

The Public Health Issue

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1. There is often marked disagreement between the degree of noise actually experienced by residents living in proximity to industrial wind-turbine plants and the predicted noise level. In Ontario, the predicted noise level is calculated by developers prior to construction, in accordance with guidelines established by the Ministry of the Environment (which specifically approves these installations). It is certain that the MOE guidelines result in calculations that substantially understate wind-turbine noise.

2. The noise experienced by such residents is a worldwide occurrence, as are the reported health effects caused by it. Usually, the noise described is of a low frequency beat or thump - sometimes referred to as a “swoosh”. This beat appears to synchronize with the blades passing in front of the turbine tower; but there are undoubtedly other aspects of the turbine contributing to the noise. Low frequency noise can travel considerable distances and through barriers, like the walls of a house. It is invasive (we have all heard in our cars the thump of a bass coming from a passing one - with all windows up.) According to many recorded accounts and supporting studies, the evening and night-time are the worst for residents when noise can reach intolerable levels in the stiller night-time air. Residents have variously described the noise as being like: “a train continually passing through the room”; “a C130 Hercules flying outside the window”; “distant pile-driving”; “someone mixing concrete in the sky”; and “a jet engine revving-up for take-off” (this was the comment of a former Melancthon resident who stated that he and his wife were forced to give up their home of many years one year after construction of the 46 wind-turbine plant, because of the noise and the serious effect it was having on his wife’s health - yet the siting of the wind turbines near their home complied with the MOE guidelines and had been approved by the ministry.) A paper presented by Julian and Jane Davis at the Second International Meeting on Wind Turbine Noise (Lyon, 2007), gives a graphic account of the torment that can be inflicted when living 930 m from the closest of only eight 2-MW turbines (www.puketiro.org/UploadedDocuments/windfarm)[1].

3. The current MOE guidelines have permitted wind turbines to be sited as close as 350 m to surrounding homes. On Wolfe Island, the developer is proposing a minimum setback of 450 m, and the ministry thinks that this is fine. There is no evidence to support 450 m as a safe distance, only mathematical modeling based on the MOE guidelines. The Ministry’s approval of 450 m setbacks seems oddly generous to the developers of industrial wind-turbine plants, when even the pro-industry, National Wind Coordinating Committee in the U.S., acknowledges that “those affected by the noise live within a few miles of a large wind power plant or within several thousand feet of a small plant or individual turbine. Although the noise at these distances is not great, it is nevertheless sufficient to be heard indoors and may be especially disturbing at night....” [emphasis added].

4. The reported effects of being subjected to long and frequent periods of pulsating low-frequency noise, particularly at night, are not difficult to imagine, they include: depression, chronic stress, migraines, nausea, exhaustion, anger, dizziness, memory loss and cognitive difficulties - children and the elderly are especially affected by the latter. This constellation of symptoms has been given the clinical term, “wind-turbine syndrome”. Measured physiologic consequences of exposure to noise during sleep include cardiac arrhythmias, increased heart rate and blood pressure (WHO, 1999, Guidelines for Community Noise, pp 42-44). The WHO guidelines also note that noise with low-frequency components is particularly bothersome in areas with low background noise (p.46), i.e. the countryside, where large wind-turbine plants are multiplying in Ontario.

5. By far the most complete, accurate and sobering summary of the public-health concerns surrounding the negligent siting of wind turbines is contained in a report by Frey and Hadden - ” Noise Radiation from Wind Turbines Installed near Homes: Effects on Health” (Feb., 2007 - available at www.windturbinenoisehealthhumanrights.com), which should be mandatory reading for all involved in the regulation of wind turbines.

6. “The Darmstadt Manifesto” (1998), endorsed by over 100 German university professors, described the health concerns that were emerging with wind turbines in Germany ten years ago:

“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 from the effects of infrasound.”

7. The situation has not improved. Nina Pierpont, M.D, PhD, has studied the health effects of wind turbines and treated patients suffering from them in New York State, where she practices. In a letter to Kim Isles of Chatham, Ontario, dated February 16, 2008, Dr. Pierpont had this to say:

“Yes, there are indeed medical problems caused by noise and vibration from current, upwind, three-bladed industrial wind turbines. I am in the process of preparing a paper for publication in a medical journal documenting the consistency of these problems from family to family, the study subjects being a collection of families in several countries who have been driven from their homes by problems with sleep, headaches, tinnitus, equilibrium, concentration, memory, learning, mood, and child behavior - problems which started when the turbines went into operation and which resolved when the family is away from the turbines. These problems all occur in proximity to recently built industrial turbines, put into operation in 2005, 2006, and 2007.....Based on my 3½ years of researching Wind Turbine Syndrome (WTS), including interviews with scores of people around the world who clearly suffer from WTS, it is my strong clinical recommendation (in line with the French National Academy of Medicine) that industrial wind turbines be

sited a minimum of 1½ miles away from homes, schools, hospitals, places of business, and anywhere else people regularly congregate.”

