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WIND TURBINES, NOISE AND INFRASOUNDS:

THE EFFECTS OF INDUSTRIAL WIND TURBINES ON HUMAN HEALTH

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Introduction
From a physical point of view, sound is the phenomenon produced when an emitter of sound causes the molecules in ambient air to vibrate.

From a physiological standpoint, sound is a subjective auditory sensation depending on the nature of the person hearing it. There is therefore a subjective element to the perception of noise.

Sounds are characterised by
- amplitude or sound pressure level, expressed in decibels (dB), and which are weighted : the weighting dB(A) is used to reproduce the sensitivity of the ear. It is given for a specific point in relation to the observer.
It is measured using a microphone.
- and by their frequency, expressed in Hertz (Hz), being the period of the vibration (eg: 10 Hz= 10 periods of vibration per second).
In the scale of frequencies there are :
- inaudible infrasounds , (below 16 Hz or 20 Hz) which are very low frequency acoustic vibrations ,
- audible sounds (frequency between 16-20 and16 000-20 000 Hz),
- and above that ultrasounds (high pitched sounds that are not audible to humans , but which are heard by dogs and bats).1
Sound is a wave, which is not necessarily audible.(heard).

The definition of 'noise' is undesirable sound, which causes disturbance or damage to receivers.

1 ORFEA; Research consultancy specialising in acoustics and vibrations. www.orfeaacoustique.com

I- Audible sounds and wind turbines

Wind turbines emit two types of noise:

I-1. mechanical noise

Improvements in technology have significantly reduced the mechanical noise emanating from the transmission and alternator . This has been achieved by using improved soundproofing in the nacelle and other measures such as the modification or removal of the gearing in some models which have transmission shafts set on shock absorbing bearings .

There is an element of uncertainty so long as it is not known which model (and the year of manufacture) will be chosen by the wind turbine developer , as is in fact the case for some projects.
Even so, the rotor blades turn at 1500 revolutions / min a speed achieved by means of a multiplier to drive the generator. The noise produced by a wind turbine at the level of the nacelle reaches 120 dB (the noise of a discotheque), and, according to the constructors, 45 dB at 300m (the noise in an office). Obviously the number of wind turbines (eg.: 10 wind turbines= 55 dB) and other factors such as the topography, background noise level, etc must then be taken into account.

The technological progress made to reduce the noise of wind turbines is unfortunately offset by the fact that the machines are more and more powerful.

They are also taller and taller, (90, then 115 m) .In fact sounds propagate more easily the higher source of the sound , as there are less obstacles to their propagation.

I-2. Aerodynamic noise,

This is caused by irregularities in the flow of air around the rotor blades and the tower, and by the changes in the speed of the wind.2

At present, it is the aerodynamic noise that is the most important factor, and it can not be eradicated.
Up to a speed of 15m/s, the blades cut through the air like the wings of a glider and emit the same rustling sound (swish in English) ....above this speed the turbulence on the trailing edge of the blade generates a droning noise.

The blades emit a "woof" each time they pass the alignment of the tower.

2 ' Wind turbine noise issues / Renewable energy research laboratory center of energy efficiency/ A. L. Rogers, PhD. Unversity
of Massachusetts at Amherst, March 2004.

I-3. The uncertainties of sound

The noise impact of a wind energy facility is measured before the machines arrive by means of computerised simulation: a comparison is made between the sound level near the neighbouring houses with (ambient noise) and without the noise expected to be generated by the wind energy facility(residual noise).
The regulations in France provide that the sound differential should not exceed 5 dB during the day or 3 dB at night.
In general, the models for wind turbine noise do not take the following elements into account: 3
- the topography
- significant obstacles in the trajectory of the wind
- the refraction of noise due to atmospheric effects (inversions of temperature)
- any changes in the propagation of the noise which modify the frequency (for example harmonics can be produced , increases by tens of Hz)

