

MINIMUM 2Km EXCLUSION ZONE AROUND DWELLINGS



Un-retouched photograph of Sunnyside Village near Tow Law, County Durham 2009

National Alliance Of Windfarm Action Groups
Justification For The Call For A Minimum 2km Exclusion Zone Around Dwellings
October 2009

Industrial wind turbines 'should not be built within 1.5 miles of people's homes. Let it be understood, however, that there will be health and life quality problems caused by wind turbines beyond this radius. People living 1.5 – 3 miles from a proposed turbines site should be notified of potential health and life quality effects, and for this they should be appropriately compensated'

Nina Pierpont MD, PhD

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EXECUTIVE SUMMARY

‘A subset of society should not be forced to bear the cost of a benefit for the larger society’.

(Kamperman and James, acousticians, USA)

The purpose of this document is to present evidence to persuade the Westminster and devolved governments of the United Kingdom that it is time to address the serious concerns of people living close to industrial-scale wind turbines or threatened by a planning application to build them. These concerns are shared with reputable scientists, medical practitioners and researchers around the world. They include:

- People are being made ill by living in close proximity to industrial wind turbines
- The noise measurement guidelines enforced on planning departments by the government are inadequate and fail to protect the public. ETSU-R-97 must be revised by unbiased researchers recognised by opposition groups
- The ability of people to peacefully enjoy their homes and family lives is being adversely affected
- Government research is failing to show that tourism in areas in close proximity to industrial wind turbines is being negatively affected
- Government and wind industry research is failing to reflect and appropriately explain the levels of opposition in communities close to turbines
- The human rights of individuals are not being protected by the government.
- The cultural heritage of this country is not being adequately protected, especially from adverse visual impacts
- General safety issues relating to turbines are not receiving adequate attention
- Inadequate risk assessments for wind turbines e.g. they do not include health risks
- Property values adversely affected
- Balanced training needs to be given to planners and planning committees

It is the contention of this paper that the government is failing to balance the arguments of pro-wind industry organisations, e.g. the BWEA, with those presented by reputable scientists such as Dr G P van den Berg of Groningen University, Professor Ffowes Williams of Cambridge University, the French Academy of Medicine and Dr Nina Pierpont of New York State. It also fails to acknowledge and give weight to the growing amount of empirical evidence now available.

The latest research of Dr Pierpont, in which she expands on her identification of what she calls ‘wind turbine syndrome’ has been endorsed by peer reviews, which can be found on www.windturbinesyndrome.com/?page_id=922. These include:

- Prof. Lord May, Oxford University, former government chief scientist: *‘Impressive. Interesting. And important.’*

- Christopher Henning, MD. Recently retired Director of the Sleep Centre at Leicester University: *'It should be required reading for all planners considering wind farms.'*
- Henry S Horn PhD, Prof. of Ecology and Evolutionary Biology at Princeton University: *'It is clear that many people are affected at far greater distances than the minimum setback distances currently allowed between turbines and residences'.*

The government must therefore respond to the call from groups like NAWAG for a minimum 2 km setback distance between industrial scale wind turbines and dwellings and attend talks with representatives of people whose lives are currently being made unbearable. The government, as represented by ministers such as Ed Miliband, must engage in a meaningful way to try to understand the legitimate concerns of ordinary citizens.

An immediate way forward would be for ministers such as Ed Miliband and Lord Hunt to attend a conference organised by members of NAWAG in the North East, preferably before the end of 2009 as a number of public inquiries are due to be determined in the near future.

BACKGROUND

History teaches us that, as humanity has developed from hunter gathering to settled farming and eventually industrialisation, the results have been both positive and negative. Today we are experimenting with wind power on an industrial scale, with turbines growing ever bigger and coming closer and closer to homes.

Experience tells us that during the course of this development, serious mistakes have been made with significant consequences for human health, blighting the lives of individuals and communities before governments finally took preventative and remedial action. We need mention only:

'asbestos and mesothelioma; tobacco and lung cancer and chronic pulmonary disease; thalidomide and birth defects; mercury and neurotoxicity; x-rays and fluoroscopes and cancer; lead-based paint and childhood poisoning and coal miners and black lung'.¹

There is also the example of DDT, which is toxic to fish and birds, and causes a range of acute effects in humans, but which took some time to be recognised as a problem for human and animal health and banned.

The purpose of this paper is to argue that a similar situation already exists today in relation to wind turbines. We argue that an adequate exclusion zone is necessary to protect vulnerable people from the harmful effects of industrial sized wind turbines currently being built too close to dwellings. This call for an adequate exclusion zone around homes is being made all round the world where industrial sized wind turbines are being built. The highly respected French National Academy of Medicine has already called for a moratorium on building wind farms closer than 1.5 km from residences and research into the health problems associated with this experiment before serious harm is done.²

THE OBLIGATION OF THE UK GOVERNMENT

It is the contention of this paper that the British government is failing in its duty to protect its citizens adequately. This is in accordance with the spirit of the United Nations Universal Declaration of Human Rights which was drawn up and adopted in the aftermath of the Second World War. The Declaration suggests that it is the duty of governments to protect the rights of individual citizens living under their jurisdiction if they chose to adopt the Declaration.

In 1998, the Tony Blair Labour administration finally incorporated the 1951 European Convention on Human Rights into British Law. The Act became effective in 2000, making it possible for British people to seek remedy in British courts rather than the European Court of Human Rights for breaches of their rights as covered by the Act.

Lord Falconer of Thornton, Constitutional Affairs Secretary and Lord Chancellor, told the Human Rights Lawyers Association in London on September 29 2006:

*'We in government will campaign passionately and defiantly for human rights for everyone in Britain. Because we believe it is the foundation for both our security and our prosperity ... The freedoms set out in the European Convention on Human Rights reflects those values. They are not the property of lawyers.'*³

Earlier that year, on May 10, the British Consulate, New York, wrote an email entitled 'UK Elected to the Human Rights Council'. The last paragraph reads:

*'The UK remains committed to striving for the highest standards of human rights both at home and around the world. We are committed to fulfilling the detailed pledges we made as part of our election campaign to promote and protect human rights in the UK and globally. We will play the fullest part in making the new Human Rights Council a success.'*⁴

The purpose of this paper is to call on the British and devolved governments, and all political parties, to live up to these ideals, and ensure that the human rights of people living close to wind farms are being protected. This includes ensuring that their rights are being properly observed and protected under:

- **Article 8: Respect for Private and Family Life**
- **Article 1 of the First Protocol: Protection of Property.**⁵

For a well argued paper on these issues, please refer to the paper written by Barbara J Frey and Peter J Hadden.⁶

The authors of this article share with many people living near wind farms or fighting planning applications for wind farms, the belief that their rights are not being adequately respected. Rather, we argue that in many cases they are being ridden rough shod over. As Kamperman and James argue:

'a subset of society should not be forced to bear the cost of a benefit for the larger society.'

We look forward with interest to the judgement in the Davis case expected next year, on the issue of noise nuisance from wind turbines and its impact on the enjoyment of one's property at the most basic level, of being able to sleep in it at night.

THE FOCUS OF THE PAPER

This paper will focus on some key issues which are inter-related as these are the ones that most urgently affect many ordinary people today, and are a major reason why so many groups have sprung up to oppose wind turbines near their homes. These are:

- The impact of industrial wind turbines on health and the peaceful enjoyment of one's property and family life. This includes the effect of shadow flicker from the sun and moon, noise and safety issues
- the failure of current practice, especially the use of ETSU-R-97, to adequately protect the public and predict the noise nuisances created by wind turbines built too close to homes, especially as they are growing ever taller
- the failure of wind farm company engineers to recognise research which conflicts with their financial interests from respected engineering and health professionals
- the visual impact of turbines, generally, and on sensitive landscapes and village settings
- safety issues generally
- risks to tourism and employment
- the impact on house prices

THE IMPACT OF INDUSTRIAL WIND TURBINES ON HEALTH

In March 2006, the French National Academy of Medicine issued its report on: **The Repercussions of Wind Turbine Operation On Human Health**. In this document they wrote:

'In current scientific literature, there is very little data on the potential hazards for humans that are posed by wind turbines. Reviewing current knowledge and assessing the possibility of this harmfulness was the mission of this work group, and led it to propose a number of recommendations to the Board of Directors'.⁷

Its conclusions are in the Appendix to this document. However, the committee members made some very valuable recommendations which are quoted here.

