

Paper on Critical Issues Associated with Wind Turbines

“Follow the Science”

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Introduction:

Since the public meeting of June, 2009 at Ryerson University, I have reflected on what I heard at the meeting from all those who expressed their concerns. I have also reviewed the handouts that the Government of Ontario handed to us and the confidential FOI report of 140 pages obtained through the Ministry of the Environment and Natural Resources (Registry #010-6708).

From the June meeting, I concluded that you appeared genuinely interested and involved, and it was for that reason that I chose to provide you with my brief on:

- 1) “A Review of the Health Effects of Noise with Specific reference to Infrasound and low-frequency noise” (ILFN – March, 2009)
- 2) “ Updates and comments on ILFN Health Effects – June, 2009”
- 3) “Infrasound – A Brief Review of Toxicological Literature” – Nov., 2001
- 4) Excerpts of interest
- 5) Extensive Bibliography – to see for yourself the evidence that exists.

Questions On Meeting Handouts

The pamphlets at the June meeting lacked some important details. As an example, see page 9 on setbacks “Proposed Renewable Energy Project Requirements”. In the chart – “1-05 Wind Turbines – 102dBA” – there was no indication as to what type of wind turbine. What power-generating capacity (.5MW, 1.2MW, 1.6MW, 2.0MW, 5MW, 8MW...)? At what wind velocity were those sound intensities measured? At what distance from the sound source were the intensity levels obtained? Were these measurements collected upwind or downwind? Was the point of measurement one and at what distance from the other wind turbines? Were the measurements collected in daytime or nighttime? Were the measurements collected by the proponents, or an independent, at-arms-length expert?

These issues are extremely important, because without this information, the informed and knowledgeable individual who attends these hearings can only conclude that the whole exercise was nothing more than “**window-dressing**”; that the government has very little regard or respect for the public and that the government officials who are ultimately responsible for the decision-making have already made up their minds.

I am sure you are aware that the type, make and size of the wind turbines (W.T.’s) greatly predetermine the acoustic emissions. W.T.’s, made by the same company, same size, power, height and rotor size are **not** exactly the same when it comes to acoustic emissions. Wind velocities greatly influence the acoustics. The location from the source where the acoustics were measured is important in order to be able to estimate sound decay and appropriate setbacks. W.T.’s have “cut-in” (at 3.5m/s speed) and “cut-out” (at 27m/s). See GE technical data for their 3.0 MW model. Therefore, one cannot just consider wind speeds of 4 to 10 m/s as on pg. 6 of your handout (Noise Guideline for W.T.’s).

On Page 15 of the same handout, you will note that the acoustic measurements required by the Government are from 63 HZ to 8000HZ in dBA levels. This is not only inadequate, but it implies that the Government is either not aware, or is totally disregarding the large body of scientific and medical evidence on the effects of Infrasound and Low-Frequency Noise (ILFN).

Measuring Wind Turbine Emissions

To properly assess the acoustics of W.T.F.'s (wind turbine factories) at 200HZ and above, one can use the dBA "weighting", but to appreciate the characteristics, fluctuations, and quality of the noise emissions in these ranges, one should use the octave, 1/3 octave, or 1/24 octave-band analysis.

For 20 HZ to 200HZ, one should use the dBC weighting, which is a more accurate assessment of the actual energy level of the emissions, and for below 20HZ, one should use the dBG weighting, as already explained. Of course, use of the octave and 1/3 octave etc, band analysis with dBC and dBG weightings yields even more accurate information about the acoustic emissions. Averaging the energy levels over a specified measurement period (LAeq) does not take into account the most annoying aspects – fluctuation and pulsation of sound emissions.

It has been clearly established that W.T.F.'s do emit ILFN at significant levels of intensity; these levels depend on the type of W.T., the wind speed, upwind or downwind, night or day and with the number of W.T.'s. The terrain where they are located and the number of obstructions greatly influence the intensity levels and their decay. For offshore W.T.F.'s, the issue of decay is totally different from the onshore ones. See Prof. Mats Abom & M. Boue's report - Marcus Wallenberg Laboratories – Stockholm, Sweden-2006.