Turbulence

It is true to say that the noise caused by wind in the trees increases rapidly with wind speed and can exceed 60 dB at 15m/s. This can mask the noise produced by the wind turbines.
For a constant wind speed, the acoustic signature of the wind turbines will be constant.
Unfortunately, in areas where the wind is mainly turbulent, the noise varies with the movement of the rotor blades, and if the machines are sited on a small ridge surrounded by undulating land, the gusts of wind create unpleasant pockets of noise.
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Topography

The propagation of the audible noise generated by wind turbines is not does not follow a straight line. Its trajectory depends on the topography of the surrounding area.
If you live under the prevailing winds, the sounds propagate more easily .
The most striking case of sound propagation is when at altitude the wind is sufficiently strong and noisy to make the wind turbines turn, and there is little wind in the surrounding valleys, sheltered from the wind, where therefore there is little noise. In this situation, the machines can be clearly heard at a distance of 1,000m.4

Day and Night

The extrapolation of night-time wind speeds based on data obtained from measuring masts is incorrect : the propagation of noise at night is not the same as during the day (and it covers greater distances). (Study carried out by the University of Groningen. The Netherlands 5)
These considerations: turbulence, topography, and diurnal amplitude explain why the theoretical acoustic measures produced by the developers can be reassuring, whilst the subsequent reality is a deception…

3 http://www.npl.co.uk/acoustics/techguides/wtnm
4 Expérience faite par l'auteur et un témoin en contrebas des éoliennes de Camares (Aveyron) , à Brusque.
5 www.rug.nl

This is why wind turbine noise continues to be a problem for local populations. The Daily Telegraph 6 reports that English people who were in agreement with the implantation of wind turbines changed their minds after they had experienced the noise generated by a nearby wind energy facility.
Group visits to existing wind energy facilities only give a general idea of the situation that can be encountered. In fact:
- you are talking and your attention is distracted, you do not listen to the silence
- you only see one situation at a given moment in time, and this will not necessarily be the same in your case
- if the developer organises the visit, he can reduce the noise generated by the wind turbines by limiting the speed of rotation of the blades.

I-4. Effects of wind turbine noise on our health

The Welsh Select Affairs Committee , on the subject of wind turbines, states « In the case of existing wind energy facilities, we can see that there are cases of people who suffer nearly continuous noise when the wind turbines are operating, at levels that do not constitute a nuisance forbidden by law or which exceed regulations , but that are clearly disturbing and unpleasant , and that can have psychological effects ». 7

English doctors, consulted by people living in proximity to wind turbines, have reported the following problems (clinical observations):
- auditory and nervous fatigue
- stress and cardiac arrhythmia,
- problems of anxiety and depression
- effects on the quality and quantity of sleep.

Noise and sleep disturbance

In this respect, in a Medical thesis published in 2004 8 , it was reported that during sleep some sound stimuli cause reactions such as an acceleration in the rhythm of breathing, tachycardia, body movements, short awakenings lasting 9 to 15 seconds, changes in the stages of sleep, without the sleeper being consciously aware of it.

In addition, the impact of noise on sleep varies according to

- age (the threshold of wakening is higher for the elderly, and it is harder for them to go back to sleep)
- sex: women have a lower tolerance for noise than men
- psychological profile

6 "Wind farms make people sick who live up to a mile away" / C. Milner- In: Daily Telegraph 25 June 2004
7 www.aandc.org/research/wind_pec_present.html CANADA www.geocities.com/nigbarnes
8 BREANT Sigrid. "troubles du sommeil et de l'éveil chez les personnes âgées" Thèse de doctorat en Médecine. Paris, Cochin,
2004.

- the characteristics of the noise (intermittent noise causes more sleep disturbance/disruption (eg: the wind turbine starts up again) than continuous noise (where there is a constant regular wind)
- the stage of sleep (eg: people wake up more easily during periods of rapid eye movement sleep)
- the emotional impact of the noise and its signification (if you detest the wind turbines, you will be more disturbed by their noise!)

Problems of sleep which seem to be innocuous at first sight, cause problems of alertness or somnolence during the day, which has serious effects on public health (in France, 1 out of 3 road traffic accidents is linked to somnolence).

