnitus, vertigo, panic attacks, migraines and sleep deprivation," *The Independent on Sunday* reported. The newspaper said that research to be published later this year by an American doctor has identified a new health risk: "wind turbine syndrome"

The story is based on the work of Dr Nina Pierpont, a New York paediatrician who is publishing a book based on her own case series study, discussions and theories. The study looked at 10 families living near wind turbines, the results of which were used to define a set of symptoms that can be used in future studies.

No firm conclusions can be drawn from this study as the design was weak and included only 38 people. Participants were asked about their symptoms before they were exposed to wind turbines to provide a control for their symptoms after exposure. This was not a sufficient control as many of the participants were reportedly already convinced that wind turbines caused their symptoms and were actively trying to move out of their homes or had already moved. Further study is needed

Where did the story come from?

The story is based on the work of Dr Nina Pierpont, a New York paediatrician who is publishing a book based on her own case series study, discussions and theories of wind turbine syndrome. This appraisal is based on a draft of the book available through Dr Pierpont's website.

What kind of scientific study was this?

The book is based around a case series study carried out by Dr Pierpont, which involved 10 families reporting symptoms they associated with living near a wind farm. The author says that the study's purpose was to "establish a case definition" for the set of symptoms that people experience while living near wind turbine installations.

The researcher interviewed 23 people from 10 families by telephone, some of whom gave information on the symptoms of other family members, resulting in a total of 38 participants to include in analysis. It is not clear how these families were selected or what countries they come from. Dr Pierpont says that she collected information about the symptoms of everyone in the family to "further create comparison groups" and to investigate if certain aspects of medical history "pre-exposure" to wind turbines could predict particular symptoms that were experienced during exposure.

The 38 family members ranged in age from less than one to 75 years and lived within a range of 300m to 1.5km from wind turbines that had been erected since 2004. They were asked for the details of any symptoms they experienced before the turbines were erected, symptoms experienced while living near the operational turbines and symptoms experienced after they had moved home or while they spent prolonged periods away from their homes.

Dr Pierpont's book discusses the results of these interviews using a narrative approach, interspersing the findings with a discussion of the potential impact of wind turbines on the environment and the human body. The publication is divided into two sections, one for clinicians and one for non-clinicians. The "family tables" present the results of the interviews in the interviewees' own words.

What were the results of the study?

Many participants had pre-existing co-morbidities at baseline (before wind turbines were erected near their homes), including:

- Seven people with a history of mental disorders
- Eight people with pre-existing migraine disorder
- Eight people with permanent hearing problems.
- Six people with continuous tinnitus.
- Twelve people who had previously been exposed to significant noise, such as through work in industrial or construction settings
- Eighteen people who were motion sensitive.
- Seven people who remembered a history of a single concussion.

[There may be some overlap in the individuals in these groups]

The author then discusses the symptoms the participants reported during their period of exposure to wind turbines. These core symptoms had to be "common and widely described by study participants," "closely linked... to turbine exposure" and "amenable to diagnosis by medical history".

These include:

- Sleep disturbance reported by 32 people (including trouble getting to sleep, prolonged awakening, night terrors).
- Headache reported by 15 subjects as having increased in frequency, duration or severity since living near wind farms. These headaches were significantly associated with a pre-existing migraine disorder.
- Tinnitus and ear sensations reported by 14 subjects as new or worse than baseline. This symptom was linked with previous noise exposure, baseline tinnitus and baseline hearing loss.
- Balance problems during exposure to wind turbines reported by 16 subjects.
- Internal quivering, vibration or pulsation sometimes in association with other symptoms (including agitation, anxiety, nausea and irritability). The author calls this condition visceral vibratory vestibular disturbance (VVVD). There was no link between VVVD and previous panic disorder or panic episodes.