In their study, "Long-Range Outdoor Sound Propagation Over Sea Applications to Wind Turbine Noise," it was clearly established that pure offshore tones of 130dB at 200 and 400HZ, and 113dB at 80HZ, were **detectable 9 ½ km away on shore**, at a residual intensity of 60-76dB. This confirmed previous observations that sound emissions from offshore W.T.F.'s travel further and decay at -3dB per doubling of distance.

But of course, Prof. Abom also pointed out that there were other contributing factors to the level of intensity, i.e.:

- 1) reflection of the W.T.'s sound emissions;
- 2) the funneling effect of such sound propagation;
- 3) the concept of spherical and cylindrical spreading, which influenced the rate of sound intensity decay (-6dB & -3dB, respectively);
- 4) and that wind speeds and their direction at higher altitudes may have a strong influence as do temperature gradients.

Hubbard & Sheppard, Van den Berg, and Prof. Abom have already exposed the complexities of measuring onshore and offshore W.T. sound emissions, and that the nature of the environment greatly affects not only the distance that sound emissions can be detected, but also their attenuation and augmentation.

It becomes clearly evident why the more detailed the measurements, the more one can understand the complaints of those affected. One **must** obtain measurements throughout the time that the W.T. rotors are functioning, i.e. from the time that they cut-in to the time that they cut-out, because at wind speeds of greater than 10m/s the intensity levels are much higher and the nature of the noise emissions become much more disturbing, greatly increasing the adverse health effects.

It is totally inadequate to use extrapolating methods, as suggested by the proponents or by those that prepared the information handouts. There are too many variables to consider and, naturally, the extrapolated measurements greatly underestimate actuality – very convenient for the proponents.

Good Thorough Science

The well-informed public demands that the noise emission data submitted by the proponents should be examined and verified by independent and at-arms-length experts. The information should also include the quantity of coolants, lubricating oils, cleansing solvents used by the wind turbine mechanisms (nacelle, transformer substation and central transformer substations). No one has discussed this important polluting problem. Why?

W.T.F.'s require connection to the electrical grid. When W.T.F.'s come on line, “dirty electricity” enters the system. This phenomenon introduces its own complexity of problems, both at the operational level and with respect to health effects. Again, this is rarely addressed or discussed, despite the added costs and adverse health effects.

Beguiling Science ?

At M.O.E. public meetings we have often heard public officials quoting acousticians: Dr. G. Leventhall, Dr. Ramakrishnan or Dr. Colby, acting Medical Officer of Health of the Municipality of Chatham-Kent County.

We have also noted in the FOI (confidential) Request Report (Registry #010-6708), the author quotes the WHO 1999 “Guidelines for Community noise” that the bedroom maximum noise level should be 30dBA and 45dBA outside the bedroom because of a 15dBA sound level drop across a wall. This is reasonable for ambient noise, but ILFN have longer wavelengths, traveling further and through walls without significant attenuation. Dr. Leventhall states in his DEFRA report, that to block ILFN you would require extremely thick walls in the order of several meters.

The report quotes Dr. J. Harrison's paper of June 2008 that based on the 45dBA recommendations of WHO the setbacks for W.T.'s should be 1.5 km.

Further down, the report states that "modern designs of wind turbine generators generally have the blades upwind of the tower (rotor facing the wind). There is no evidence that the current upwind turbine technology presents any problems related to the generation of infrasound/low frequency sound energy."

In the DEFRA report of Dr. Leventhall, 2004, the author reviewed the literature up to that point in time. He clearly highlighted the differences that exist in the methods used in measuring sound emissions and where and when one should use the dBA, dBC, dBG, Octave, 1/3 Octave, 1/24 Octave, LAeq, LA90, LA10, etc., to better appreciate the **real** energy levels and characteristics of sound emissions.

He reviewed the evidence of Effects of Low Frequency Noise on Health extensively, not only quoting from human studies, but also from animal model studies. The author noted the various effects of all aspects of noise including Infrasound and LFN on the whole organism, the cellular and biochemical level, whether human or animal.

