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Wind Turbines and Health

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WIND TURBINES AND HEALTH

The introduction of Ontario's Green Energy Act in 2009 (1), designed to rid the province of air-polluting, coal-fired electricity generators, resulted in forests of giant wind turbine electrical generators springing up over the rural landscape of south-western Ontario. Almost immediately complaints began pouring in of adverse health effects. The official government response was that there was no convincing evidence of ill effects caused by the turbines, a position they claimed was supported by numerous studies. There is, however, ample evidence of the adverse health effects associated with low frequency sound waves (Low Frequency Noise or LFN) at and above certain threshold sound pressures (see below). Some people have abandoned their homes of many years because of the continual assault of the LFN. Protests multiplied across the province. The controversy heated up even further when plans were announced to establish offshore wind farms in Lake Huron and Lake Erie. Physicians around the world have recorded an array of similar symptoms associated with exposure to noise arising from wind turbines. These physicians include Amanda Harry of England, Robyn Phipps in New Zealand, Robert McMurtry (formerly Dean of Medicine of the University of Western Ontario in London, Canada) in Canada and Nina Pierpont of New York. Dr. Pierpont refers to the symptoms as the "wind turbine syndrome" and is convinced that it is primarily due to the effects of LFN (20-200 Hz) on the inner ear, which is the site of equilibrium and balance control. Inner ear disturbances are commonly associated with vertigo. Another possible complicating factor is the strobe, or flicker effect that occurs when the sun is behind the blades. It is well known that this can trigger a seizure in some photosensitive epileptics (2). The World Health Organization notes that measurable effects on sleep begin around 30 dB and continuous noise should not exceed this level indoors (3). Some evidence suggests that exposure levels may be much higher than this.

The array of symptoms referred to above include sleep disturbance, headache, tinnitus (ringing or buzzing in the ears), pressure in the ears, dizziness and vertigo, nausea, blurring of vision, tachycardia (accelerated heart rate), irritability, concentration and memory problems, panic associated with sensations of internal pulsation or quivering that can occur both when awake and asleep.

Representatives of the Canadian Association of Physicians for the Environment (CAPE), including its Chairperson Dr. John Howard, issued a press release stating that there was no scientific evidence that wind turbines had adverse health effects provided the setbacks from habitations were adequate (more on this point later) and discredited data collected by others as anecdotal and therefore unreliable. Their opponents had collected over 100 reports of adverse effects like those listed above by September 2009 (the year in which the Ontario Green Energy Act was passed) with more coming in daily (4). CAPE was correct in stating that there is no 'scientific' evidence of harmful effects of wind generators but this is only because no good scientific studies have been done here. The province has not been willing to fund such a study, influenced no doubt, by their commitment to their green energy programme. This is not to say that there is no evidence of harmful effects of LFN, however. Berglund *et al.* (5) in 1996 and Wayne (6) in 2004 published exhaustive reviews of the health effects of LFN. The authors

describe the characteristics of LFN (20-200 cycles per second or Hz). Low frequencies may propagate for long distances, with little attenuation of noise. They will pass with little attenuation through walls and windows. At long distances from the source, or indoors, the noise spectrum will be selectively attenuated, resulting in one dominated by low frequencies. Indoors, room resonances in the low frequency range will increase the sound pressure levels and also lead to variations in sound pressure level inside the room. LFN will tend to mask higher frequencies rather than the other way around. LFN can also produce resonance in the human body and cause substantial subjective reactions. Sound below 20 Hz is generally called infrasound and conventional wisdom believes that it is inaudible to the human ear. But evidence suggests that there are considerable inter-individual differences amongst people and infrasound may be perceived by some. Loudness, or noise pressure, measured as decibels (dB) and duration as well as frequency will affect the audible threshold. The following health effects have been reported both in laboratory studies and in the field.

Hearing and Balance: Studies have consistently shown that temporary threshold shifts (in hearing) occur with exposure to LFN, higher pitched sounds causing longer recovery periods. The clinical significance of this is unclear, but the authors (5) suggest that there is the potential for permanent threshold shifts with long term, chronic exposures in the community setting. Animal studies in monkeys and guinea pigs have shown evidence of vestibular effects of LFN but behavioural effects were small.

Respiratory Effects: LFN has been shown to cause suspended or reduced respiration, gagging and coughing but only at high levels of 150-154 dB and these symptoms are therefore of significance mainly for extreme occupational exposures.

Annoyance, Loudness and Noisiness: The most frequently reported effect of LFN is annoyance rather than loudness. The responses of individuals may be quite varied and depend on a number of factors including culture, activity at the time of exposure, the person's attitude to the source of the noise, their individual sensitivity to noise and their ability, or lack thereof, to control the source. Two, fairly recent studies (7, 8) in Sweden in 2007 and in The Netherlands in 2009, examined this annoyance factor in a thorough, scientific manner. In both studies over 700 individuals were surveyed by standard questionnaire and sound pressure measurements were taken outside their dwellings. The metres employed are generally equipped with filters usually identified as A, B or C type that help to isolate the frequency range of the sound being measured and to approximate the response of the human ear. Measurements of LFN use dB(A). The authors found a dose-response relationship between the level of noise and the degree of annoyance experienced. At 30-35 dB(A) 44% of respondents reported being annoyed by the noise, the highest percentage recorded. At 40-45 dB(A) 32% found the noise annoying and 10% found it very annoying. In general people found the noise from wind turbines more annoying than equivalent sound pressures from traffic. The authors speculate that this may be the result of the swishing noise from the turbine blades as a number of respondents commented on this. There were other, psychological factors that influenced attitudes toward the turbine noise. Those who were benefiting financially from the turbines were more tolerant of their noise. Those who found them visually intrusive and ugly were less so. A rural location tended to increase the frequency of those who found the noise annoying and complex, hilly ground also increased the annoyance factor. Annoyance was associated with lower sleep quality and negative emotions. It should be

