

*Health Canada*

*Wind Turbine Noise and Health Study:*

Designing a credible,  
effective study  
based on indisputable science

*Filed with:*

David Michaud – Principal Investigator  
Health Canada

*Submitted by:*

**MULTI-MUNICIPAL WIND TURBINE WORKING GROUP**  
COMPRISED OF ELECTED OFFICIALS AND APPOINTED CITIZENS FROM THE  
MUNICIPALITIES OF BRUCE, DUFFERIN, GREY, HURON & PERTH COUNTIES

Mark Davis, Deputy Mayor of Arran-Elderslie, Chair

## Contents

About us .....	3
Introduction .....	4
Updating the research base for the study .....	5
Enhancing participation with published experts .....	7
Clarifying the research design .....	8
Broadening the parameters to include other factors of irritation .....	13
Elucidating the sample set to obtain indisputable results .....	14
Community safety issues: another dimension not to be overlooked .....	15
Considering social impact as a community health issue .....	16
An ethics statement will improve acceptability .....	17

## About us

**The Multi Municipal Wind Turbine Working Group** consists of members of elected councils and citizen representatives from over 15 municipalities in Ontario including Ashfield Colborne Wawanosh, Arran-Elderslie, Brockton, Central Huron, Chatsworth, Georgian Bluffs, Grey Highlands, Huron East, Huron Kinloss, Kincardine, Meaford, Melancthon, North Bruce Peninsula, North Perth, Saugeen Shores, and West Perth.

**Our municipalities currently host at least one-third of the wind turbines operating in Ontario.**

We are targeted for the installation of many more within the next 3 years as Ontario heads towards its 2012 Ontario FIT Review target of 10,800 MW of renewable energy by 2015.

**These projects are having a huge impact on our communities.** Our municipal councils have received many deputations from well-respected citizens expressing concerns for their health and safety. Many have already been suffering from adverse impacts since the arrival of the wind turbines. We recognize our principal responsibility for the health, safety, security, and well-being of our citizens.

**We support an effective federally sponsored study, conducted in a transparent manner.** We have to point out that the scope of damage extends throughout the system. There is growing evidence of widespread socio-economic impact as well. Municipal councillors are in a stressful position, caught in the middle and spending copious amounts of time attempting to deal with an issue that goes well beyond their normal local planning functions. In addition, our ability to safeguard the well-being of our citizens has been removed by the Ontario Green Energy and Economy Act.

**We believe that our local experience living with so many industrial wind turbines gives us a unique opportunity as well as a responsibility to contribute to the study design.** We welcome the opportunity to comment and we are encouraged that feedback such as ours (as provided in this report) will be posted on the Health Canada website along with the design committee's responses. We are therefore presenting positive suggestions which we feel will enhance the effectiveness and credibility of the study and reinforce Health Canada's excellent reputation internationally.

We believe that the precautionary principle requires that further implementation of wind turbines anywhere in Canada must be stopped until an effective study is completed and until all existing concerns have been acceptably addressed. **Precaution and prevention go together.** Dr. Robert McMurtry, (who has served as Dean of Medicine at the University of Western Ontario, a member of the Health Council of Canada, special advisor to the Royal Commission under Roy Romanow, visiting Cameron Chair to Health Canada and Founding and Associate Deputy Minister of Population & Public Health, Canada), concurs: **"The admission by Health Minister Aglukkaq that there are substantial gaps in our knowledge reveals the absence of evidence-based guidelines. There is thus the need for a moratorium on further IWT development until the requisite evidence of safe placement of wind turbines is available."**

## Introduction

The wind turbine health issue has inflamed intense emotions in Canada and around the world. Health concerns have been raised in countries as widespread as the United Kingdom, Australia, New Zealand, Europe, Japan

and the United States. In fact, several of these countries have already begun their own investigations. It is inevitable then, that Health Canada's project will attract international attention. This makes it of paramount importance that the study be designed scrupulously: beyond criticism of bias, lack of transparency or failure to consult widely. Canada will be looked to by many other countries as a leader in fairness and scientific scrutiny.

