I am Jane Davis. I live on a farm on the Fens in Lincolnshire, England, an area known as South Holland.

May 2006, eight 2 megawatt turbines
100 metres tall
930 metres away
Location of Grays Farm and Various Wind Farm Components

Legend
- Wind Turbine
- Noise Monitoring Location
- Noise Prediction Location

Deeping St Nicholas Windcluster
Local Context
Scale: 1:25000

Grays Farm Measurement Location
Perceptions of Noise

- Swish – blade cutting through the air.
- Ripping /lashing
- Hum – low frequency drone similar to mains transformer, but uneven.
- WD40 noise.
- Background roar.
- Helicopter noise (aerodynamic modulation - AM) …Whoooppmph
- Enhanced helicopter noise (amplitude modulation of aerodynamic modulation)
Factors That Emphasise Turbine Noise Pollution

*Shelter* – Trees, especially Conifers, tend to filter out other noise, making the sound of the turbines clearer.

*Reflective Surfaces* – Buildings (especially with steel cladding) reflect the sound, increasing the annoyance and making the enveloping of the area even more complete.

*Insulation* - from other sounds (double glazing, wall insulation, ear plugs etc) leads to greater selection for lower frequency sound pressure waves as they have a much greater ability to penetrate and are practically impossible to protect against in a domestic situation.

*Wind direction* - Most effects are worst when the wind is from a southerly direction, blowing through the wind farm toward our home. Stable air conditions associated with temperature inversion on summer evening, i.e., still air and quiet at ground level but strong wind at 100 metres above ground level. [i] (Van den Berg)
"It should be noted that the methodology for assessing noise from wind farms is different from other more traditional sources of noise (eg. Loud music). The standard ETSU-R-97 is used for wind farms as opposed to BS:4142 for most other noise sources, meaning that traditional measures of nuisance do not apply."
Deeping St Nicholas Wind Farm
Regression Analysis of Wind Farm Noise Levels
All Wind Directions

Regression Figure 1: LD820: Location 1: 10m agl wind speed
Noise Monitoring Graph over 1 minute within first floor bedroom - Window open
Davis's House - 5 July 2007 - Wind Farm noise

This graph shows typical internal Amplitude Modulation experienced on 5th July 2007 -
Subjectively considered to be a day when impact was much reduced. The peak to trough
variation shows the AM
Noise Monitoring Graph within centre of first floor bedroom - Window open for ventilation
Davis’s House - 5 July 2007 - Wind Farm noise

The spikiness shows the modulation. Not only does it occur approximately once per second it also fluctuates in level over longer periods of time.
Noise Monitoring Graph measured within First Floor Bedroom - Window open
Davis's House - 5th July 2007 - Wind Farm Amplitude Modulation
Showing significant low frequency content

Fluctuation exceeds 10dB

Note: Each fluctuation in the sound level at 125Hz and other bands corresponded with an audible beat/thump. A slight phase difference was noted between different frequency bands. This is one reason why the dB(A) level did not fluctuate as much as the individual third octave band levels.
<table>
<thead>
<tr>
<th>Actual Days</th>
<th>Date</th>
<th>Time</th>
<th>Problem</th>
<th>&quot;Whoosh&quot;</th>
<th>Pulse</th>
<th>Hum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25/06/2006</td>
<td>15.00 to 23.00</td>
<td>Significant noise and sensations</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>11.5 revolutions per min and grinding/rumble heard at night</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td></td>
<td></td>
<td>02/07/2006</td>
<td>17.00 - 24.00</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td></td>
<td></td>
<td></td>
<td>Woken at 02.00 to go to the toilet, still awake at 03.43.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Woken by house humming and ears pulsing, whoosh, throb and house humming.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td></td>
<td></td>
<td>04.37 - 07.30</td>
<td>Woken at 04.37, ears pulsing, whoosh, throb and house humming. I cried.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td></td>
<td>04.38</td>
<td>01/08/2006</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td></td>
<td></td>
<td></td>
<td>04.44</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td></td>
<td>02/09/2006</td>
<td>04.38</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Woken by house humming and ears pulsing, Turbines whooshing and thumping.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>06/09/2006</td>
<td>04.47</td>
<td>Yes</td>
<td>Yes</td>
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<td>Woken by house humming and ears pulsing. Turbines whooshing and thumping.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
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<td></td>
<td>07/09/2006</td>
<td>05.35 -23.00</td>
<td>Yes</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Hum very loud and &quot;rattly&quot;</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>08/09/2006</td>
<td>02.00 - 24.00</td>
<td>Woke at 02.00 to go to the toilet, still awake at 03.43.</td>
<td>yes</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Hum more of a noisy grinding in the background than a hum, and not easy to get back to sleep. Hum and whoosh very noticeable at midnight when we had visitors!</td>
<td>yes</td>
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<td></td>
<td>09/09/2006</td>
<td>04.44 - 23.00</td>
<td>Woke briefly and could hear hum but went back to sleep as had taken sleeping tablets</td>
<td>yes</td>
<td></td>
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</table>
Disturbed Sleep.

Noise can cause difficulty in falling asleep, reduction in deep resting sleep. Increased awakenings during sleep and adverse after effects such as fatigue and decreased performance. These effects are avoided if noise levels are kept below 30dB LAeq continuous noise or 45dB LA max indoors. (LAeq values refer to steady state continuous noise. LA max values refer to noise events.)
So what steps can be taken to protect the residential amenity?

Consider what is the difference between sound and noise? Clearly more than the loudness alone. An aircraft is very noisy, but a dripping tap at night can be more than enough to spoil a good nights sleep.

ETSU-R-97 just talks about noise as in volume – it does nothing to account for the intrusive character of the noise. So in a rural area 35dB(A) may be as much as 15 dB(A) over background and modulate as well. 43dB(A) (the nighttime recommended criteria WILL be too high in a rural area, even with a nearby road!). “A” weighting masks the low frequency element by diminishing it!

Spacing is crucial. Spacing between turbines (following current best practice) should be at least 4 x the rotor diameter apart. Between rows of Turbines it should be 10 x the rotor diameter.

Whichever turbine is chosen as the model for the EIA then that IS the model and any changes should have a new noise assessment done. Size DOES matter!!!!! The relationship between blade length and tower height is critical and crucial to the material effect that it will have on noise and the residential amenity.

Distancing from homes/schools etc should be 1.5 miles (in an ideal world) but NEVER less than 1000m, irrespective of whom the inhabitant is going to be!!!