noted that sleep deprivation can result in all of the other symptoms. (Sleep deprivation, after all, has been a standard “enhanced interrogation” technique at Guantanamo Bay prison.) These authors commented on the paucity of reliable studies and felt that such factors as geography and other area-related factors should be considered when locating wind farms (7, 8).

Cardiovascular Effects: Laboratory studies have shown changes in heart rate and blood pressure, especially in individuals sensitive to LFN.

Performance and Cognition: Noise has been shown to adversely affect these, especially learning in children but studies of LFN specifically are scarce and inconclusive.

Sleep: Both continuous and intermittent noise have been shown to disturb sleep. Waye (6) reviewed numerous papers and concluded that controlled clinical studies were scarce and that adequate data on sound frequencies and strengths were often lacking. Nevertheless, he concluded that, despite the need for additional, well designed studies, such studies as existed supported the findings of field studies that LFN at comparatively low pressures disturbs sleep.

Other effects discussed by Berglund *et al.* (5) are more relevant to occupational exposures than to continuous, low volume LFN exposures.

The importance of individual differences in sensitivity to noise cannot be overemphasized. Stansfeld reviewed studies of noise sensitivity and its relationship to psychiatric disorders (9). In two groups of women, one highly noise sensitive and the other with low noise sensitivity, the low sensitivity group habituated quickly to the physiological responses to noise but not the noise sensitive group. The latter group attended more to noise, discriminated more between noises, found noises more threatening and out of their control and adapted to noises more slowly. Their defence/startle responses were also greater than in the low sensitive group. There appeared to be an association between depression and high noise sensitivity which tended to abate somewhat when the recovery from depression but which remained elevated.

The Chief Medical Officer of Health for the Province of Ontario, together with a panel of experts, conducted a survey of existing scientific literature related to health effects of wind turbines. Their summary states that “while some people living near wind turbines report symptoms such as dizziness, headache and sleep disturbance, the scientific evidence available to date does not demonstrate a direct, causal link between wind turbine noise and adverse health effects. The sound from wind turbine noise is not sufficient to cause hearing impairment or other direct health effects, although some people may find it annoying (10). This despite listing most of the papers cited here.

To summarize what can be said with some degree of certainty about LFN:

LFN can propagate over very long distances with little attenuation, penetrate walls and windows with little attenuation, lead to room resonance and non LFN may be filtered out, mask higher frequency sounds, produce resonance in the human body, cause annoyance, a common complaint associated with LFN, and cause sleep disturbances, from which the other reported ailments could well flow.

The characteristics of LFN clearly indicate the importance of setbacks, which some medical authorities feel should be at least 2 km (1 1/4 mi). The current 550 metre setback may well be inadequate to protect all individuals. It is important to note that the articles cited above appeared years before the Green Energy Act was passed so they can hardly be viewed as having bias toward any particular point of view. Thus there appears to be considerable validity to requests for a proper study of the noise levels to which people are exposed. Measurements of these levels should be conducted at various distances from the source, most especially including indoor measurements of the dwellings. This is especially important given the modifying effect that dwellings can have on the noise. Both frequency (Hz) and sound pressure (dB) need to be measured.

In the face of ongoing and vociferous protests over the proposal to create offshore wind farms in Lakes Huron Erie and Ontario, the government withdrew its plans to do so (11). Tourism is a very important industry in Ontario. The eastern shore of Lake Huron is often referred to as “Ontario’s West Coast” and it is famous for its spectacular sunsets. The spectre of a forest of giant wind turbines interposed between the viewer and the sunset horrified the tourist industry and angered lakefront property owners and renters who had paid a premium for their view. A measure of the discontent in rural Ontario over the wind turbine issue, which was forced on them with no legal recourse permitted for regional governments, is the fact that in the fall election of 2011, the sitting Liberal Government did not win in a single rural riding and was indeed returned with a minority of seats.

Wind Concerns Ontario is a coalition of some 60 citizens’ groups from across the province. In their web site (12) they have posted (Nov. 26, 2011) a letter from Dr. Michael Persinger who is a behavioural neuroscientist in the Departments of Biology and Psychology at Laurentian University. In it, he makes many of the same points iterated here and provides additional scientific evidence. He also expresses disbelief that the provincial report could claim that there is no convincing evidence of adverse health effects from wind turbines. This web site also notes that existing noise guidelines in Ontario allow up to 51 dB continuously for 24 hr daily, considerably higher than the 40 dB purported to be the maximum permitted.

It is a poor reflection on the provincial medical authorities that they have dismissed wind turbine noise as having no adverse, health effect. In doing so, they have trivialized the discomfort of hundreds who have endured sleep loss for nights on end with all of the resulting consequences. Absence of evidence of major, lasting damage to health is no assurance that anything less is merely an annoyance.

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