Because the wind turbine health issue has already taken on international dimensions, the last few years have seen the publication of a growing body of international, expert, peer-reviewed literature which has quickly become the standard for research. Although the present design outline is still scanty making public comment difficult, it does seem to have overlooked references to many of the more current documents.

## Updating the research base for the study

For example, the study should incorporate points recognized from recent papers at last year's **Wind Turbine Noise conference in Rome (WTN-2011)** including:

(a) Madsen and Pedersen at WTN-2011 - *Noise from Large Wind Turbines - An Update on Low Frequency Noise*. (Larger wind turbines produce more low frequency noise than smaller ones).

(b) Lundmark at WTN-2011 – *Measurement of Swish Noise – A New Method*. (Sound from wind turbines cannot be compared to the lapping of lake waves, or waterfalls, due to the periodic, amplitude modulation of the wind turbine sound, while the natural sounds are random).

It would be blind of the study to continue to maintain (as the initial design has done) that “to date there have been no field studies that have included objective health measures in their study design which could lend support to some of the self-reported claims derived from questionnaires”.

In the interest of thoroughness, evidence submitted to the Kent-Breeze Ontario Environmental Review Tribunal, (which is available in the public record) needs to be part of the preliminary reference material. This includes the scoping epidemiological survey done by Dr. Michael Nissenbaum of Maine as well as his paper presented at the **10th International Congress on Noise as a Public Health Problem (ICBEN) 2011, London, UK**, which looked at sleep disturbance from wind turbines and changes required in prescribed medication.

A number of useful peer-reviewed papers have also now been published by presenters at the **First International Symposium on Adverse Health Effects from Wind Turbines** held in October, 2010 at Picton, Ontario. Peer reviewed field studies by Thorne, Rand and Ambrose, have also been published.

**No doubt the design panel will want to update this information.**

Perhaps because of our greater awareness of so many people currently being affected by wind turbines in Ontario, we have had the advantage of access to many of these international experts through their participation in symposia and conferences.

With regard to study design and process, we particularly commend the recommendations of Carmen Krogh who has been researching the wind turbine-adverse health and social justice issue since 2009. She has personally visited nearly every community in Ontario where wind turbines are installed

and has spoken with many of our municipal council colleagues as well as affected citizens throughout the province. Subsequent to a meeting held on 25 April, 2012 with senior officials and several Members of Parliament, she submitted upon request, a ***Draft Proposal Researching Human Health and Industrial Wind Turbines: A Dose Response Relationship***. The *Draft Proposal* urges that prior to release of the public consultation, subject experts with published research on industrial wind turbines and other researchers be included to assist with the design of the research, and that consultation with those reporting adverse health effects be initiated.

The process of including those reporting adverse health problems at the front-end follows the *Health Canada Decision-Making Framework* to “Provide adequate opportunities for affected and interested parties to be involved in the risk management decision-making process.” As part of this process we trust Carmen Krogh will be added to the design panel.

## Enhancing participation with published experts

We want to emphasize that the credibility and prestige of the study will be greatly enhanced by the participation on the study design panel of the following internationally recognized independent authorities who have already spent several years working directly on wind turbine illness and researching related issues: Dr. Jeffery Armmuni, PhD, epidemiologist, Canada; Dr. Arline Bronzaft, PhD, noise and health specialist, USA; Dr. Christopher Hanning, M.D., FRCA, MRCS, LRCP, sleep specialist, UK; Richard James, acoustician, USA; Dr. Mauri Johansson, specialist in community health and occupational medicine, Denmark; Carmen Krogh, BSc Pharm; Dr. Sarah Laurie, M.D., Waubra Foundation, Australia; Dr. Robert McMurtry, M.D., F.R.C.S. (C), F.A.C.S., Canada; Dr. Henrik Moeller, acoustic specialist,

Denmark; Dr. Michael Nissenbaum, M.D., USA; Dr. Carl Phillips, PhD, M.P.P., wind turbine syndrome researcher and author, USA; Dr. Daniel Shepherd, PhD, noise and health specialist, New Zealand; Dr. Robert Thorne, PhD, health sciences and acoustics expert, Australia.