1. To demonstrate the possible harmfulness of wind turbine noise on humans, the Academy considers it is essential that two types of studies be conducted involving:
 - The development of a procedure for recording , over a period of several weeks, the noise created by wind turbines in homes, then analyzing that noise at different times in order to apply this expertise to the populations in question.
 - An epidemiological investigation into the possible health consequences of this wind turbine noise on the populations which will be correlated with the installation distances of these machines and the results of the measurements proposed above.

2. Pending the results of these studies, the Academy recommends that the public authorities take the following measures immediately:
 - As a precautionary measure, suspend the construction of wind turbines whose parks have over 2.5 MW of power when they are located less than 1.5 km from homes.
 - Modify article 98 of the law of July 2, 2003, as appropriate so that these wind turbines are considered industrial facilities if they exceed a certain power and so that their installation be henceforth subject to specific regulations that account for the highly distinctive sound nuisances that they create.

This study was undertaken because, as more and taller, turbines are being built closer and closer to homes, accounts are being collected from people living close to industrial wind turbines who believe that they are being made ill by their presence. Some are quoted in the French document; others are quoted in a paper by Doctor Amanda Harry ⁸, an English GP, and another by Welsh Doctor Bridget Osborne ⁹. More are quoted in a peer reviewed and highly commended research document by Dr Nina Pierpont, MD and PhD. Dr Pierpont's research is

shortly to be published in book form. She gave evidence before the New York State Legislature Energy Committee on March 2006¹⁰, a copy of which is to be found in the Appendix.

The following quotation gives a flavour of what people are experiencing, and it helps to explain the fear with which people threatened by a wind turbine planning application respond when they first learn about it and start their researches. This quotation seems to be fairly representative. It was gathered at an inquiry held at Askam in Cumbria in January 2004 into the problems being experienced by people living close to a wind farm. This respondent, known only as Member of Family O3 said:

*'They were noisy immediately, blades 'whooshing' around if the wind is from the East, or the South, the noise is horrendous. You can't get away from the noise, where can you go? It's all around outside and you get it inside the house as well. It's worst during the night. I have to 'bed hop' to get any sleep But it doesn't work... This noise is like a washing machine that's gone wrong. It's whooshing, drumming, constant drumming noise. It is agitating. It is frustrating. It is annoying. It wears you down. You can't sleep at night and you can't concentrate during the day It just goes on and on.....It's torture...{four years later} You just don't get a full night's sleep and when you drop off it is always disturbed and only like 'cat napping'. You then get up, tired, agitated and depressed and it makes you short-tempered... Our lives are hell.'*¹¹

In 1998, the German Academic Initiative Group, endorsed by more than 100 university professors, wrote in the Darmstadt Manifesto that :

*'More and more people are describing their lives as unbearable when they are directly exposed to the acoustic and optical effects of wind farms. There are reports of people being signed off sick and unfit for work. There are a growing number of complaints about symptoms such as pulse irregularities and states of anxiety, which are known to be from the effects of infrasound (sound frequencies below the normal audible limit).'*¹²

Residents of Bradworthy in North Devon describe their concerns about the impact of shadow flicker on their health. A resident living only 533 m from three wind turbines which are 85 m high (so much smaller than ones being proposed today of over 125 m high) complained that he experiences:

*'Strobe or shadow flicker entering my Kitchen, Conservatory and Sitting room, all on the East side, when the sun rises in the east, in autumn and Winter behind the wind turbines. This will last for three months and is NOT ACCEPTABLE.... The prolonged flicker causes a headache, affects my eyes and causes disorientation.'*¹³

Complainants often mention that they were told before the site was built that the problems they are experiencing would never occur, as with the resident of Bradworthy. They also frequently complain that the problems they then experience are not dealt with effectively after the site is built.

The gradual but inexorable accumulation of such evidence has led Dr Nina Pierpont to identify what she has now called ‘**Wind Turbine Syndrome**’. A description can also be found in the evidence given to the New York State Legislature in the appendix. She told the Legislature that she, a doctor in Australia and a doctor in England were all studying the syndrome and identifying the same symptoms. These are:

- Sleep problems: Noise or physical sensations which make it hard to go to sleep and cause frequent awakening.
- Headaches, which are increased in frequency or severity.
- Dizziness, unsteadiness, and nausea
- Exhaustion, anxiety, anger, irritability and depression
- Problems with concentrating and learning
- Tinnitus (ringing in the ears)

Dr Pierpont explained that not everyone near turbines experiences any or all of these symptoms, because people have different levels of susceptibility, known as ‘risk factors’. She explained that epidemiologic studies of these risk factors and the proportion of people who get the symptoms were underway. She said chronic sleep disturbance was the most common problem. She argued that exhaustion, mood problems and problems with concentration and learning were ‘the natural outcomes of poor sleep’.¹⁴

The paper produced by National Wind Watch: **Simple Guidelines for Siting Wind Turbines to Prevent Health Risks**¹⁵, written by George Kamperman and Rick James in July 2007 argues that the people most likely to be affected by wind turbine noise are children, people with pre-existing sleep disorders and the elderly. Some people are unaffected, while some nearby neighbours develop serious health effects caused by exposure to the same turbine noise. They argue that the most common problem is chronic sleep deprivation during nighttimes. They argue that medical research documents show that this may develop into far more serious physical and psychological problems.

The consequences for health of poor sleep are fully investigated in a paper by Dr Christopher Hanning called: **Sleep Disturbance and Wind Turbine Noise**¹⁶. On page 5 he writes:

‘Inadequate sleep has been associated not just with fatigue, sleepiness and cognitive impairment but also with increased risk of obesity, impaired glucose tolerance (risk of diabetes), high blood pressure, heart disease, cancer and depression. Sleepy people have an increased risk of road traffic accidents’.

In the appendix Hanning includes a table showing **Recommendations For Setback Of Residential Properties From Industrial Wind Turbines** which is included here. It shows the recommendations made by different authorities based on their understanding of noise issues.

Authority	Year	Notes	Recommendation	
			Miles	Km.
Frey and Hadden	2007	Scientists Turbines >2MW	>1.24	>2
Frey and Hadden	2007	Scientists Turbines <2MW	1.24	2
Harry	2007	UK physician	1.5	2.4
Pierpont	2008	US physician	1.5	2.4
Welsh Affairs Select Committee	1994	Recommendations for smaller turbines	0.93	1.5
Scottish Executive	2007	Based on visual rather than noise criteria apparently	1.24	2
Adams	2008	US lawyer	1.55	2.5
Bowdler	2007	UK noise engineer	1.24	2
French National Academy of Medicine	2006	French physicians	0.93	1.5
The Noise Association	2006	UK scientists	1	1.6
Kamperman and James	2008	US noise engineers	>0.62	>1
Kamperman and James	2008	US noise engineers	>1.24	>2
Bennett	2008	New Zealand scientist	>0.93	>1.5
Acoustic Ecology Institute	2009	US noise engineers	0.93	1.5

Dr Pierpont concludes that:

'Data from a number of studies and individual cases document that in rolling terrain, disturbing symptoms of the Wind Turbine Syndrome occur up to 1.2 miles from the closest turbine. In long Appalachian valleys, with turbines on ridge-tops, disturbing symptoms occur up to 1.5 miles away. In New Zealand, which is more mountainous, disturbing symptoms occur up to 1.9 miles away. In New York State, with its mixed terrain, I recommend a

setback of 1.5 miles (8000 feet) between all industrial wind turbines and people's homes or schools, hospitals or similar institutions. The setback should be imposed immediately for turbines not yet built. The legislature might want to set up a panel of clinicians to review the data and medical information I refer to here, but until this happens, and as research continues, a moratorium on all wind turbine construction within 1.5 miles of homes would be appropriate'.¹⁷

The conclusion of Dr Pierpont and the French National Academy of Medicine that there should be a moratorium on building wind farms of some sort is echoed by EPAW¹⁸ – the European Platform Against Windfarms which currently represents 360 groups from 19 countries. This was founded in 2008 to lobby at the European level for the interests of people whose lives and health are already blighted by industrial wind turbines or are at risk at the moment. NAWAG¹⁹ (the National Alliance of Windfarm Action Groups) founded in 2009 to offer a national voice here in Britain has commissioned this paper for similar reasons.