This example shows that problems of sleeping which do not appear to be dangerous can have serious effects on public health.

Wind turbines and daytime perceptions/sensations

The human ear is a very sensitive organ, even to relatively slight noises made by modern wind turbines.

During the day, the more repetitive and rhythmical the noise, the more we notice it (these are called pure tones, such as the drops of water from a dripping tap falling regularly into the sink, or a door banging several times) . We notice less the noises that are random, (white noises, for example the noise of a bucket of water being tipped over).

To account of this, the dBs(A) should be added to the values obtained by the acoustic laboratories.9

People living near wind turbines have described the noise of the machines as being similar to that of a refrigerator or a washing machine. One person described the noise as being like the sound of " a cement mixer over my head ".

"It's only when they stop that I hear the silence. They wear us out, you can't escape them".10
The wind turbine noise destroys their lives .
It is true that you can find people who appear to be less affected than others, everyone is different and we do not all perceive noise in the same way as we have seen.

However, certain people are exposed to a risk. Even if they are in the minority, they should be taken into account, just as account is taken of the 5% of people who are handicapped in France, who fortunately have made their voice heard by government authorities through the actions of several associations.

It must be remembered that English doctors have stated that audible noise from wind turbines can affect human health at distances exceeding a mile (1609 m)

9 www.windpower.org . Danish Wind Industry Association.
10 "Wind farms make people sick who live up to a mile away" / C. Milner- In: Daily telegraph 25 June 2004.

II- Infrasounds

Infrasounds or low frequency acoustic vibrations are much less well known, because they are not audible.
At frequencies below 16- 20 Hz, we no longer hear the sounds, but we can perceive the vibrations (infrasounds) which envelope our entire body 11 . We can even perceive sounds at the frequency of 1 Hertz if the sound pressure level is high enough.12

II-1. Propagation**:**
Infrasounds are inaudible but very powerful and propagate through the air faster than the wind (speed :360m/s), and at greater distances from their source than audible sounds.
The atmosphere has various temperature gradients which guide the waves. 13
They propagate more freely than audible sounds as they lose less energy.
They are not stopped by trees, the wind , nor by the walls of houses, and the sound insulation of windows is ineffective so far as infrasounds are concerned.

It is worth noting the words of the ADEME, which has an odd way of informing the public about infrasounds :
"If the low frequencies can propagate far enough, the sound intensity decreases rapidly" 14

This sentence is contradictory and leads to confusion: if the infrasounds propagate over a long distance, it is because they lose less energy than sounds, therefore the intensity of their sound decreases less quickly than that of audible sounds.

In fact, according to A Le Pichon, a researcher at CEA15 , the infrasounds emitted by a wind energy facility of 7 wind turbines 100m tall travel as far as 5 to 10 kms at a frequency of 10 Hz (which can vary depending on the obstacles encountered and the wind).

II-2. Detection
Infrasounds can be detected by various sensors depending on the frequency of the infrasound: 16
- F= << 1Hz (nuclear explosions that last for several minutes covering a great distance): a barometer (barograph in German)
- F> 0,001 Hz = electrostatic microphones cover the range from 1 Hz
For high levels of infrasounds, piezoelectric microphones can also be used

11 Laboratoire acousitque du CNRS. Ile de France. chapitre "infrasons"
12 Altmann, Jürgen, AcousticWeapons – A prospective Assessment, Universität Dortmund / Institut für Experimentalphysik III
April 1999 p.16
13 Contribution d'un modèle 3D de tracé de rayons dans un milieu complexe pour la localisation de sources infrasonores.
Thèse de doctorat en géophysique en cours . CEA. /Alexis le Pichon, dir. 2004
14 ADEME « Des éoliennes dans votre environnement? 6 fiches pour mieux comprendre enjeux » février 2002
15 Commissariat à l'énergie atomique. Paris France.
16 Encyclopédie Universalis

A "solion" microphone is used for the range from 0,003 to 50 Hz : vibrations transmitted to a liquid modulate the current of the ions in an electrolyte.