8. Professor Katz, Chair of the Department of Epidemiology and Health Promotion, New York University, has called for a two-year moratorium on locating wind turbines near dwellings, *“to allow for a multi-disciplinary team of scientists to research all the health and environmental concerns.”*

9. The Frey and Hadden report, previously mentioned, calls for setbacks from homes of at least 2 km for wind turbines of less than 2 MW and greater distances for those above that rating. In March, 2006, France’s National Academy of Medicine called on the French Government to impose an immediate moratorium on the placement of turbines within 1.5 km of homes while further research is conducted on the health effects of wind-turbine noise and infra-sound. It is to be noted that President Sarkozy recently announced a wind-turbine ban in rural France, directing development to brownfield areas. The UK Noise Association fully concurred with the National Academy of Medicine’s call for a moratorium in an authoritative report entitled “Location, Location, Location” (July, 2006), in which the noise and health effects of wind turbines were reviewed. The Report’s conclusion is of interest:

“Wind farms can play a role in reducing global warming emissions. But there is 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 those turbines should be shut down, that possibility should never be ruled out. However, it would seem 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 does not have to be the case. The positive conclusion of this report is that there is a constructive 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 for us to get that right.”

[<http://www.countryguardian.net/location.pdf>]

10. Obviously, the health and well-being of Ontarians are of concern here and yet matters are left to planners, acoustical engineers and the MOE to resolve. Not one of these entities is qualified to determine a medically safe distance for the siting of wind turbines. Expertise in medicine, the biologic sciences and epidemiology is required. Astonishingly, the MOE appears to have sought no qualified medical opinion whatsoever. In failing to have this public health issue addressed by competent medical authorities, the Ontario government is surely running a serious risk of substantial criticism and of having this failure cited as evidence of its willful negligence in the law suits that are almost certain to come. One thing is clear: the issue of wind turbines and their effect on the health and well-being of Ontarians will not go away.

The Serious Inadequacies of the MOE Noise Guidelines

11. The MOE guidelines have been used by virtually all local municipalities as the basis for determining noise setbacks for wind turbines in planning applications. In this they have the support of the Ontario Municipal Board, which held at the Kincardine hearings that if the developer's calculations show the guidelines will be met, then there is no further planning issue to consider regarding noise set-backs. Thus municipal planning has sought, most likely ineffectually, to avoid responsibility for the negligent and harmful siting of wind turbines by seeking the protection of the guidelines. In addition, the MOE has assumed, on its own account, responsibility for the placement of wind turbines by issuing certificates of approval, which are contingent on compliance with the guidelines. Consequently, the guidelines, which are at best an ill-considered guide to the placement of wind turbines, are given the full force of law and, unlike other laws, they are being written, amended and interpreted at the discretion of MOE bureaucrats. The Ontario Government should not consider this cause for optimism.

12. The MOE guidelines are designed and implemented to authorize excessive noise levels in the following ways:

a) Decibel levels used in the guidelines are expressed as dBA - the 'A' refers to an A-weighted noise level that is used to measure the higher frequency sounds. This A-weighting significantly underestimates the presence of invasive low frequency noise (e.g., the "swoosh"), which is better measured by using a C-weighted noise level - expressed as dBC. The international standard IEC 61400 (Wind Turbine Generator Part 11) recommends the comparison of A and C weighting to assess the presence of low frequency noise, and Paul Schomer noted that "It [A-weighting] certainly cannot be used for room noise criteria", pointing out that at low frequencies about one third of people are "C-weighted listeners" - [Journal of the Acoustical Society of America, 2002, Nov; (5, pt 2: 2412)]. The guidelines ignore this.

b) At wind-speeds up to 4 metres per second, the guidelines authorize a wind-turbine noise level of 40 dBA at a rural dwelling at any time of the day or night. This is a five-fold increase over the background noise level of a quiet country night that is typically around 25 dBA. It is to be remembered that decibels are measured on a logarithmic scale and that an increase of 6 dBA is heard as a doubling of the sound. This generous allowance for the intrusion of wind-turbine noise appears to have been a committee decision within the MOE which was not supported by any impact study or medical advice. The guidelines then proceed systematically to compound the generosity of this allowance.