Frey and Hadden (2007)²⁰ also argue on page 22 of their paper that ‘there appears to be a total disconnect between the experiences of those living near wind turbines and those who have a commercial interest’ and argue that ‘at the least, further investigation into the health effects is warranted, with a minimum buffer zone of 2km between the nearest wind turbine and any dwelling’.

It should finally be noted in this section of the paper that Dr Nina Pierpont’s forthcoming book on wind turbine syndrome is peer reviewed at the highest levels and is being very well received by them.

Additional information on health issues can be found in the appendix.

WHY DO PEOPLE LIVING NEAR TURBINES GET ILL?

Introduction

What arguments have been put forward to account for what Dr Nina Pierpont calls ‘Wind Turbine Syndrome’? In essence, the argument centres around the different kinds of noise and vibration emanating from wind turbines and the impact that these can have on susceptible people, particularly children, the elderly, people with pre-existing conditions and sleep problems. Dr Nina Pierpont argues that it is susceptibility to low-frequency noise that is a significant risk factor in people developing Wind Turbine Syndrome.

This has been explained lucidly in a paper called: **Location, Location, Location**²¹ prepared and published by the Noise Association. It draws on the work of reputable scientists who are highly respected in their respective fields, such as Dr G P van den Berg of Groningen University. The Noise Association points out on page 3 that a major part of the problem is that:

‘there are people who are suffering badly as a result of the noise generated by neighbouring wind farms...’ but that ‘the wind farm industry and its allies can refuse to acknowledge the extent of the suffering that this noise can cause and they sometimes deny its very existence.’

This is in part because as they say on page 4:

‘wind farms have also divided noise experts. There is an on-going technical debate about the noise and vibration produced by wind farms. The debate has led some acousticians to question whether the Government’s guidelines for wind farms are rigorous enough.’

Meanwhile, as the evidence in the previous section has shown, growing numbers of people are becoming ill as turbines are spreading across the country.

Does ETSU-R-97 Adequately Protect the Public Against Falling Ill?

Dr Van den Berg²² argues that the methods used to predict wind turbine noise from the present generation of ever taller turbines are fundamentally flawed. He argues that measuring wind speeds at a height of 10 metres is unrepresentative of wind speeds at the greater height of modern turbines (often 100 metres and above) because the wind speeds can be markedly greater above 10 metres. Van den Berg argues that this is particularly the case at night, when wind speeds may fall to zero at ground level, but the blades continue to turn as the wind remains fast enough at the height of the blades. His work shows that this means that wind speeds can be 2.6 times higher at night than expected. The result is that residents may experience noise up to 10 decibels higher than expected, particularly in areas where there is limited background noise to mask it. His work is supported by other acousticians such as Paul Botha²³ and Eja Pedersen.²⁴

This may be part of the explanation as to why many people living close to turbines experience sleep deprivation.

Wind farm companies often try to reassure people by pointing out that modern wind turbines are mechanically quieter than turbines built nearly twenty years ago in the early 1990's. However, the problem is that turbines are getting substantially taller, with much larger blades, and these can still end up making much more noise than smaller blades.

This is important because the issue that people most often cite when complaining about noise from turbines is the 'swish, swish, swish' noise they make. This is made by the blades as they move through the air.

An argument put forward in its paper by the Noise Association is that some people find it difficult to shut out this repetitive 'swishing' noise from the turbines. These people often find the noise problem made worse by the sight of the blades rotating. They are also badly affected by the dancing shadows that the turbines can cast at certain times of day, mainly in sunlight but also in strong moonlight. This is what is called 'shadow flicker'. A number of European studies have shown that there is a statistically significant link between noise annoyance at the 'swishing' noise and annoyance at the flicker effect created by turbine blades, which in combination, some people find makes them ill.

A paper submitted by Pederson and Persson Waye²⁵ to a conference in Berlin on wind farm noise argued that:

'the informants description of their feelings when exposed to wind turbine noise, as well as shadows and the rotating movement of the rotor blades, were in our analysis interpreted as an intrusion into the private domain. The noise was physically perceived in the living environment e.g. in the garden, in spite of the bushes and fences put up to keep out invaders, and was to those who could not mentally shut it out, an obstacle to pleasant experiences, decreasing the joy of daily life in the home. For some informants, the intrusion went further into the most private domain, into themselves, creating a feeling of violation that was expressed as anger, uneasiness and tiredness.'

Pederson suggests that it is the **combination of the noise, the flickering shadows and the rotating rotor blades** that together give rise to the major health issues that are being identified by people like Dr Amanda Harry and Dr Nina Pierpont.

The issue of low-frequency noise is also of concern. When the wind and turbulence are high, the movement of the blades through the air can produce low-frequency noise. Turbines built on the top of hills are particularly prone to producing this type of noise. Dr Geoff Leventhall²⁶ gave a paper at a Berlin conference in which he said:

'All wind turbines produce low frequencies, mainly mechanical noise, which has been reduced to low levels in modern turbines, but there are circumstances in which turbines produce increased levels of low frequency noise. This is mainly when inflow of air to the turbines is very turbulent, and there are interactions between the blade and the turbulence.'

The problem with low-frequency noise seems to be that some people are more susceptible to hearing it than others; it may be that the people who are getting ill are the ones who are most susceptible to low-frequency noise. To measure it effectively, both the loudness of the noise (decibels) and the frequency (hertz) have to be measured since it is the combination of the two that determines whether and how badly individuals will be affected by it. Unfortunately, the source of low-frequency noise can be difficult to trace, since it can travel through the ground and through the air, and much further than conventional sound can travel. This is one reason for arguing for a 2 km exclusion zone around homes to ensure that this distance is covered.

Noise in general can penetrate buildings, but the impact is much greater for low-frequency noise. The greater penetration also means that low-frequency noise can be much more disturbing to those experiencing it. Jane Davis says her house has been shown to 'move'. This means that it is absolutely vital that low-frequency noise should be measured both outdoors and indoors in order to make prediction as accurate as possible. Accuracy is vital if people are to be adequately protected and not made ill.

The World Health Organisation argues that to do this effectively, wind turbine measurements must be taken using a 'C' weighting, whereas in England the practice seems to be to take measurements mostly using an 'A' weighting. The Noise Association argues that this is why low-frequency noise from turbines is being underestimated on a daily basis, and strongly suggests that the government should use the 'C' weighting to measure low-frequency noise and the G rating for infrasound. They also argue for noise being measured both inside and outside buildings.

All of these problems would appear to be of greater significance where background noise levels are particularly low, such as in quiet rural villages. This is of particular importance as, as the Alliance and Leicester Survey 3/6/02²⁷ said that:

'Peace and quiet is the single most important factor people have in mind when buying a home.... with one in five prospective homebuyers rating it as the most important consideration when choosing where they will buy'.