II-3. What produces infrasounds?

NATURAL SOURCES

- Infrasounds occur in the atmosphere, produced by natural occurrences such as thunder, volcanic eruptions, avalanches, and earthquakes, which can shatter windows a 100 kms away from their source
.
Meteorites entering the atmosphere 17 also generate infrasounds.
Infrasounds of very low frequency (0,2 to 0,3 Hz) are also produced by the swell of oceans.

ARTIFICIAL SOURCES

The "bang" of supersonic planes emits infrasounds.
Explosions such as the recent gas pipeline explosion at Ath near Brussels, which was picked up on infrasound sensors of the BRG over 1,000 kms away, in the east of Germany (on the border of Austria and the Czech Republic) , more strongly at HUFE (Northern Germany), and at Flers in Normandy as well. 18
- nuclear tests, which produce infrasounds that have such a strong amplitude that they are propagated round the world, like earthquakes. A worldwide network of infrasound sensors monitor the planet and can detect the origin of the smallest nuclear test.
In normal everyday life, lorries and motorbikes passing by at high speed on the roads produce infrasounds of harmful intensity, as do trains.
When you bang the door, you produce infrasounds, but at a level which is insignificant.

-the deep bassoon of an organ 19 (infrasounds correspond to low-pitched sounds, whereas ultrasounds correspond to high-pitched sounds)
Microwaves produce ultrasounds, sounds of very high frequencies, but also generate low frequency pulsations .
- Some devices : piston compressors 20 or machines that vibrate in general : eg air conditioners or slowly rotating ventilators also emit infrasounds.

17 Gouvernement Canada. Commission géologique:
BRG:: laboratoire de recherche allemand en séismologie et infrasons. www.seismologie.brg.de
18
19 CI multimédia, magazine du Web
20 Membres Lycos

The same can be said for household electrical appliances such washing-machines when spinning.
- Only the low-pitched elements of sounds are left in aircraft cabins and inside cars as the high-pitched sounds are absorbed by silencers, acoustic insulation and the air.

It should be noted that the natural and artificial phenomena described above are only transient and for a limited period of time . If they are harmful in nature, they only have to be endured for a moment.
However, heavy rotating machines 21, industrial noise from factories (ZI)22, and industrial wind turbines produce recurrent and repetitive infrasonic vibrations, which, as we shall see, can have more harmful effects on the human organism.
No-one contests the fact that wind turbines emit infrasounds; by what mechanism ?

According to Dr Hartmann, an infrasound specialist 23 (BGR Laboratory, Germany), the infrasounds are produced by the rotation of the blades, which create a flux of low frequency waves when they pass in front of the tower. The frequency of the infrasounds depends on the rotation speed of the wind turbine blades. This can increase in the event of obstacles (winds)
It is also possible that there is a phenomenon of resonance in the tower, as we know that for example a pipe 24 m long can emit infrasounds and resonate at 2.5 Hz .24.

II-4. Impact of infrasounds on the human organism

The subject is very complex for several reasons:

-There is a wide variety in the approach to the research carried out: physics (acoustics) and medical research. These are entirely separate disciplines, with no cross-disciplinary view of the problem.

- Detection is difficult, as it can be difficult to distinguish the action of infrasounds from that of audible sounds, (both are present up to a certain distance), and that of other factors of human pollution.

- The psychological nature of some symptoms is difficult to record rigorously.

- They affect some people, and not others.

- They have a different effect depending on the length of exposure, the frequency (Hz), and the amplitude (dB) of the infrasounds and the distance from the source.