On page 60 of his report, he devoted **8 lines** to his conclusion: "There is no doubt that some humans exposed to Infrasound experience abnormal ear, CNS, and resonance-induced symptoms that are real and stressful. If this is not recognized by investigators or their treating physicians, and properly addressed with understanding and sympathy, a psychological reaction will follow and the patient's problems will be compounded. Most subjects may be reassured that there will be no serious consequences to their health from infrasound exposure, and, **if further exposure is avoided** they **may** expect to become symptom-free."

The author appeared to dismiss the hard evidence **and views the victims' complaints as "psychological reaction"**.

The author devoted the next 20 pages on complaint procedures, limits and criteria, validation of the Methods and Further Research.

More Beguiling Science?

In the FOI report, under the heading of:

"If asked about low-frequency noise/infrasound:

- Modern wind turbines do not create a significant amount of LFN – the 'swoosh' as the turbine blade passes is actually the modulation of higher frequency noise.
- In the report **Health Impact of Wind Turbines_....**"Infrasound is inaudible and not generated in a manner harmful to humans." Dr. Colby – Municipality of Chatham-Kent, Acting Medical Officer of Health "...as long as the MOE guidelines for location criteria of wind farms are followed, it is my opinion that there will be negligible adverse health impacts on Chatham-Kent citizens. Although **opposition to wind farms on aesthetic**

grounds is a legitimate point of view, opposition to wind farms on the basis of potential adverse health consequences is not justified by the evidence.”

- “In response to concerns that wind turbines emit infrasound and cause associated health problems”, Dr. G. Leventhall says: “I can state quite categorically that **there is no significant infrasound from current designs of wind turbines.**”

Hubbard & Shepherd (NASA Longley Research Center) published their article on “**Wind Turbine Acoustics**” in 1990. They analyzed both downwind and upwind measurements. They compared an upwind rotor 91.4m in diameter with a downwind rotor 78.2m in diameter. After factoring for these diameter differences and velocity, they concluded that “acoustic radiations upwind and downwind were about equal and were greater than that in the crosswind direction”. They also noted “different atmospheric turbulence structure during the night”.

It is no wonder that the public becomes less trusting of proponents and/or government bureaucrats when they are told that new W.T.’s have their rotors in an upwind position and, therefore, their ILFN emissions are not significant or inexistent. The public is most likely aware that W.T.’s also emit broadband noise (arising from the rotating blades’ interaction with the wind inflow to the rotor) and that it is a significant component for all configurations of rotors, regardless of whether the low-frequency impulsive components are present. This broadband noise dominates a typical W.T.’s acoustic spectrum at frequencies above about 100HZ.

The Facts

If ILFN is present, whether masked by ambient noise, it is still there. Ambient noise and ILFN appear to affect organisms quite differently, and whether in combination or separately, they can still cause their own specific harm. It is quite true that studies have been done using noise intensity levels >60dB, but in pharmaceutical studies very high doses of drugs are used in animal models to determine whether adverse effects occur. The higher the dose, the sooner potential adverse effects are unmasked. Similarly, with respect to levels of noise intensity, the higher the intensity, the sooner adverse effects are unmasked. Indeed, the data reviewed suggested that the longer the time of exposure, the longer the duration and severity of the adverse health effects.

Both Hubbard/Shepherd and Jakobsen, it seems to me, demonstrated quite clearly that all the types of W.T.’s studied emit significant levels of ILFN.

Jakobsen, who reviewed Hubbard and Shepherd’s study, along with other studies, concluded that downwind emissions were greater than upwind by 30dB (100dBG vs 70dBG respectively), leading the author to conclude that upwind W.T.’s were safer and, therefore, acceptable because their emissions complied with the guidelines. Dr. Colby’s comments also refer to the point that if one follows the guidelines they should be safe.

But: Is the direction that winds blow always constant? Is it not true that wind direction can change?

I suspect that the answer can be a resounding “Yes, wind directions do change.” What was once upwind can become crosswind or downwind at a later stage. Therefore, the argument of positioning W.T.’s upwind to minimize the intensity of the emissions is purely “window-dressing” by the proponents. Further, there are obvious disagreements between Hubbard et al and Jakobsen. This suggests that opinions based on the models studied do vary and so do the conclusions.

Faced with statements as we have just read, the public becomes more confused and senses that their concerns are not being taken seriously.