c) Ontario, along with New Zealand, appear to be the only jurisdictions that permit the authorized wind-turbine noise level at a dwelling actually to increase with wind speed. This further and generous allowance is based on a false and facile assumption that the background noise will always increase with wind speed and satisfactorily mask the growing turbine noise as wind speed rises. At wind speeds of up to 4 metres per second the MOE authorizes wind-turbine noise level of 40 dBA at a rural dwelling; at 10 metres per second the authorized level rises to 51 dBA - this represents an astonishing twenty-

fold increase in noise level over the 25 dBA background noise level of a normal country night. It is correct that turbulent air at ground level can increase the masking effect of background noise. However, for much of the time and particularly at night, the air is stable, the wind speed at ground level is much lower than at the height of the hub of the turbine and the masking noise is absent or much reduced. The MOE's approach is in obvious contrast to the criteria of ISO 1996 - 1971, Community Noise Limits (a 30 dBA indoor evening limit and a 25 dBA night limit in rural areas), and to the WHO which contends that sleep disturbance is encountered above 30 dBA and calls for that limit, regardless of wind speed.

d) (i) As the MOE has chosen the unorthodox regulatory method of authorizing greater wind-turbine noise with increasing wind speed, it is reasonable to expect that the MOE has actually measured and studied wind speeds at the operating height of these large turbines (80 m at the hub and 125 m at the high point of the blades), together with the noise they produce. Unfortunately, this is not the case, even though opportunities to do so have been readily available. The guidelines only require developers to obtain wind data at a height of 10 m (the proxy for ground level) and not at the operating height. To allow for this major discrepancy, the guidelines proclaim that the wind speed in the operating zone is deemed to be 1.4 times the wind speed at 10 m. Unfortunately, this allowance is not supported by the facts. The available evidence clearly supports the conclusion that the 1.4 allowance substantially understates wind speed, and therefore noise, at the operating height. Once more the industry is advantaged to the serious prejudice of residents.

d) (ii) The guidelines' substantial understatement of wind speed at operating height is demonstrated, for example, in a study by Dutch physicist G. P. van den Berg, who took noise and wind measurements over a four-month period at a small wind-turbine plant in Germany containing seventeen 1.8 MW turbines. Measurements at night showed that the average wind speed at hub height was up to 2.6 times higher than had been anticipated from an earlier noise assessment study for the site, based on a sound propagation model. This resulted in the periodic beat (or "swoosh") being up to 15 dBA louder at night. Noise at ground level caused annoyance to residents at 1900m - a distance at which, theoretically, they should have heard nothing. [The report was published in the Journal of Low Frequency Noise, Vibration and Active Control, vol. 24, # 1, 2005; also available at www.ninapierpont.com]

(d) (iii) The work of van den Berg, is endorsed by the UK Noise Association and is otherwise well supported, for example: the analysis and conclusions of William Palmer, P. Eng., from Ontario, in a paper presented at the Second International Conference on Wind Turbine Noise (Lyon, 2007)[2]; together with Enbridge wind measurements presented at the OMB hearings in Kincardine, and the MNR's own wind speed data for Essex County, clearly support the conclusion that there are often significantly higher wind speeds at the operating height of these turbines than are to be found at ground level. Far greater, in fact, than a wind speed that the ministry decrees is 1.4 times the speed at ground level. On April 4th, 2008, the Dutch newspaper Noordhollands Dagblad reported that the Dutch authorities have accepted that van den Berg's conclusions are right and are now reviewing their rules for measuring wind-turbine noise.

e) The wind-turbine noise habitually complained about is a tormenting beat. The MOE noise guidelines allow this periodic noise to be averaged over time so that the noise peaks are lost for the purpose of compliance calculations! Julian and Jane Davis, in their paper mentioned above, describe how a commonplace event is affected by the tormenting beat that the guidelines average to insignificance: “the evening [for a BBQ] will be still with no wind at ground level and then - just as the food is ready comes the THUMP, THUMP, THUMP that indicates AM [‘Amplitude Modulation’, or the beat] is back...and when that happens, it’s really difficult to even find out if someone wants a sausage or a beef burger...”

f) The guidelines do provide for a 5 dBA penalty to be added where the noise is periodic. But the MOE does not enforce it! This penalty was not imposed in Kincardine, or on Wolfe Island.

g) The noise guidelines take no account of the combination of direct and reflected noise that reaches the ear from a turbine. For frequencies below 300 Hz, where much of the turbine noise is concentrated, this can increase the noise level by 50%. The manufacturers of wind turbines are aware of this effect; they deduct an allowance for reflected noise when establishing the published noise output of their wind-turbine models.

h) The noise from blade motion through turbulent air inflow is also ignored by the noise guidelines. This noise contribution has been measured, for example, at the Renewable Energy Laboratory research turbine in the U.S., and it can and should be estimated before wind-turbine locations are approved.

13. The critique above draws heavily on a technical analysis of the noise guidelines by physicist and acoustical expert, Professor John Harrison of Queen’s University. A copy of his analysis was provided to the MOE in October, 2007.