21 "Infrasound at working places in Finland In:Combined Effects of Occupational Explosures / Janhunen HK. In: Proceedings of
the Fourth Finnish-Soviet Joint Symposium. Institute of occupational Health, Helsinki, Finland. 1984.- pp 134-139.
22 Encyclopédie Universalis
23 hart@sdac.hannover.bgr.de
24 Encyplopédie Universalis

1- Generally speaking, it has been proven that infrasounds, which can occur in total silence, have negative effects on human health.
The symptoms are as follows:
- central nervous system: tiredness, insomnia, problems sleeping and resting.
- Psychological : problems of productivity, loss of concentration , nervousness, oppression, aggression, stress or anxiety, and general emotional and cognitive changes . 25

- Autonomic nervous system: effects on balance, breathing and heartbeat and on the digestive system (nausea). These problems exist in cases of prolonged exposition.
This has been confirmed in particular by numerous articles in the Journal of Low Frequency Noise, Vibration and Active Control published by Multi-science Publishing Co Ltd,26 , and a Swiss research laboratory studying safety at work. 27

Jet plane pilots and astronauts are well aware of the risks of vibro-acoustic disease. For example, for its pilots in space vehicles NASA limits exposure to infrasounds to 24 h at 120 dB (in respect of frequencies from 1 to 16 Hz) to protect its personnel . Nevertheless, at these amplitudes, even with people in perfect health can have visual reactions/problems, and problems with their circulation . 28

Many studies of both men and animals carried out in industry and in laboratories have shown and confirmed the existence of these behavioural problems and the following physiological changes : increase in blood pressure, alteration of breathing patterns, and problems of balance , after short periods of exposure (5 to 50 mins), to levels of sound pressure from 90 to 120 dB (frequencies :7 to 16 Hz).

In rats, prolonged exposition (45, 60 days), to a frequency of 8 Hz, biochemical and morphological changes of the tissues are observed. 29. At higher frequencies, the effects observed are more pronounced .
Where the period of exposure is longer (for example, 4 months) some of the negative effects on health are irreversible.
In fact , the nature of the health problems depends on the amplitude of the infrasounds.

25 Wall, Military Use Of Mind Control Weapons
26 A questionnaire survey of complaintes of infrasons…/ H. Moller.- In: Journal of Low Frequency Noise, Vibration and Active Control September 2002, vol. 21, no. 2, pp. 53-63(11)
27 Recommandations et règles de sécurité au travail / CUSSTR commission Universitaire pour la Santé et la Sécurité au Travail Romande . décembre 2001.
28 Encylopédie Universalis
29 "Infrasound. Brief review of toxicological literature infrasound Toxicological Summary, Nov. 2001. ET "Early response of the organism to low-frequency acoustic oscillations / Karpova N.I, and alii. In: Noise Vib. Bull. 11(65). pp 100-103.

If you combine high amplitude and high frequency, around 16 to 17 Hz,

the infrasounds become a formidable acoustic weapon. This has been tested by the ministry of Defence laboratories of several countries, including France, since 1960 30 (under Official secrets).
In fact, the infrasound weapon produces very clear physiological effects on human beings, causing eyesight problems, disorientation, nausea, and even internal lesions.. 31

From this, we can see that infrasounds are not harmless phenomena..
Much lower amplitudes and frequencies more like the infrasounds emitted by wind turbines propagated over long distances can cause health problems.
The following are some examples taken from scientific literature:

- A slowly rotating air-conditioning ventilator producing infrasounds of 6 Hz (at 90 dB) and 8Hz (at 80 dB) in a telephone switchboard caused the following health problems to the personnel:
- headaches, problems of attentiveness and concentration
- palpitations and nausea, cerebral compression.
After the air-conditioning was modified so that it stopped producing infrasounds, these disorders disappeared .32
Exposure to frequencies from 6 to 16 Hz at 10 dB are linked to problems of attentiveness and to sleeping problems.33
Subjects exposed to infrasounds of less than 20 dB suffer from annoyance and feel pressure in their eardrums. Their cardio-vascular system and their general performance are unaffected. 34
People exposed to infrasounds of 10, 20, 40 and 60 Hz whilst they are asleep suffer modifications to their sleeping patterns.35
In conclusion, most of the studies reported in scientific literature have been carried out in the laboratory over very short periods of time; in the vast majority of cases, the results show harmful effects on health, which increase in function with the sound pressure and the frequency band of the infrasounds.
It is also known that the longer the period of exposure 36, the more dangerous the emission.