It is therefore no surprise that many of the action groups that have been set up to fight planning applications for industrial wind turbines are centred around small hamlets and villages.

The Noise Association's²⁸ conclusions and recommendations can be found in the Appendix to this document. They recommend a short moratorium on large wind turbines until issues to do with noise and health are investigated adequately and, like others, argue that it is time for the

government's noise measurement regulations, namely ETSU- R-97 to be fundamentally revisited by people representing all sides of the argument.

The Renewable Energy Foundation wrote a report in response to the report produced by Salford University and requested through the Freedom of Information Act the release of data produced by Salford. This report was commissioned by the government to investigate noise complaints at over 100 windfarms. The report (which included Malcolm Hayes of Hayes Mackenzie as one of the authors) concluded that, in essence, there was no problem with ETSU-R-97. However, the REF in its 2009 paper by Dr John Constable and Dr Lee Moroney responded critically to the Salford work, after using the Freedom of Information Act to access some of the vital information it contained such as which windfarms had been studied. The REF contradicted the Salford Report and instead argued that:

'REF believes that this material provides further evidence that the current noise assessment guidance (ETSU-R-97) is not fit for purpose, is failing to protect the amenity of neighbours and is urgently in need of revision'.²⁹

The evidence offered above would suggest that current guidelines enforced by the government through the planning system are inadequate to protect the public. Consequently there is an urgent need to create a sensible and responsible setback distance from homes, such as the 2km suggested in this paper to protect people who are particularly sensitive to low-frequency noise and shadow flicker.

As Professor Ffowcs Williams, Emeritus Professor of Engineering at the University of Cambridge said:

'The regulations (ETSU-R-97) are dated and in other ways inadequate. It is known that modern, very tall turbines, do cause problems, and many think the current guidelines fail adequately to protect the public'.³⁰

SAFETY AND WIND TURBINES

It is logical to say that, the more industrial wind turbines there are, the more related accidents there are likely to be. A number of issues are relevant to an argument about the need for a 2km exclusion zone from homes. An analysis of wind turbine accidents can be found on www.caithnesswindfarms.co.uk.³¹ This is regularly updated but does not claim to be fully comprehensive and may only represent 'the tip of the iceberg'. The figures given on the site in June 2009 are:

Average number of recorded accidents:	2002 – 2008	65.4
	1995 – 2001	15.9

The closer that industrial wind turbines get to homes, and the higher these turbines are built, the more relevant these considerations will become, although some of the risks described are undoubtedly small. In some cases, it is wind farm workers who are clearly most at risk.

Issues that relate to safety include:

- **Blade failure:** the biggest number of recorded incidents was due to blade failure which can arise for a number of reasons. It results in either whole blades or pieces of blade being thrown from the turbines. Between 1990 and June 2009 154 incidents were identified. Of these, 14 occurred between January and June 30 2009. Pieces of blades are documented as travelling over 400 m, but for turbines that are rather smaller than ones being built and proposed today. **This is a major reason why CWIF believes there should be a minimum distance of at least 2km between turbines and occupied housing in order to adequately address public safety issues.**
- **Fire:** this is the second most common accident cause in incidents identified. It can arise from a number of sources and some turbine types appear to be more susceptible than others. A total of 131 fire incidents were recorded between 1990 and June 2009. The problem for fire brigades is that the fire often occurs too high up for the brigade to take any action – leaving the fire to burn itself out instead. The problem in windy/stormy conditions, particular if the summer is warm and dry, is that combustible material may be scattered over a wide area. **This could again prove a risk in areas close to forests or moorland or close to houses and supports the argument for a sensible exclusion zone.**
- **Structural failure:** the data shows this to be the third most common accident cause and refers to a major component failure under conditions which components should be designed to withstand. This mostly relates to tower collapse and storm damage. It may be the result of poor quality control, lack of or inadequate maintenance and component failure. There were 75 examples found between 1998 and 2009. The annual number of structural failures has increased, with 11 in 2007 and 9 in 2008. So far there have been 6 up to June 30 2009. Smaller turbines are now being built closer to buildings like schools, which may have an impact in the future.

- **Ice throw.** Some Canadian wind farms have warning signs posted asking people to stay at least 305m from turbines in icy conditions. If such recommendations were adopted here, then many bridleways and footpaths near wind farms would become unusable during very cold times. Ice throw has been reported up to 140m. A report published in 2003 reported 880 icing events between 1990 and 2003 in Germany alone. 33% of these were on the lowlands and on the coastline.³²
- Dr Terry Matilisky, Associate Professor of Physics and Astronomy at Rutgers University, says: *'The bottom line is that ice, debris or anything breaking off the wind turbine blades (including the blades themselves) can impact a point almost 1700 feet away from the base of the turbines.'*³³
- **Risk Analysis of Ice Throw from Wind Turbines.**³⁴ This paper was presented by Henry Seifert, Annette Westerhellweg, Jurgen Kroning et al to the Boreas 6 conference at Pyha, Finland, 9 – 11 April 2009. They write on page 5:

'If a wind turbine operates in icing conditions which are described (in the text) two types of risks may occur if the rotor blades collect ice. The fragments from the rotor blades are thrown off from the operating turbine due to the aerodynamic and centrifugal forces or they fall down from the turbine when it is shut down or idling without power production.'

There seems to be no form of regulatory system in the UK to monitor and investigate turbine reliability and safety. This situation should be contrasted with the aviation industry, where the CAA keeps a tight rein on aircraft safety standards, with maintenance procedures under constant review and aircraft incidents and accidents subject to rigorous investigation. In some circumstances, aircraft are grounded until the root cause of the problem has been identified and remedial action implemented.

It is distressing but necessary to point out that during the period of time that this report was written, the first death on a wind farm has occurred on a site at Thurso in Scotland so this situation may be up for review in the immediate future.

VISUAL AMENITY AND WIND FARMS

Introduction

As long ago as 1994, Stevenson and Griffiths carried out a comprehensive audit of eight windfarms in England and Wales after they had been constructed. Each was visited on up to four occasions throughout the year. They came to the conclusion that:

- In most situations turbines dominated the view up to a distance of 2km
- Turbines appear visually intrusive at distances between 1 and 4.5 km in average to good visibility
- Turbines are noticeable, but not intrusive, at distances between 2 and 8 km, depending on the atmospheric conditions and other factors.

These findings are particularly significant to the argument of this paper, since they focused on turbines which are only **40.0 to 61.5 m high**. The turbines being built today are in many cases over 125 m high, that is, twice to three times as tall.

Thomas and Sinclair drew up the Thomas and Sinclair-Thomas matrices in 2001 and suggest that:

- For turbines up to 74 m high, they can dominate up to 3km away due to the ‘large scale, movement, proximity and number’
- For turbines up to 100m high, they can dominate up to 4km away due to large scale, movement and number.

PAN 45 (revised 2002):³⁴ describes the general perception of a wind farm in open landscape as:

- ‘Up to 2 km Likely to be a prominent feature’.

Newcastle University (2002) drew up a research paper entitled: ‘Visual Assessment of Windfarms: Best Practice’³⁵ for Scottish Natural Heritage. In this document, which quotes all of the findings listed above, also points out that they are not static objects (unless the wind is not blowing or blowing too strongly or it is too cold to allow them to operate safely) and the moving blades make them a more prominent and eye drawing feature in the landscape. On page 52 the researcher notes:

‘The movement of the blades, in all cases where this is visible, increases the visual effect of the turbines because it tends to draw the eye.’