These are all highly respected professionals who have long gone beyond basic theoretical considerations of the problems through extensive contact with real patients and investigation of a variety of actual local conditions. We believe their cumulative experience will be necessary if the study is to make meaningful progress. They will provide a huge preliminary boost to the study's knowledge base and lend international credibility to the final product.

## Clarifying the research design

While we support this initiative by Health Canada, it must be stressed that we expect the study to follow the most rigorous scientific standards in order to produce valid results. It is therefore vitally important that the health study be conducted with an open attitude to determine *all* the facts related to health effects from wind turbines. If the present text of the research design is clarified at the outset, it can avoid suggesting, as it does now, that the study has been formulated with an initial bias.

### (a) AVOIDING PRECONCEPTIONS WILL ELIMINATE BIAS

We recognize that any health study needs to address the advantages of a technical solution intended to address a known problem as well as the potential adverse effects of the solution.

However, statements such as "This source of energy is viewed as a viable and environmentally friendly alternative to fossil fuels", do not give assurance that the study is starting without preconceptions, especially in the light of the recent report of the Auditor General of Ontario (and many other studies) which question the viability of wind energy as well as its ability to reduce greenhouse gas emissions. Biologists are now pointing to cumulative wildlife habitat fragmentation and loss and significant declines for endangered species, especially birds and bats.

In the case of an application of wind turbines, many claims are made which, upon closer inspection, reveal errors. The design of the Health Canada study must be careful to not repeat claims of supposed advantages that are not factual. Consider the following statements taken from the Natural Resources Canada website:

"Using wind energy reduces the environmental impact of generating electricity because it requires no fuel and does not produce pollution or greenhouse gases"; "The benefits of increased deployment of wind energy include grid-wide energy savings and reductions in greenhouse gas emissions and air contaminants (including SO<sub>x</sub>, NO<sub>x</sub> and mercury)"; "By encouraging the growth of domestic wind energy expertise and the development of wind energy technology specifically relevant to the Canadian environment, Canada can realize many business, economic, energy, societal and environmental benefits."

These claims differ markedly from the published peer reviewed literature which indicates that:

- Wind turbines *do* produce noise, recognized as a pollutant, and *do* pose a physical risk.

- Wind turbines do not cause the supposed reduction in greenhouse gas emissions, since wind is not available when the system demand is greatest. Intermittency and unpredictability require fossil-fuelled back up (in Ontario, gas electricity generation)—which because it has to be maintained 24/7 and run in an inefficient mode, is by no means free of harmful particulate waste emissions. The inflexibility in wind scheduling results in adverse impacts on other greenhouse gas free generators such as hydro and nuclear.
- The economic benefits of wind accrue to the developers, while consumers see increased costs, requiring the dedication of discretionary income to pay electricity bills-- money that might have been used to buy healthy food or pay for childcare.
- Increased electricity costs drive away long term jobs, rather than creating sustainable employment.

It is appropriate for the health study design to recognize errors in the claimed advantages of wind generation while it studies adverse impacts in order to be able to properly position risks and benefits.

(b) INCORPORATING ADVANCES IN MEASURING SOUND WILL MAKE THE STUDY UP-TO-DATE

As with any new technology, observation methods and standards quickly become more sophisticated as the gaps in our knowledge are gradually filled in so that evidence-based guidelines can be put into place. Scientific objectivity will be critical when the study considers whether the Health Canada “justification of 45 dBA” is now outdated in view of the fact that many people are experiencing sleep disturbance, and other adverse health

effects (for which they have sought medical care) at noise levels under this Health Canada criterion.