30 "Le son silencieux qui tue" / Gavreau.- In: Acoustiqua, vol.17, 1966 et Science et Mécanique, 1968.
31 "Les armes qui s'attaquent au cerveau"/ Serge Brosselin.- In: Le Point n°1629, 5 déc. 2003.- p 88-89.
32 Communication de CABRAL et ROSZAK, Institut de médecine du travail du Nord 24 fév. 1973.http://membres.lycos.fr/infrasons
33 Infrasonic threshold levels of physiological effects / Landstrom U., Bystrom M. In: J Low Noise Vib. 3 (4) , 1984. pp 167-173.
34 Physiological and psychological effects of infrasound on humans / H. Moller.- In: J Low freq Noise Vib, 1984 3(1).- pp 1-16
35 Comparative study of the effects and low frequency sounds with those of audible sounds on sleep. / A Okada, R Inaba.- In: Environ. Int., 1990.- 16 (4 6).- pp 483-490.

There is a lack of epidemiologic studies carried out on humans over long periods of exposure (several years) to prolonged repetitive doses of infrasounds, as experienced in our actual environment . (eg: wind turbines)
Therefore, for the time being, no limits of acceptability have been established in respect of the intensity and length of exposure of humans to infrasounds. .37

II-5. Effects of infrasounds emitted by industrial wind turbines on human health

The affirmations of the "ADEME"
The mission of the "ADEME" is to contribute to energy economy, but which it distorts by systematically promoting the production of energy by industrial wind turbines, ostensibly giving information to the public, to the advantage of the developers . The Ademe specialises in giving out not infrasounds, but " infra-affirmations", without giving any references whatsoever, nor any details about the frequencies, amplitude or distance of propagation of infrasounds.

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According to the ADEME , industrial wind turbines emit infrasounds but: « If these low frequency vibrations can in fact – in some cases - have an influence on human health, so far as wind turbines are concerned they are completely harmless »38
And in another study 39: " The measures of infrasounds produced by wind turbines carried out in Germany do not mention any effect on health"
It seems immoral that this organization can assert that the infrasounds emitted by wind turbines are completely harmless without giving any references whatsoever , and moreover to report so-called "measures", when the only way of proving the impact of infrasounds produced by wind turbines on people is by carrying out epidemiologic studies.
In another publication, the ADEME states:
that " there is no scientific basis which shows that infrasounds from wind turbines present a danger for health" 40
Note the subtleness of this disinformation. The ADEME uses the concept of "danger" which, if it is not defined, leads to confusion.

Does the ADEME consider that having problems sleeping constitutes a DANGER ?

36 Cyril M. Harris, Editor-in-Chief, Handbook of Acoustical Measurements and Noise Control, New York: McGraw-Hill, Inc.,
1991.
37 Leo L. Beranek and Istvan I. Ver, Noise and Vibration Control Engineering: Principles and Applications, New York: John Wiley
& Sons, Inc., 1992.
38 ADEME « Des éoliennes dans votre environnement? 6 fiches pour mieux comprendre les enjeux » février 2002
39 ADEME:Une énergie dans l'air du temps: les éoliennes / ADEME . mars 2004, page 19. Sources non données.
40 ADEME: www.ademe.fr/htdocs/publications

Scientific proof

<u>This is what has been scientifically proven</u>:

1- Infrasounds travel much further than audible sounds
2- Infrasounds have gradual effects on human health, which vary from negative to dangerous depending on 3 parameters : the amplitude in relation to the distance, the frequency, and the duration of exposure.

3- Wind turbines emit infrasounds which can be detected up to 5 and even 10 kms away.
Logically, therefore, it can be concluded that:
4- The infrasounds emitted by industrial wind energy facilities can have negative and in some cases dangerous effects on health.
This is particularly so in cases where there is prolonged exposure to the infrasounds of wind turbines, as this increases sensitivity.