Newcastle University, in their document, also suggested that:

- Where turbines are very large, commanding and controlling the view, with very few modifying factors, they should be described as ‘dominant’

Newcastle University studied a number of sites and found that the turbines in several cases were more dominant than the wire frames and photomontages produced beforehand for the EIS for planning purposes had suggested. This was the case for example at:

Deucheran Hill Wind Farm

At viewpoint 8: ‘turbines seem much larger than at the visualisation’

Dun Law Wind Farm

At viewpoint 2: ‘says 8 turbines will be visible but 11 are actually visible. Photomontage impression is much smaller than reality’

Hagshaw Hill Wind Farm

At viewpoint 14: ‘individual turbines on photomontage appear smaller than on site’

At viewpoint 8: ‘turbines more obvious in view than in wire frame’.

At viewpoint 8: ‘turbines appear taller than in photomontage’

Hare Hill Wind Farm

At viewpoint 5.5: ‘towers appear taller and less clustered than in photomontage’

On page 41, the researchers in fact point out that in only two out of eleven cases, and in six of the inaccurate cases, the wind farm appears larger, when built, than in the photomontages.

It is particularly important that photomontages and other vehicles used to ‘predict’ the visual impact of turbines should be accurate now that turbines are being built that are taller than a forty storey block of flats as close as 450 m from homes, as they dwarf and overpower them. A good place to see the impact is Tow Law in County Durham, although the turbines are less than 125m high.

THE NEED FOR A 2 KM (OR GREATER) EXCLUSION ZONE AROUND DWELLINGS

It is clear from the above information, that turbines built close to homes will dominate the view and have the potential to have a negative impact on the sort of people described in the section on health and turbines, who are already becoming ill.

In their paper: ‘Location, Location, Location’³⁶, The Noise Association quotes Pederson from a paper presented to a major conference in Berlin on Wind Farm Noise. She had asked people to describe their feelings when exposed to wind turbine noise, as well as shadows and the rotating movement of rotor blades. It is worth repeating the quotation from Pederson used earlier in this paper when she writes that people feel that it is tantamount to:

‘an intrusion into the private domain. The noise was physically perceived in the living environment, e.g. in the garden, in spite of the bushes and fences put up to keep out invaders, and was to those who could not mentally shut it out, an obstacle to pleasant experiences, decreasing the joy of daily life at home. For some informants, the intrusion went further into the most private domain, into themselves, creating a feeling of violation that was expressed as anger, uneasiness and tiredness’.

It is the argument of this paper that the British government should be protecting the right that individual citizens have to the peaceful enjoyment of the amenity of their homes, and to pursue their family lives there, rather than making it impossible for increasing numbers of people to do this.

The other major impact that turbines close to homes can have is on the historic environment that surrounds many small rural communities that are threatened by industrial wind turbines the height of forty storey blocks of flats and bigger. This will affect detrimentally and for many years to come ‘the sense of place’ that organisations like English Heritage describe and value.

This links very clearly to this statement made by the Renewable Energy Foundation which supports renewable energy and energy conservation while also emphasising that:

‘such development must be governed by the fundamental principle of sustainabilitywe urge the need not to damage or destroy the very environment action on climate change is designed to protect’.

In other words, we must make sure that we do not destroy the very things we value and are trying to preserve, including tranquillity, in the name of protecting them.³⁷

WIND TURBINES, TOURISM AND JOBS

It is a mantra of the British Wind Energy Association that turbines do not threaten tourism and jobs. This is an area that needs solid, unbiased research to be done, by people without a vested interest one way or the other as much of the research quoted by the BWEA does not seem to relate specifically to tourism in areas less than 2 km from wind turbines. This is important as small businesses in rural areas, such as B & B's, small camp sites and small caravan parks, often depend heavily on tourism. These businesses in turn offer custom to shops and suppliers and employment to the immediate rural community.

Here one solid piece of research can be offered to suggest that such an investigation is long overdue, and also suggests that there should most definitely be an exclusion zone established at least 2 km from dwellings, including caravan and camp sites, unless specifically set up for those elusive people who we are told would love to live or holiday so close to turbines.

In 2005, Npower was granted permission to build an eight turbines Windfarm at Knabs Ridge, near Harrogate. The planning inspector's report stated:

'There is no good reason to believe that the presence of the wind farm would put off visitors to the area to the extent that the local tourism industry or related businesses would be adversely affected'.³⁸

A caravan park at High Moor Park Farm, within 430 m of that windfarm, has traded extremely successfully for twenty-eight years, showing an average of less than 5% vacant pitches over that time. The caravan park has pitches for permanent caravans and tourers. The windfarm opened 11 November 2008. Since then the park has lost custom to the point that 25% of the pitches are now vacant. At the same time, other parks further away from the site have not experienced a similar drop in custom and have maintained their occupancy levels. Up to June 2009, the owners of the site believe that they have lost £91,000 in pitch fees and £400,000 in caravan sales.

In Scotland, tourism consultant Professor Terry Stephens, speaking at a public meeting called by Speyside Business Alliance, said that the findings of Glasgow Caledonian University 2008 have not been fully appreciated. He quoted the research as suggesting that:

'although the overall scale of the negative impact at the national level may be minimal, the local effect of this displacement may be very significant'.³⁹

In other words, although tourism at the macro level may be unaffected, local communities will feel the ill effect when tourists take their business elsewhere because of the presence of turbines. This will affect local employment in the process.

In small villages where pubs are already closing at a very fast pace, some are only kept going by the financial input from tourists, and the loss of tourists may be the last nail in the coffin of

the last public amenity. This goes against the fundamental ideal of sustainable communities which is currently being promoted by the government.

In the case of the village of Bolam in County Durham, concern about the possible erection of up to seven wind turbines the height of a forty storey block of flats is preventing the owner of the local pub from investing further in his business, which would in turn create more local jobs. He has recently set up a small camping and caravan site, and would love to build the small accommodation block for which he has planning permission. However, he is holding back from this investment until he is sure that potential customers will not be driven away by the noise from the proposed turbines. If this business closes, a number of existing jobs will be lost to the local area, and no local jobs will emerge from the turbines site to replace them. The pub in Bolam is the only amenity available to the small community, apart from the small village church, as the post office closed in the recent past, there is no shop and no bus service either. A local horse training stables fears it will be similarly affected and local jobs lost.

WIND TURBINES AND HOUSE PRICES

Part of the ongoing debate about industrial wind turbines developments is the impact that they have upon people's enjoyment of their property and on their lives. Intrinsic to this debate is one regarding their impact on house prices. Arguably, the capital tied up in a home is probably, for most people, their most significant asset (apart from, perhaps, their pension). Connected to this is the issue of whether the erection of wind turbines (or indeed even the possibility that they may be erected) may in addition make many properties (other than those on which the turbines are located) unsalable. This can be of great significance if a family is forced to sell its home due to job relocation, illness or old age at a time of falling property values and negative equity

There is a good deal of anecdotal evidence relating to this subject. In the case of my own village, a farmhouse and two barn conversions have been withdrawn from the market. In the case of one of the barn conversions, a couple reluctantly withdrew their offer after hearing about the turbines and attending the wind turbines company's public exhibition and that of the local wind turbines action group. Another house in my village has also been withdrawn from the market for the same reason. A family early in 2009 signed a contract on a house in the village and found out about the turbines the next day. They tried to cancel the contract but were told it would cost them about £50,000 to do this. They could not afford this and had to go ahead with the purchase. They had bought the house for tranquillity and the views. They have two children, one under five and one aged twelve, who will be particularly vulnerable to any problems the wind turbines create. The house is unfortunately at the end of the village nearest to the proposed 125m high turbines. We have also been told of one village with 23 houses on the market, with not a single sale to date.

In the case of the UK, however, there is some solid data available. The Royal Institution of Chartered Surveyors (RICS) published a report: 'The Impact of Wind Farms on the Value of Residential Property and Agricultural Land' in November. The RICS has no vested interest and seems therefore to have credibility.

This study clearly indicates that 60% of Chartered Surveyors with **experience** of transactions impacted by wind turbines (transactions of buildings from where the wind turbines can be seen) detected a reduction in value compared to similar transactions which were not impacted by a wind farm. In the South-West of England this percentage increased to 77%.