The need for a complete review of the guidelines for noise and ILFN exposure must be reassessed. Independent, at-arms-length acousticians and medical personnel versed in the subject, must be used to advise the MOE and MONR. The public must be properly informed and allowed to participate in the decision-making. Passing laws (**Green Energy Act**) that remove the **democratic rights** from its citizens and shift the **burden of proof** from the proponents to its opponents is regressive and will certainly not go unnoticed.

The public is aware that there are many sources of ILFN. They are also aware of the hundreds of scientific publications from many different countries on the effects of ILFN at various intensities, ranging from just below the audible human range to much higher intensities. These papers have led the readers to come away with information that, generally, ILFN, regardless of the source, at high enough levels of intensity at 500HZ and less, can cause harm both at the cellular, biochemical, and structural levels in the human organism, as well as in the animal model.

These findings have been extrapolated to the ILFN emissions of W.T.F.’s. The dilemma here is that the proponents and their consultants state that the W.T.F.’s emissions in ILFN range are of a level of intensity well below the audible range, that they conform to the regulations of the local jurisdiction and, therefore, pose no threat. But, the studies on ILFN health effects also suggest that the effects are time- and dose-sensitive. Therefore, who can state, without any doubt, as to what level of intensity is low or high enough not to be detrimental? How can you determine thresholds of harm when every individual human and/or animal is different?

There are no unbiased, long-term epidemiological studies of W.T.F.’s adverse health effects, only extrapolations and mostly dealing with high-intensity levels (greater than 60dB).

The public has the right to such studies **before** they are involuntarily subjected to long-term exposure to nearby W.T.F.’s. Marshall McLuhan correctly stated 50-60 years ago, that the artifacts we create shape us and that too much of any one thing does the opposite of what it was intended to do.

There are suggestions by Dr. Castelo Branco and his many associates (Portugal) that ILFN, regardless of the source, at high-enough intensity, can cause adverse health effects to susceptible individuals. They have been studying this phenomenon in a specific group of people exposed to an ILFN-rich environment at high intensity levels (>90dB). Their study has been ongoing since 1980. They are convinced of the association between ILFN and a whole range of pathological processes. Many of their findings have been reproduced in animal models. Other researchers have also found ILFN adverse effects and these articles have been summarized and provided to you to examine in my brief. Hundreds of these studies have been included in the brief.

In one of the M.O.E. meetings, this Portuguese-based evidence was mentioned. Dr. Leventhall was contacted by teleconference and he was quoted to have said something to the effect that the Portuguese group was practicing journalism. I am not sure what Dr. Leventhall intended by this statement, but with due respect to all concerned, it seems to me, from my reviews of their publications, that what they have been saying for more than 25 years is being confirmed not only through their animal model studies, but also by other researchers in other countries.

Dr. Castelo Branco's credentials do not seem to be in question. He is a medical doctor with a specialty in pathology. His associates are experts in acoustics, cardiology, respirology, endocrinology, neurology, etc. None of these authors appear to have a conflict of interest.

The long list of references and reviewed articles provided in my brief also do not appear to have any conflict of interest.

It is also true to say that a number of studies do not involve large numbers of studied subjects (human and/or animal), but the sheer number of studies provided should more than make up for the lack of the numbers in the individual studies.

Drs. Leventhall, Ramakrishnan & Colby's qualifications and levels of knowledge in their field is not in doubt, but when it comes to the assessment of noxious environmental pollutants and their adverse effects on organisms, cell structure, physiology and biochemistry, **they should** reach out for advice from the appropriate experts in the medical field. All experts, whatever their field of knowledge, must have an open mind and be ready to alter their views if the evidence is reproducible. If the evidence is lacking and there are questions raised, one must investigate. Lack of evidence does not mean safety. One must prove that the artifacts that we create will cause no harm. Implementation of wind energy-generating factories must not proceed, unless proof of their safety can be proven. It is not sufficient to say that they may affect only 5% of the population over 55 years of age. In 10-15 years there will be a much bigger number in that age group. **That represents millions of people.**

Who has the right to punish this group of more susceptible individuals? Why should they be victims of industries' collateral damage statistic?