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Studies are currently being carried out, notably in Germany, in the United Kingdom (University of Salford) as a result of complaints from people living in proximity to wind turbines, and at the request of government authorities and even that of the British Wind Energy Association 41.
We will have scientific proof in about 15 to 20 years' time. Epidemiologic studies should be carried out over a long period of time, (over 20 years, like for fluoride) at several distances, and using large numbers of people living in proximity to wind turbines.

Clinical observations
There are however more and more clinical observations made by general practitioners, and these are being reported in the national press and medical journals.
These report the following symptoms:

Eye trouble, anxiety, irritability, nausea, diarrhoea, problems sleeping and resting, tinnitus (ringing in the ears) , depression.

Oddly enough, these accounts resemble the problems caused by infrasounds described above.
Questions should be asked…
In Denmark, where large numbers of wind turbines have been installed for 30 years, as a result of public demand , the government has by precaution, particularly because of the risk to health, stopped all new implantation of wind turbines onshore.

<u>Conclusion</u>

The sounds and infrasounds emitted by wind turbines have an undoubted impact on human health and can ruin peoples' lives ....

From the existing clinical observations, it is known that risks do exist, and that different people have varying sensitivity.
41 "Wind farms make people sick who live up to a mile away" / C. Milner- In: Daily Telegraph 25 juin 2004
The problems are real, and have been observed in neighbouring countries that have more hindsight than we have : Germany, GB,
Sweden, Ireland… and the nuisances have already been acknowledged by the medical profession in France. An article in the "Concours Médical" 42 compares

several nuisances resulting from wind turbines: Some (nuisances) are more palpable, like the sustained noise all the time that the wind blows, the infrasounds,…" Complaints have always come before scientific studies. These have started in other countries, so far as infrasounds produced by wind turbines are concerned. Government authorities in Europe and even the British Wind Energy Association have financed long term epidemiologic studies which should be carried out on those living in proximity to wind turbines. The results are still awaited.

We should not let ourselves be misled by soothing words.
In France we have already had asbestos… a catastrophe for public health :

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Asbestos is a good insulating material that was widely used , despite the fact that **since 1945 doctors have known the risks attached to this substance**. They knew that asbestos can be the cause of occupational health problems. In recent years, epidemiologists have increased their attacks against the asbestos industry. The proof and the reaction came late in the day. **In 2004, 100,000 victims died of pleural cancer, caused by exposition to asbestos 43....**

Diethylstilboestrol is another example where the manufacturers were condemned for the first time in 2004. This hormone, which was intended to prevent miscarriages, **was prescribed for 160 000 women in France between 1950 and 1977**. **This drug had however been banned in the USA in 1971** . It caused cancer, and genital malformation in children who had been exposed to this drug in utero. 44
These two examples illustrate the fact that, **in France, there is an exceedingly long delay between the time when doubts are expressed** concerning any particular nuisance as a result of numerous clinical observations , the fight against the commercial companies, **and the time when finally the scientific truth is made available to the general public.**

The principle of precaution is now part of the Constitution. It should be used immediately in respect of infrasounds emitted by industrial wind turbines.

It is the responsibility of wind turbine developers to take adequate measures to reduce the health risks for those living in proximity to wind turbines by ensuring that the wind turbines are not 500 m away from houses as suggested in their publications, but 1600 m away in respect of audible noise and at least 5kms away in respect of infrasounds..

In conclusion, no industrial wind turbines should be installed less than 5 kms from a house because of the risks caused by infrasounds.

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42 "Risques des éoliennes" In: Concours médical, hebdomadaire des praticiens n° 22, du 09-06-2004, page 1247.

43 "Amiante 100 000 morts, pas de responsables? / F. Desriaux.-In: le Monde, 29 nov. 2004. p 15.
44 "Le fabricant de Distilbène condamné pour la première fois à indemniser la victime d'un cancer de l'utérus./ S. Blanchard.- In:
Le Monde, 19-20 déc. 2004.

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