In a legal case reported in the Times newspaper on January 10th 2004, Judge Michael Buckley ruled that the value of a house in Marton in the Lake District fell by 20% due to the construction of a nearby wind farm. The Davis family in Lincolnshire also had their council tax reduced due to loss of amenity brought about by wind turbines.

In Canada '*property values decreased by 20% to 25% (an average of \$48,000), were on the market more than twice as long as properties in adjacent areas, and a large number (four times those that did sell) could not be sold at any price.*' This quotation is to be found in: 'Living with the Impact of windmills' by Chris Luxemburger, Director, Brampton Real Estate Board,

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In the USA, J Boone (2007) reports on a study in 2001 and 2002: 'Final Report of the Township of Lincoln's Wind Turbine Moratorium Committee, Kewaunee County, Wisconsin'. In this study they compared property sales prices to assessed values before and after the construction of two wind energy facilities, each having relatively small 65 MW turbines. An assessor reported that property sales (vs. 2001 assessed values) declined by 26% within one mile and by 18% more than one mile from the project. The Moratorium Committee also sent anonymous survey forms to 310 property owners, of whom 223 responded. These responses were then grouped based upon proximity to wind plants. The survey results found that:

- 74% of respondents would not build or buy within ¼ mile
- 61% within ½ mile
- 59% within 2 miles of the wind turbines

A large percentage of those who responded in fact said that they would not buy a home within 5 miles of the turbines. The wind firm's offer to purchase neighbouring houses **for demolition** to create '*an additional buffer for the wind turbines*' came immediately following the release of a noise study showing the Lincoln wind turbines increased the ambient noise level significantly, depending on wind conditions etc. (<http://www.windaction.org/documents/166>)

CONCLUSION AND RECOMMENDATIONS

The conclusion of this paper is self-evident. Taller and taller turbines are being built closer and closer to homes without due regard to the impact on people's health, enjoyment of their homes and private lives, on tourism and employment and on the cultural heritage of this country. We are in fact in danger of destroying much that we value in the name of saving it.

Vested and financial interests (BWEA, wind developers) have adopted a 'WARYDU' attitude to objectors: 'we are right, you don't understand' and continue to disregard empirical evidence. Such evidence must be given the full recognition it deserves, and be given appropriate weight in the planning system, in the training that planners receive, and in the training that councillors who sit on planning committees also receive. In particular, any training provided by organisations such as the BWEA must be balanced by training provided by organisations like the Renewable Energy Foundation.

A 2 km exclusion zone around dwellings would go some way towards protecting vulnerable people from the damage that a rapidly accumulating body of credible evidence suggests is being done every day, to growing numbers of people, throughout the country. It seems in the present circumstances that this exclusion zone will need to be backed by statute to give it the force it needs to protect ordinary people.

Credible research must be undertaken by unbiased researchers into the effects of wind turbines on health, after which a 2 km exclusion zone may prove to be too conservative in scale, and a wider one introduced, especially if ever-taller turbines continue to be built.

It is the responsibility of the government to see that this happens, in the light of its responsibilities to individuals under the terms of the United Nations Universal Declaration of Human Rights and the European Convention on Human Rights, as incorporated into British Law under the Human Rights Act.⁴⁰

There is a need in the meantime for ministers such as Ed Miliband and Lord Hunt to engage with people involved in protests such as NAWAG in a meaningful way. A way forward immediately would be for them to attend a conference organised by members of NAWAG in the North East, preferably before the end of 2009.

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CONCLUSIONS OF THE FRENCH NATIONAL ACADEMY OF MEDICINE

‘The harmful effects of sound related wind turbines are insufficiently assessed People living near the towers, the heights of which vary from 10 to 100 meters, sometimes complain of functional disturbances similar to those observed in syndromes of chronic sound trauma the sounds emitted by the blades being low frequency, which therefore travels easily and vary according to the wind, Constitute a permanent risk for the people exposed to them.... An investigation conducted by the Ddass (Direction Departementale des Affaires Sanitaire et Sociales) in Saint-Crepin (Charent-Maritime) revealed that sound level 1km from an installation occasionally exceeded allowable limits’

Wind Turbine Syndrome

Testimony before the New York State Legislature Energy Committee

March 7, 2006

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I am here to talk to you today as a physician-scientist about a clinical phenomenon called Wind Turbine Syndrome. This is relevant to today's hearing because it critically affects implementation of the RPS (Renewable Portfolio Standard) in terms of the siting of industrial wind turbines. Current siting practices (which are solely industry-driven) disregard public health. The supervision of the legislature—of this committee—is needed to create siting standards to protect the citizenry, all the citizenry, including citizens who are rural, old, ill, impaired, and very young.

Federal agencies are trying to put the brakes on willy-nilly wind turbine construction, citing, for instance, wildlife issues. The GAO (Government Accountability Office) last fall told US Fish and Wildlife to get involved. The National Academy of Sciences in April 2005 initiated a 20-month study on environmental impacts whose final report is due in December this year. There also needs to be a focus on human health, and the state needs to step up to the plate in terms of regulation.

I live in Franklin County, the poorest in NY State. Two years ago, after passage of the RPS, wind energy companies showed up there in force, as they have in all the poor, rural parts of the state. They showed up with no controls whatsoever, unregulated by either the legislature or NYSERDA (New York State Energy Research & Development Authority). Our town boards, made up of farmers, teachers, corrections officers, etc., were told, "You guys handle this," by our state representatives. I got involved as a responsible citizen and physician. Over the last 1½ years I have done a lot of reading, research, and interviews. I have spoken at town board meetings and before the St. Lawrence County Legislature, and published alone or with my husband (a retired university professor) numerous editorials and letters to the editor in local newspapers. My focus has been health issues and to some degree wildlife, in which I also have credentials in my PhD.

I get a lot of slander and abuse from the wind salesmen. Their favorites are saying that my abundantly referenced and footnoted articles, like the one before you (note: a separate handout), have "no evidence," or that I think wind turbines cause mad cow disease. The latter smear came from a town meeting in Ellenburg, NY, in October 2004, when I presented information culled from the medical literature on possible effects of low frequency noise. This included a paper out of the UK linking low frequency sound to prion diseases by a complex and highly speculative mechanism. I was very clear how speculative it was, but apparently the concept of something being speculative was over their heads, including over the heads of wind salesmen in the room.

I am not for or against the RPS. I'm an intelligent person and I support renewable energy. I am not here to shoot down wind energy, which probably has its place, though that place is not near people's homes or near schools, hospitals, or other locations where people have to sleep or learn.

I would like to stress that these are not "farms." One doesn't "farm" wind any more than one "farms" water in a hydroelectric dam or "farms" neutrons in an atomic plant. These are large, industrial installations. They make large-scale, industrial noise. "Jet engines" is the most common description I hear in surveying people—a jet engine that doesn't go away and which you can't get used to.

A syndrome in medicine is a constellation of symptoms and findings which is consistent from person to person. Defining a syndrome is the first step in investigating any new disease. The symptom cluster has to make sense in terms of pathophysiology—there has to be a plausible mechanism in terms of how the body and brain work. Defining a syndrome, and making that knowledge available to the medical community, lets other doctors go from scratching their heads over weird presentations of illness which are coming through their offices, to being able to validate and name what is going on and start to do something about it. It also opens the door to epidemiologic studies to define prevalence and risk factors, which will guide prevention and treatment.