More Collateral Damage: Communications

In my brief, I referred to the real cost of wind energy. I also referred to the effects of wind turbines on the communication system. These issues should be looked at very closely, especially W.T.F.'s effects on wireless and microwave-based communications.

Toronto Hydro is proposing to install W.T.'s in Lake Ontario, within 2 km from shore. One should be fully aware of what effect this may have on the safe operations of the Pickering nuclear facility. Has anyone done any research on the possible interference with this nuclear facility's wireless or microwave-based communication system? The public should be made aware one way or the other.

More Collateral Damage: Birds and Bats

U.S. and Spanish studies reviewed generally agreed that each W.T. caused the death of approximately 35-45 birds/year/turbine by direct rotor trauma. The authors recognized the fact that ground scavenger animals could affect the final count of dead birds found near W.T.'s.

Bird migration has been shown to be significantly affected by W.T.F.'s. There are several North American and Danish studies, readily available to you through the internet; e.g. "Final Results of Bird Studies at the Offshore Wind Turbine Farms at Nysted & Horns Rev, Denmark" – NERI Report. These studies have clearly shown changes in the spring and fall flight patterns of birds. Birds avoid W.T.F.'s all together, whether the rotors are turning or not. Birds take routes that are at least 200-500 meters away from such structures. They do not go anywhere near W.T.F.'s and obviously, settle elsewhere if their normal habitats are otherwise compromised. This implies great changes in the ecosystem wherever W.T.F.'s are built.

Changes in bird habitat, because of W.T.F.'s will result in changes in other animals that interact with those birds and so on down the ecosystem chain. I need not dwell upon this issue, because I am sure you understand clearly the consequences. There are at least 4 large-scale Danish studies which confirm these changes. Of course, those studies supported by W.T.F.'s proponents tend to focus on rotor-kill numbers, which is really only part of a much bigger disaster in evolution.

Bats appeared to develop lung tears and fatal internal bleeds caused by either negative pressures created by the rotor, or by the direct ILFN effect on vessels, lymphatic system or the delicate lung tissue of bats. There are several studies that I have reviewed, which confirm ILFN effects to these structures. See my brief + Updates + Infrasound Toxicological effects that I have provided for your perusal.

When bats are affected and their numbers reduced, the mosquito population increases. It has been estimated that each bat consumes 500-1000 mosquitoes per day. For humans, this change implies more mosquito bites and, therefore, more chances to contract mosquito-borne infections, including West Nile.

More Collateral Damage: Shoreline

W.T.F.'s emit sound and vibration. This translates into waveforms (energy). Sound energy decays in intensity as it is propagated in all directions by spherical and cylindrical patterns. It is reflected and decays when it hits the shoreline by releasing heat.

Shorelines are already being influenced by the wave action of water. Sound emissions are also waveforms through air. ILFN waveforms have longer wavelengths, therefore, do not decay as sound at frequencies $>400\text{HZ}$. The lower the frequencies, the longer the distances of propagation and higher levels of energy, therefore, shorelines are subjected to one more form of eroding wave action.

More Collateral Damage: Drinking Water Quality

Of even greater concern so far not addressed, is the issue of offshore W.T.F.'s implementation in the Great Lakes of North America.

In February, 2009, I and many others attended a symposium on the Rights of Individuals to Access of Clean, Fresh, Drinkable Water, at the University of Toronto. The information was videotaped and recorded and is available to those interested.

During the question period, I asked the expert "Will the industrialization of Lake Ontario and/or the Great Lakes with the construction of W.T.F.'s affect the fresh drinkable water supply of North America". The expert's reply was an emphatic "Yes".

I asked this question because I was fully aware of the many different toxins present in the lake sediment, especially Lake Erie and Lake Ontario, and the irreparable harm that their **disturbance** would have on the drinking water of those communities that depend on their supply of water from the Great Lakes.

I am sure you are aware that any minor change to such an ecosystem would affect marine life, as well as those animals that depend on such marine life for their sole source of food.