We note that two of the four authors of the design study have previously published work identifying their opinion that the sound conditions experienced by those suffering are not a cause for concern. *A Justification for Using 45 dBA Sound Level Criterion for Wind Turbine Projects* by Stephen E. Keith, David S. Michaud, and Stephen H. P. Bly<sup>1</sup> published back in 2008 stated that “Health Canada derived a noise criterion of 45 dBA as the level at which mitigation is recommended for wind turbines operating in quiet rural areas. This criterion is intended to avoid noticeable rattles, sleep disturbance and an increase in %Ha<sub>n</sub> greater than 6.5%.” (%Ha<sub>n</sub> = percentage of people highly annoyed with noise).

It is not correct to assume that 40 dBA or 45 dBA are adequate before the study has been completed.

Investigators must be open to determine what target is appropriate for a cyclical / amplitude modulated source high above receptors, **recognizing that “A” weighting minimizes the measurement of the effect. The study design must recognize that the cyclical nature of wind turbine noise results in an amplitude modulation variation measured at 5 dB or more.** (Siponen, research report VTT-R-00951-11, *Noise Annoyance of Wind Turbines*, also discussed at WTN-2011). **The cyclical nature of sound is acknowledged by researchers (K. Persson-Waye,)<sup>2</sup> as being a major contributor to annoyance.**

As a result, measurement of sound levels proposed in the study design in “Leq – A weighted”, (equivalent continuous sound level - weighted to reduce

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<sup>1</sup> Published in the *Journal of Low Frequency Noise Vibration Active Control*, (Volume 27, Number 4, December 2008).

<sup>2</sup> Private communication.

the impact of frequencies below 1000 Hz or above 8000 Hz) is not an adequate measure of annoyance, as the equivalent continuous level over the sample time period **does not recognize the annoyance caused by the cyclically changing sound, which is predominant at low frequency**. Similarly **measuring sound as Leq – A Weighted does not adequately predict the related indirect adverse health effects annoyance can cause**. Comments that "WTs produce broadband noise similar to that produced in buildings by heating, ventilation, and air-conditioning systems" miss the point altogether by failing to consider the characteristics of cyclical sound.

It is important that the study design not minimize identified concerns rather than looking into them. **The study must recognize the cyclical nature of wind turbine sound by measuring the amplitude modulation, requiring measurement of the variation between the cyclically varying peak and minimum sound levels.**<sup>3</sup>

### (c) MEASURING SYMPTOMS

It appears to us that the actual process of information gathering still requires considerable refinement and, of course, input from medical practitioners and

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<sup>3</sup> A similar problem may arise from the study design material reference to the World Health Organization "Night Noise Guidelines for Europe (2009)" as setting a criterion of 40 dBA noting that the Guidelines are based on transportation noise sources, stating: "current science shows that the same levels are applicable to noise emitted from WT's."

**It is incorrect to give the impression the 40 db is based on WHO guidelines.**

The WHO 40 db does not apply to wind turbines but to road, air and rail noise. Wind turbine noise is more annoying than these 3 types of industrial noise so it is incorrect to cite WHO 40 without advising of these facts. As well, other types of noise must be included – tonal, LFN, infrasound, AM etc. **The study design must recognize**, as it refers to the work of Pedersen, van den Berg, Bakker and Bouma, **that research shows people are annoyed at a lower sound level from wind turbines than from transportation noise**. Including this will avoid unacceptable bias in the design basis. It should also be noted that the peer reviewed study by Thorne calls for 32 dB, while the Ontario Ministry of the Environment documentation released under the Freedom of Information Act indicates 30 to 32 dBA.

epidemiologists experienced with investigating the complaints of those living near wind turbines. The design is unclear as to how the 25-minute computer-assisted personal interview, taking blood pressure following a standardized protocol, taking a hair sample to determine cortisol levels, and wearing a wrist-worn actimeter during sleep will be sufficient to assess health effects.

The survey will also need to look at changes in prescribed medications. The design must be specific as to whether “taking blood pressure following a standardized protocol” involves a single point measurement, or tracking blood pressure as turbine conditions change.