14. In summary, the MOE:

- fails to address low-frequency C-weighted sound;
- sets too high a minimum noise level (5 times background);
- permits the authorized noise level to rise with wind speed, ignoring international standards;
- ignores true wind speeds at operating height;
- averages away the thump;
- ignores reflected noise;
- ignores the contribution of turbulent air-flow;

- does not enforce its own guidelines.

15. What is it about the MOE that produces noise guidelines which give advantages to the wind industry at every turn and demonstrate a cynical indifference to the health and well-being of Ontarians?

Does the ministry not have a collective conscience?

Does it not have any curiosity over the plethora of serious reports, studies and opinions that raise legitimate concerns for the public's health and well-being?

Does it know something, for example, that the French Academy of Medicine does not, when the latter calls for a moratorium on locating wind turbines closer than 1.5 km to dwellings? What is certain is that the MOE has a statutory duty to protect the environment, which includes protecting the health of the public, and that it has given a woeful account of itself in discharging that solemn duty.

16. The MOE has been conducting an internal review of the guidelines for some time; but there is no evidence that the ministry has the fortitude to make the required major changes to the guidelines in the face of the Ontario government's very public commitment to wind-turbine initiatives. The proof of this assertion is to be found in the ministry's very recent acceptance of the developer's noise modeling for the eighty-six, 2.3 MW turbines proposed for Wolfe Island.

17. Wolfe Island will have 266 residences within 1 km of wind turbines. It is virtually certain that all of these residences will exceed the 40 dBA noise limit in reality, as they are at or very close to that limit when the noise levels are calculated under the MOE's seriously flawed guidelines. In fact, 238 of these residences would exceed even the calculated 40 dBA limit by just adding the 5 dBA penalty for periodic noise - had this not been ignored by the MOE. In addition, it must be assumed that there are many homes beyond 1 km that will also feel the impact of this massive development. Consequently, many on the island may now look forward to a life of torment or worse, their future histories having already been written in other parts of the world. The actions of the MOE in creating this situation are far from reprehensible, they are scandalous and actionable.

Solutions

18. Protecting the public from wind-turbine noise is not complicated. First must come the recognition that any uncertainty will be resolved in favour of nearby residents and not the industry. No one should be stressed and depressed from the denial of a proper night's sleep and no child should be gratuitously presented with learning difficulties. The onus must be on the regulators to ensure that such things will not occur and that no harm be done. The solution is simply to place wind turbines at a distance where it will be known that they will not be heard inside a dwelling. Calculating that distance turbine by turbine

with elaborate and inaccurate mathematical models is clearly not working, as a plethora of reports demonstrate.

19. At the present time, a minimum mandatory distance is needed and no further wind-turbine projects should be approved without it. From all the available evidence, land-based turbines, rated in excess of 2 MW, should be set back 2 to 3 km - probably 2.5 km is about right. Lower-rated turbines, excluding small ones used by the owner, would be at 1.5 km. [Off-shore turbines may well be a different matter and need to be carefully studied; in Europe, with its massive change to off-shore installations, the distances from shore are far greater than any setbacks encountered on land.] A committee of senior physicians recommended by the Ontario Medical Association, assisted by independent acoustical experts, should be appointed by the Minister of Health, to consider all health-related effects of wind turbines on local inhabitants (this should include sunlight flicker and infra-sound, which are not covered in this memorandum), and to make recommendations for their appropriate siting. It has become self-evident that these matters cannot be left solely to the MOE any longer.

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[1] "If a body can't rest then a body can't work...or function properly - and that is what we found. A tired mind and body become more prone to accidents, not ideal in any circumstance but dangerous on a farm. The peculiar noises that wind turbines emit can not only be heard, they can also be felt by the body, and thus trying to rest becomes impossible. We tried: fans, white noise machines, sleeping tablets, red wine and ear plugs. The latter again masks background noise but allows the low frequency that we get to penetrate so that it feels part of your body and the beat - the pulsation - that is slightly faster than our human hearts beat, means that you feel as if you are constantly trying to get your heart to catch up with this external rhythm that is felt by the body rather than heard ... so rest is impossible." They were forced to rent an additional house as a place to sleep!

[2] Mr. Palmer stated: "In summary, the results for one wind farm, the Kingsbridge wind farm near Goderich, Ontario, which has the closest distance between the wind turbines and the Environment Canada weather office monitoring station, show that about 31% of the hours of the year show an unmasked noise output above the Ontario Standard (sic), and for nearly 10% of the hours of the year, the noise is significantly above the provincial standard (over 3 dBA), in many cases about 10 dBA above the background level produced by the wind at the receptor. In 6 months from October 2006 to March 2007, on 64% of the days, there were hours of unmasked noise. This demonstrated the problem to be chronic and significant in nature.....For another Ontario wind farm, the results in the summer period between May 1st and August 31st, 2006 showed 59% of the days demonstrated the problem, with it occurring 48% of the nights, and 33% of the showing the condition sustained for 3 or more hours."