Describing and documenting symptoms is the province of physicians. So is research on the causes of diseases. Deciding whether people have significant symptoms is not within the expertise of engineers or specialists in acoustics, even when the symptoms appear to be caused by noise. We physicians appreciate the noise data which engineers provide, but this data has nothing to do with whether people have symptoms or not. One British acoustics expert, Dr. Geoff Leventhall, is especially outrageous in this regard, insisting that people "can't" have symptoms because turbines "don't," he says, produce low frequency noise. His fallback, for which he is well paid by the industry, is that people make up their complaints. But he's not trained to distinguish whether people are making up their complaints, or to know about the range of physical, psychiatric, and neurological symptoms people might have. A related point: the hallmark of a good doctor is one who takes symptoms seriously and pursues them until they are understood (and ameliorated). This includes symptoms related to the brain, our most complex organ—symptoms which may be neurologic, psychiatric, or physical.

Three doctors that I know of are studying the Wind Turbine Syndrome: myself, one in England, and one in Australia. We note the same sets of symptoms. The symptoms start when local turbines go into operation and resolve when the turbines are off or when the person is out of the area. The symptoms include:

- 1) Sleep problems: noise or physical sensations of pulsation or pressure make it hard to go to sleep and cause frequent awakening.
- 2) Headaches which are increased in frequency or severity.
- 3) Dizziness, unsteadiness, and nausea.
- 4) Exhaustion, anxiety, anger, irritability, and depression.
- 5) Problems with concentration and learning.
- 6) Tinnitus (ringing in the ears).

Not everyone near turbines has these symptoms. This does not mean people are making them up; it means there are differences among people in susceptibility. These differences are known as risk factors. Defining risk factors and the proportion of people who get symptoms is the role of epidemiologic studies. These studies are under way. Chronic sleep disturbance is the most common symptom. Exhaustion, mood problems, and problems with concentration and learning are natural outcomes of poor sleep.

Dr. Pierpont on Wind Turbine Syndrome March 7, 2006 Page 3

Sensitivity to low frequency vibration is a risk factor. Contrary to assertions of the wind industry, some people feel disturbing amounts of vibration or pulsation from wind turbines, and can count in their bodies, especially their chests, the beats of the blades passing the towers, even when they can't hear or see them. Sensitivity to low frequency vibration in the body or ears is highly variable in people, and hence poorly understood and the subject of much debate.

Another risk factor is a preexisting migraine disorder. Migraine is not just a bad headache; it's a complex neurologic phenomenon which affects the visual, hearing, and balance systems, and can even affect motor control and consciousness itself. Many people with migraine disorder have increased sensitivity to noise and to motion—they get carsick as youngsters, and seasick, and very sick on carnival rides. Migraine-associated vertigo (which is the spinning type of dizziness, often with nausea) is a described medical entity. Migraine occurs in 12% of Americans. It is a common, familial, inherited condition.

To keep our balance and feel steady in space, we use three types of input: from our eyes (seeing where we are in space), from stretch receptors in joints and muscles, and from balance organs in the inner ear. At least two of these systems have to be working, and agreeing, to maintain balance. If the systems don't agree, as in seasickness or vertigo, one feels both ill and unsteady. Wind turbines impinge on this system in two ways: by the visual disturbance of the moving blades and shadows, and by noise or vibration impacting the inner ear.

Other candidate risk factors for susceptibility to Wind Turbine Syndrome are age-related changes in the inner ear. Five percent (5%) of otherwise healthy people from age 57 to 91 experience dizziness, and 24% experience tinnitus or ringing. Damage to the ears or hearing from other causes, such as noise exposure, is also a potential risk factor. Inner ear organs are closely linked, by proven neurological connections, to the brain systems which control mood, anxiety, and one's sense of well-being. Disturbing the inner ear disturbs mood, not because a person is a whiner or doesn't like turbines, but because of neurology.

Data from a number of studies and individual cases document that in rolling terrain, disturbing symptoms of the Wind Turbine Syndrome occur up to 1.2 miles from the closest turbine. In long Appalachian valleys, with turbines on ridge-tops, disturbing symptoms occur up to 1.5 miles away. In New Zealand, which is more mountainous, disturbing symptoms occur up to 1.9 miles away. In New York State, with its mixed terrain, I recommend a setback of 1.5 miles (8000 ft.) between all industrial wind turbines and people's homes or schools, hospitals, or similar institutions. This setback should be imposed immediately for turbines not yet built. The legislature might want to set up a panel of clinicians to review the data and medical information I refer to here, but until this happens, and as research continues, a moratorium on all wind turbine construction within 1.5 miles of homes would be appropriate.

To recapitulate, there is in fact a consistent cluster of symptoms, the Wind Turbine Syndrome, which occurs in a significant number of people in the vicinity of industrial wind turbines. There are specific risk factors for this syndrome, and people with these risk factors include a substantial portion of the population. A setback of 1.5 miles from homes, schools, hospitals, and similar institutions will probably be adequate, in most NY State terrain, to protect people from the adverse health effects of industrial wind turbines.

Vibroacoustic Disease and Wind Turbines

In 2007, the Second International Meeting on Wind Turbine Noise was held in Lyons in France on September 20 – 21st.

This conference was attended by Mariana Alves-Pereira and Nuno AA Castelo Branco. Their paper was called: 'In-Home Wind Turbine Noise is Conducive to Vibroacoustic Disease'. Mariana works at Erisa Lusofona University in Lisbon Portugal, and Nuno works at the Center for Human Performance in Alveria Portugal.

They had been contacted to act as independent experts by a lawyer who was fighting a case on behalf of a family in Portugal who believed they were being made ill by turbines built about 400 m from their home. Their aim was to get the turbines removed.

The results of their research led them to conclude that the family was already suffering from the disease, which is recognized as an industrial disease, as a result of the turbines and that it was likely that they '*will also develop severe VAD*' if the turbines are left in place and they remain living in their current home.

They concluded that: '*safe distances between wind turbine rotating blades and inhabited buildings have not yet been determined by the scientific community*'.

Overall Conclusions from “Location, Location, Location”

1. Wind Farm noise, in common with noise generally, affects different people in different ways, but the evidence suggests that there is rarely a problem for people living more than 1 – 1.5 miles from a turbine,
2. For many people living relatively close to turbines, the noise does not present a problem. For those who are annoyed by the noise, it is overwhelmingly the “swish, swish, swish” of the turbines which troubles them.
3. For people who cannot shut out the noise, the problem can be exacerbated by the rotating blades and the dancing shadows of the turbines . This can mean that the noise from turbines can be much more intrusive than other noises of a similar decibel level.
4. For some people the impact of turbines can be overwhelming.
5. The noise can be a particular problem in rural areas where background noise levels are low.
6. The infrasound content of wind turbine noise is too low to be heard by most people.
7. At times, low frequency will form an audible, but not major part of the “swish” sound of the turbines which can, for people sensitive to low frequency noise, create additional problems. But the low frequency content of wind turbine noise is no greater than the low frequency component found in other noise sources and can only be heard downwind of a turbine when there is a fair bit of turbulence.
8. However the low frequency may be underestimated because of the persistent use of ‘A’ weighting in measuring the noise, rather than taking ‘C’ weighted measurements.
9. Research by medical doctors has unearthed persistent complaints from people saying they not only hear the noise from wind turbines, but can “feel” disturbance in their bodies. This has lead to complaints of illness. The symptoms people are complaining about are very similar to those associated with vibroacoustic disease. The suggestion is that the unique combination of noise (containing an element of low frequency) and the strobing effect of the flickering blades, is having a physical effect on some people.
10. Modern turbines are mechanically quieter, but there is convincing evidence that the noise they emit is being underestimated because measurements continue to be taken at a height of 10 ft. from the ground, thereby underestimating the speed of the wind (particularly at night) at the top of large modern turbines over 100 m high.