(d) NEED TO INVESTIGATE BROADER ASPECTS OF COMMUNITY HEALTH INCLUDING THE OCCURRENCE OF CARDIAC EVENTS

Some members of our communities have observed an increase in the occurrence of unpredictable fatal cardiac events following the arrival of the wind turbines. We suggest that epidemiological research required as part of the study should include a comparative before and after longitudinal survey of coroners’ reports and public death records monitoring changes in cardiac related events for people living in the area of wind turbines.

## Broadening the parameters to include other factors of irritation

A significant number of complaints relate to other factors, and they should be considered in the design of a “health study.”

A practical study design will focus on the “health study of effects from wind turbines” rather than only on “noise.” Many complaints relate to irritants such as “tingle voltage”, blade shadow flicker, and flashing night-time aircraft

warning beacons. These additional recognized factors must be included as part of the whole picture. As an example, a Hydro One employee in Ontario has reported detecting significant variation in the “tingle voltage” from the neutral to ground that varies in direct proportion as the adjacent wind turbine output varies. The circuits have the design separation from the wind generator “collection lines” and yet, noticeable variation in “tingle voltage” is detected, showing that the design separation is inadequate to prevent measurable problems.

## Elucidating the sample set to obtain indisputable results

**The desired results will be achieved only if the distribution of the sample set is defined more clearly.** For example, the following statement needs clarification: “The sample will consist of 2000 dwellings at setback distances from less than 500 metres to greater than 5 kilometres from 8-12 wind turbine power plants”; or alternately “The study will be conducted on a sample of 2000 dwellings randomly selected from those located near 8 to 12 WT installations in Canada”. Does this mean the dwellings will be related to installations of 8 to 12 wind turbines, only? (There are only 7 of such arrays identified by the CANWEA listing of wind turbines in Canada). Or does it mean the dwellings will be related to 8 to 12 installations of wind turbines?<sup>4</sup>

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<sup>4</sup> For example a single Siemens 2.3 MW wind turbine at 500 metres has a predicted sound at a receptor of 40 dBA, (using an ISO 9613-2 propagation model). Conversely 5 similar turbines at a distance of 1000 metres will have a predicted sound of 40 dBA, and 15 such turbines, if all equidistant at 1500 metres will produce 40 dBA at a receptor. Of course, in reality, the distance from a receptor to wind turbines in a large installation of over 100 turbines might well have the closest turbine at a distance of under 500 metres, 5 to 10 more at distances from 500 to 1000 metres, 10 more from 1000 metres to 2000 metres, and

## Community safety issues: another dimension not to be overlooked

The issue of community safety is of vital importance to our municipalities. This concern can be addressed only if the health study addresses the increase in public safety risk from ice throw, turbine fires and blade failures. Each of these not uncommon occurrences has an impact on public safety and therefore an impact on community health.

We have seen the photos and videos of burning blades traveling downwind hundreds of metres from wind turbines. We are aware that the wind turbines have no fire extinguishing capability to put out blade fires, and nor have our fire departments. There have been blade failures at wind turbines in Ontario.

Denmark is now reporting an issue about land fill and what to do with toxic blades which can't be buried and can't be burned. They are now facing the problem of disposing of hundreds of tons of blades and other toxic parts. This is a major concern for rural municipalities.

Ontario's Hydro One guidelines call for wind turbines to be placed no closer than 500 metres from their 500 kV power corridors to protect their assets.

### ***The current practice of locating turbines at blade length plus 10 metres***

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perhaps 10 - 20 more at distances from 2000 to 3000 metres. (This example uses several real instances at the Enbridge Underwood Wind Power Development). Their situation predicting over 45 dBA with a number of sources interacting is far different than someone with a single turbine at 500 metres. **Greater accuracy can be achieved by revising the study design to have a distribution that gives adequate numbers of sample points for each 3 dBA contour to be statistically significant, so there are roughly the same number of samples predicted from 40 to 43 dBA (if any), 37 to 40 dBA, 34 to 37 dBA, 31 to 34 dBA, and under 30 dBA, if the intent is to relate noise to impact.**

*from roadways and then posting a sign to stay back 305 metres defies logic. Signs are posted along highways warning people to stay away from wind turbines if icing conditions might occur in the wintertime and yet proposals call for turbines to be as close as 61 metres from roadways used by school buses. Even the maintenance procedures of the manufacturers require the maintenance staff to stay up to 400 metres away from an operating wind turbine that may have icing.* This means that our children riding in school buses or neighbours in their own fields do not have adequate protection from known hazards, including ice throw.