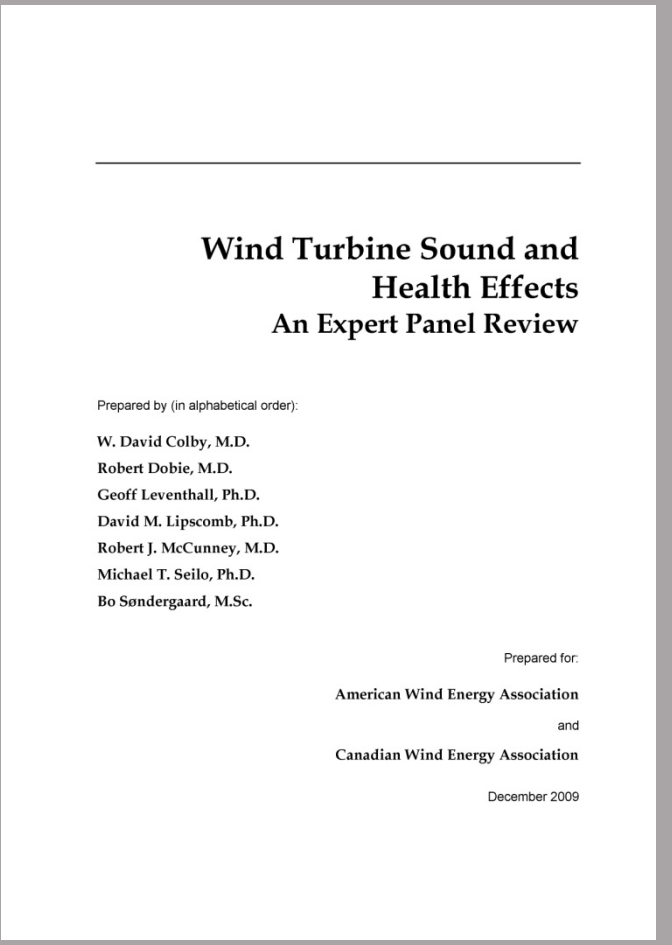
See: http://www.nhs.uk/news/2009/08August/Pages/Arewindfarmsahealthrisk.aspx

4.5: NINA PIERPONT & HEALTH: What do other people think?

Independent expert panel (2 MDs; 4 PhDs) reviewed entire area, not just WTS, and concluded that:

- "there is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects"
- "ground-borne vibrations are too weak to be detected by, or to affect, humans"
- "there is no reason to believe that sounds from wind turbines could plausibly have direct adverse health consequences"

NB: panel comprised medical doctors, audiologists & acousticians from US, Canada, UK & Denmark



Wind Turbine Sound and Health Effects
An Expert Panel Review

Prepared by (in alphabetical order):

W. David Colby, M.D.
Robert Dobie, M.D.
Geoff Leventhall, Ph.D.
David M. Lipscomb, Ph.D.
Robert J. McCunney, M.D.
Michael T. Seilo, Ph.D.
Bo Søndergaard, M.Sc.

Prepared for:

American Wind Energy Association

and

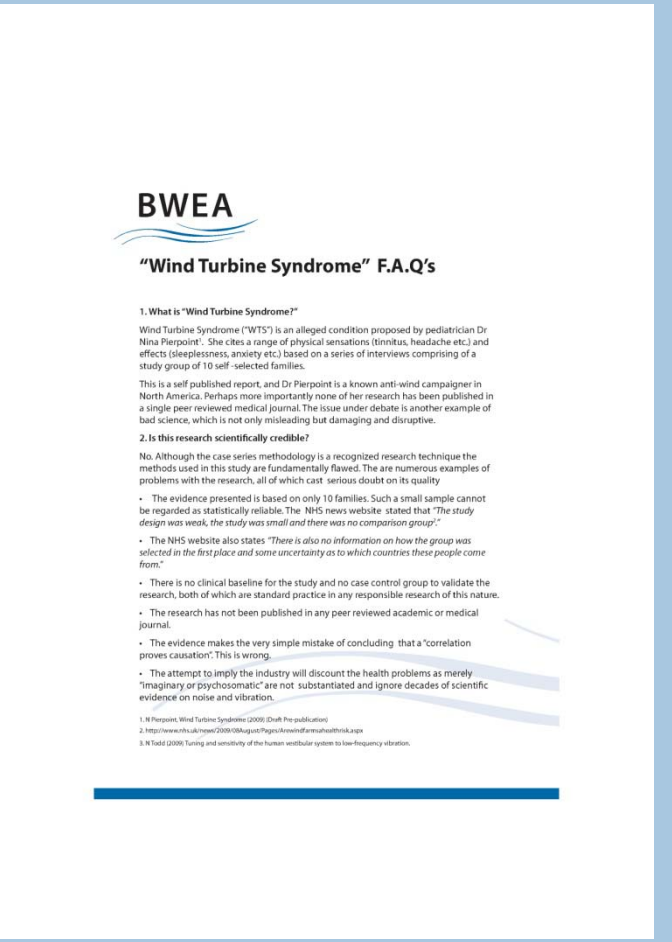
Canadian Wind Energy Association

December 2009

4.6: NINA PIERPONT & HEALTH: What do other people think?

BWEA (now RenewablesUK) concluded that:

- not scientifically credible
- sample size too small to be statistically significant
- there is no clinical baseline for comparison, nor any control group
- there is no peer review
- correlation ≠ causation
- mis-use of research on human ear by Dr Neil Todd
- 1 case of nuisance from UK wind farm in entire history. Nearly 40,000 from industrial noise in only 1 year!