Overall Recommendations from “Location, Location, Location”

1. It would be prudent that no wind turbines should be sited closer than 1 mile away from the nearest dwellings. This is the distance the Academy of medicine in Paris is recommending, certainly for the larger turbines and until further studies are carried out. There may even be occasions where a mile is insufficient depending on the scale and nature of the proposed development.
2. Wind farms should only be located in areas where the “swish, swish, swish” of the turbines will not cause noise problems for people.
3. There needs to be a clear and public recognition by the Wind Power Industry that wind turbines are causing significant noise problems for some people. This could open the door to constructive discussions.
4. The industry should also recognise that the evidence is persuasive that the noise problem can be exacerbated by the rotating blades and the dancing shadows of the turbines.
5. The official government guidelines for the siting of wind turbines need to be revised to take account of the more intrusive nature of noise in areas where the overall background noise is low.
6. The debate on wind farms would do well to recognise that the infrasound content of wind turbine noise is too low for most people to hear.
7. People need to be careful not to exaggerate the audibility of the low frequency of the noise. It can be a problem at times, but over emphasis can detract from the main noise problem: the “swish, swish, swish” of the blades.
8. The guidelines should use the ‘C’ weighting (and ‘G’ weighting for infrasound) as well as ‘A’ weighting when measuring the noise from turbines in order to fully capture the low frequency element.
9. Further work needs to be undertaken urgently to test the claims that the overall effect of turbines is having a physical effect on people to the detriment of their health.
10. There should be a short moratorium on the installation of large modern turbines until it is established, through trials, the amount of noise they actually emit.

Sleep and Wind Turbines

A most useful paper to read on this subject is “**The ‘How to’ Guide to Siting Wind Turbines to Prevent Health Risks from Sound**’.

Kamperman and James are highly respected acousticians. They write:

‘our review of the studies listed in Tables 1-4 of our Noise Con paper show that some residents living as far as 3km from a wind farm complain of sleep disturbances from the noise. Many residents living 1/10 of this distance (300m or 984 feet) from wind farms experience major sleep disruption and other serious medical problems from nightmare wind farm noise.....children, people with certain pre-existing medical conditions and the elderly are likely to be the most susceptible(the noise is) more annoying than traffic noise.....low frequency noise is a problem inside buildings’

The **Acoustic Ecology Institute of Santa Fe** has produced a Fact Sheet on Wind Energy Noise Impacts. It says:

‘A recent UK government survey suggests that about 20% of wind farms tend to generate noise complaints; the question is, what are the factors in those wind farms that may be problematic, and how can we avoid replicating these situation elsewhere.’

‘It is important to recognise that night-time ambient noise levels in rural areas are often 35dB or lower; so it is not that hard for wind farms to become a new and dominant acoustic presence.’

‘If temperature or other atmospheric instability effects that cause excessive noise occur just 10% of nights, that means that nearby residents may find that sleep is disturbed 35 nights a year.’

‘It appears that noise travels further in calm night air; one widely respected study (van den Berg) found that sound levels were 5 – 15 dB louder than predicted in some night-time atmospheric conditions, and noted that residents as far away as 1.9 km were disturbed by the noise. In nearly all cases, those downwind bear the brunt of the sound; if you live upwind of a wind farm, noise problems will likely be far less severe.’

The WHO (World Health Organisation) says that *‘to protect children’s health sound levels should be less than 30 dBA during sleeping periods. They note that a child’s autonomic nervous system is 10 – 15 dBA more sensitive to noise than adults. WHO night time recommendations for the general public are 30dBA inside bedrooms and 45 dBA outside open bedroom windows. Even for adults, health effects are first noted in some studies when the sound levels exceed 32 dBA, 10 – 20 dBA lower than the levels needed to cause awakening.*

WHO researchers found that sound levels of 50 dBA or more strongly disrupted hormone secretion cycles. For sounds that contain a low frequency component, which is typical of wind

turbines, the WHO says that noise levels need to be even lower than 30 dBA to not put people at risk.'

Recently, an article in the Dominion Post in New Zealand wrote about the problems the people of Makaka are experiencing with wind turbines and noise at night leading in turn to sleep deprivation and ill health. There were twenty complaints in one week. One woman said: *'It was like an airport'* on bad nights and added *'it could drive you mad'*. A second resident said: *'It's been horrific. It's noise torture.'* A third said: *'We just want some sleep. We don't think that's an unreasonable request'*.

A recent article in the Telegraph on 5 July 2009 has suggested that lack of sleep is also more dangerous for women than for men. A study claims that it increases the risk of heart disease more among females than males. Research by the University of Warwick and University College London found levels of 'inflammatory markers' – indicative of coronary disease – vary significantly with sleep duration for women but not for men. Researchers found levels of Interleukin -6- one marker – were much lower in women who reported sleeping eight hours compared to those who slept seven hours. Dr Michelle Miller, associate professor of biochemical medicine, said the findings *'support the idea that short sleep is associated with an increase in cardiovascular risk and that the association between sleep duration and cardiovascular risk factor is markedly different in men and women'*. Results were consistent with the idea that *'seven or eight hours appears to be optimal for health.'*

In Ontario recently a survey has been updated. The original survey in April 2009 by Dr Robert Mc Murty said that 53 people reported ill-health due to turbines. He revisited the survey and this time the number of people reporting ill-health had risen to 86, a rise of 62%. One victim said: *'we hear wind noise from turbines every evening; the setbacks are 800 m, 1100 m, 1200 m, 1000 m, 1500 m and 2000 m.'* The people hear report sleep disturbance as being the most common symptom, with an average of 5 symptoms each. Some have had to leave their homes to escape the noise problems and protect their health. Some are losing income due to ill-health.

It is also worth noting that night-shift workers (e.g. nurses) suffer greater health problems than day-workers because of disrupted sleep patterns. The Danish government has recently paid compensation to night-nurses and flight attendants who were diagnosed with cancer. Night shifts are rated just one rung below asbestos and smoking in the league of potential cancer triggers. This is referred to in a recent Guardian article of March 17th 2009.

It is also a very well documented fact that sleep deprivation is universally recognised as a torture technique which is condemned by civilised societies that respect such things as the Geneva Convention and the Universal Declaration of Human Rights.

The Salford University Report and the REF Response

The Salford Report is significant because politicians and developers cite it as a ‘review of noise/review of ETSU-R-97’ and use it to argue against the calls for a comprehensive and unbiased review of ETSU-R-97 by concerned world renowned experts that it ‘*fails to protect the public*’. (Professor Ffwcs-Williams).

However, the use of the Salford Report in this way is questionable because:

- It only studied amplitude modulation (AM) noise
- Conclusion p47 para 11: the report itself actually says ‘AM is not fully understood and cannot be predicted at present’ and recommends that ‘since AM cannot be fully predicted at present, and its causes are not understood we consider that **it might be prudent to carry out further research to improve understanding in this area**
- 27 of the 133 windfarm sites operational across the UK at the time of the survey had attracted noise complaints at some point – around **20%**. This means they were already adversely affecting a considerable number of people by 2007 when the survey was conducted. It did not include **Wharrels Hill** where noise was an issue at the time.
- Since 2007 more and taller turbines have been built and approved. More people are reporting problems every day around the world. See the body of this report.
- It is not a ‘comprehensive and unbiased review of ETSU-R-97’.
- Knowledge and understanding has overtaken it

The Renewable Energy Foundation itself had to use the Freedom of Information Act to find out which wind farms had been studied, and recommends that free and fair access to information is crucial.

Concluding Comment From ‘Location, Location, Location’

Wind farms can play a role in reducing global warming emissions. But there is a very real danger that, in the enthusiasm to embrace clean technology, legitimate concerns about noise are being brushed aside. There is no doubt that some existing wind farms are causing real noise problems. This report has stopped short of arguing that turbines should be shut down, though that possibility should never be ruled out. However, it would be quite unacceptable to our fellow citizens for this situation to be replicated in other parts of the country as new turbines come on stream. But this need not be the case. The positive conclusion of this report is there is a constructive way forward. It simply requires sensible siting of the new wind farms. It’s all about “location, location, location”. It is in the interests of the wind power industry, environmental groups and local communities to get that right.