Wind Turbine Factories also emit vibrations which propagate down the rotor-supporting structure to the lake/sea bed, and in all directions, including towards the shoreline. These vibrations and those from the substations would definitely disrupt the 100-200-year-old toxic-containing sediment of lake beds, even if these vibrations conformed with government guidelines. With time, the sediment will be disturbed, it will float into the lake currents and it will be spread far and wide, eventually causing massive increase in water-suspended toxic particles of PCB's, dioxin, mercury, tritium-containing matter.... Just to name a few of the vast number of **the toxic cocktail that is part of the lake bed sediment**.

This will affect **our drinking water supply**.

What is the vigilance reliability of our government agencies with respect to frequent, proper monitoring of all of these toxic agents? What is the ability of our water purification system to remove **all** of these toxins from the water we expect to drink?

On May 21, 2009, the Ontario Drinking Water Advisory Council (ODWAC) released their “Report and Advice on the Ontario Drinking Water Quality Standard for Tritium”, prepared for the Hon. John Gerretsen, Ontario Minister of the Environment. It is quite interesting reading and I urge you to carefully review it.

What is even more interesting is that I wrote a letter to the Minister in March, 2009, raising the issue of W.T.F.’s in Lake Ontario and the safety of the drinking water. To date, I have not received a reply.

Consider, if you will, the construction of W.T.F.’s, the substations, the electrical lines that will connect to the grid, the lubricants, oils, cleaning fluids required by them for their efficient function, **the disruption of the sediment at time of construction, during their operation because of the transfer of vibrations to the lake bed, and further disruption at decommission when they have outlived their usefulness.**

Canada has the largest fresh-water supply in the world. It is a priceless commodity. Let us not squander it to satisfy the insatiable appetite of industry, as other countries have done. Consider what has happened to one of the world’s largest aquifers under the soil of Uruguay, Paraguay and Argentina, or what has happened to the free water supply of the inhabitants of Bolivia. These countries now have to pay private water companies for their drinking water. It used to be their water and it was free. Now they are becoming ill and dying, because they cannot afford to pay for it and are drinking what little water is flowing in their dried up rivers, full of toxic contaminants from the upstream factories.

Is Canada destined for the same fate? Water-bottling companies do not need our help. Of the top 10 companies in the world, 4 of them are water-bottling companies. With all the fresh water supply, are we becoming complacent and are we going to squander this resource, because we have been told by wind turbine companies that putting W.T.F.s in the Great Lakes is the best possible option for the generation of energy? We are already dealing with the consequences of the energy industries’ errors and the contamination of our Great Lakes with tritium.

In the ODWAC report previously alluded to, you will note the number of accidents that have occurred where tritium and tritiated water were released in large quantities into the lakes. But, what about the number of occasions where the water purification plants located nearby were **not** notified of such a release of tritium into the lakes ?? (see pages 15 to 18.) It is no wonder that the more the public discovers through their research, the less trust they have of their elected officials and of the proponents.

CONCLUSIONS

Wind turbines emit infrasound and low-frequency noise. There are many other sources of these emissions.

The studies available raise more questions than they help answer. It is, however, quite certain that ILFN at high levels of intensity cause adverse effects to organisms at the structural, cellular, and biochemical level.

What levels are safe? Since research, to date, seems to suggest that the adverse effects are time- and dose-dependent and that the longer the exposure the less reversible the adverse effects become, it is naturally of great importance to perform appropriate long-term studies of people presently exposed to W.T.F.'s sound emissions. These epidemiological studies must be performed by unbiased, at arms-length researchers with no possible affiliation to the proponents. They must be of sufficient duration to leave no doubt as to the adverse effects.

The Ministry must also review the economics, the environmental safety, the communication interference and, most of all, the safeguarding of our water supply issues.

The setbacks can only be determined appropriately when all the questions have been clearly answered.

With current knowledge, the onshore setback is 1.5 km and 10 km for offshore. This may be viewed as extremely conservative by the proponents, but if one must err, one should err on the side of caution. W.T.F.'s should never be considered in our fresh water lakes.

When more definitive answers are provided through proper unbiased research, the Ministry can safely proceed with the knowledge that they have acted with the interest of the citizens of this great country of ours, free of the "pork-barrel" influences of lobbyists.

I thank you in advance for your genuine interest in this complex issue.

Yours sincerely,

LPL/rl

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