BWEA

"Wind Turbine Syndrome" F.A.Q's

1. What is "Wind Turbine Syndrome?"

Wind Turbine Syndrome ("WTS") is an alleged condition proposed by pediatrician Dr Nina Pierpoint[1]. She cites a range of physical sensations (tinnitus, headache etc.) and effects (sleeplessness, anxiety etc.) based on a series of interviews comprising of a study group of 10 self -selected families.

This is a self published report, and Dr Pierpoint is a known anti-wind campaigner in North America. Perhaps more importantly none of her research has been published in a single peer reviewed medical journal. The issue under debate is another example of bad science, which is not only misleading but damaging and disruptive.

2. Is this research scientifically credible?

No. Although the case series methodology is a recognized research technique the methods used in this study are fundamentally flawed. The are numerous examples of problems with the research, all of which cast serious doubt on its quality

- The evidence presented is based on only 10 families. Such a small sample cannot be regarded as statistically reliable. The NHS news website stated that *"The study design was weak, the study was small and there was no comparison group"*.[2]
- The NHS website also states *"There is also no information on how the group was selected in the first place and some uncertainty as to which countries these people come from."*
- There is no clinical baseline for the study and no case control group to validate the research, both of which are standard practice in any responsible research of this nature.
- The research has not been published in any peer reviewed academic or medical journal.
- The evidence makes the very simple mistake of concluding that a "correlation proves causation". This is wrong.
- The attempt to imply the industry will discount the health problems as merely "imaginary or psychosomatic" are not substantiated and ignore decades of scientific evidence on noise and vibration.

1. N Pierpoint, Wind Turbine Syndrome (2009) (Draft Pre-publication)
2. http://www.nhs.uk/news/2009/08August/Pages/Arewindfarmshealthrisk.aspx
3. N Todd (2009) Tuning and sensitivity of the human vestibular system to low-frequency vibration.

See: http://www.bwea.com/pdf/wind_turbine_syndrome.pdf

6.0: TALK OVERVIEW:

1. Wind Turbine Noise
2. ETSU-R-97 Guidance
3. Jack's Lane Noise Assessment
4. Jane Davis & AM
5. Nina Pierpont & Health
6. **Whitehall Cover-up?**
7. Questions?

THE MEASUREMENT OF LOW FREQUENCY NOISE AT THREE UK WIND FARMS

CONTRACT NUMBER:
W/45/00656/00/00
URN NUMBER: 06/1412

Contractor

Hayes Mckenzie Partnership Ltd

The work described in this report was carried out under contract as part of the DTI Technology Programme: New and Renewable Energy, which is managed by Future Energy Solutions. The views and judgements expressed in this report are those of the contractor and do not necessarily reflect those of the DTI or Future Energy Solutions.

First published 2006

6.1: WHAT DOES THE LFN REPORT SAY?

This report stated that:

- infrasound & LFN were unlikely to have any bearing on complaints at the 3 problem properties he visited
- AM was occurring at much higher levels than anticipated by ETSU at these 3 properties
- this was the true source of the disturbance

Note that little evidence presented to substantiate this claim – purely speculative

The Government response:

- to investigate this specific conclusion, NWG reformed & Salford work commissioned
- the Government re-iterated that PPS22 and ETSU-R-97 were still relevant guidance
- Salford report already discussed – AM infrequent so no further work required
- the Government again re-iterated that PPS22 and ETSU-R-97 should be followed

6.1 WHITEHALL COVER-UP?

- FOI request by Mike Hulme
- revealed 3 previous, marked-up drafts of report
- *it has been alleged that Civil Servants suppressed a recommendation in this report that the maximum noise of the blades should be 33 decibels (not 38)*

My view:

- early draft with some speculative statements in it
- The author was happy to receive these comments
- the allegations do not reflect the author's view
- the study only looked at sites with a problem and comments were made in that context
- given lack of controls, not possible to extrapolate from 3 problem sites to all non-problem sites

Regardless of my view:

- Malcolm Hayes has said in Public Inquiries that his views were not suppressed
- Inspector's in recent Public Inquiries have found no merit in these criticisms of the report
- shortly to be tested in the High Court!

0: TALK OVERVIEW:

1. Wind Turbine Noise & the ETSU-R-97 Guidance
2. Jack's Lane Noise Assessment
3. Jane Davis & AM
4. Nina Pierpont & Health
5. Whitehall Cover-up?
6. **Questions?**


power for good