Our children and neighbours are our community assets.

## Considering social impact as a community health issue

Similarly the social impact on the community is a significant concern to us as councillors and citizens of rural communities. We are looking for an examination of the ***impact on community health and relationships posed by wind turbines.*** There has never been an issue that polarized our communities more than the installation of wind turbines. A number of authors have observed that wind turbines are driving a huge divide into rural Ontario, and causing immense harm to the fabric that holds community spirit together. Many lifelong friends, neighbours and even family members are no longer on speaking terms. This stress is leading to health problems – stress is known to negatively affect health status.

## An ethics statement will improve acceptability

We expect the Health Canada study to meet the highest standards of excellence and ethics. An essential requirement must be the inclusion of a firm ethics statement. If the study confirms the evidence of adverse health effects, then Health Canada must have the authority to demand the immediate cessation of operation of all wind turbines located at similar distances from receptors.

The study and Health Canada will gain greater respect if it treats those who are suffering, with respect. Dismissive treatment of identified concerns (noting them as “self reported”) has the significant effect of diminishing those concerns. Something is causing the adverse effects these citizens are experiencing, and the study must be prepared to determine what that cause is. It is absolutely imperative that the study design include meeting with those who have already reported concerns, and collecting information from these individuals, rather than treating them as a “challenge” to the vision of the wind energy industry. As councillors, we have met with many of these people, and they are neither mal-contented nor crack pots.

### (a) TRANSPARENCY OF STUDY QUESTIONS

At present, the secrecy that identifies that study questions cannot be revealed until after the study is complete lends itself to the suspicion that the survey does not trust that those surveyed will be honest. This must be rectified.

### (b) WE ARE INSISTING ON AN OBJECTIVE SCIENTIFIC ENQUIRY

Assumptions which echo industry spin have no place in objective scientific inquiry. For example, the statement “it is not clear if those receiving economic benefit experience lower WTN annoyance because they gain

financially, or if they begin with a lower annoyance and therefore were more likely to become participating receptors”, conveniently neglects the fact that those who have signed contracts to host wind turbines have legally committed that they will not complain and may be subject to legal action if they do. Members of the Multi Municipal Wind Turbine Working Group are aware of people who *did* sign contracts to host wind turbines but who are now suffering, and as a result have had to leave their homes. Many non-participants have also found it necessary to abandon homes in order to recover their health.

The study will do well to consider the advice of epidemiologist Dr. Carl Phillips, Professor of Public Health Policy, University of Texas Medical School, who demonstrates that the action of people choosing to leave their homes at considerable inconvenience and financial loss rather than endure the adverse effects of the turbines provides “an objective measurement in epidemiology of what would otherwise be subjective phenomena.”

In order to meet the highest standards of research, the study will have to actually look for causes of health impacts, not only compliance with already predetermined published guidelines.

Two independently conducted and peer reviewed and published research studies in addition to one published at ICBEN (International Commission on Biological Effects of Noise) all determined people welcomed the turbines – then got sick (Krogh 2011; Shepherd *et al* 2011; Nissenbaum – ICBEN).

(c) URGENT NEED TO STUDY ALL THOSE WHO HAVE REPORTED ADVERSE HEALTH EFFECTS

Previous studies carried out by government agents such as the Ontario Chief Medical Officer of Health have failed to investigate methodically the

identified health effects through direct contact with impacted individuals, substituting instead a selective literature review. That is ethically and scientifically unacceptable.

In conclusion, we must reiterate the seriousness of the effect wind turbines are having in our communities. The fact that we are increasingly receiving complaints from people who are experiencing adverse effects requires that **all those who have self-reported adverse health effects must be studied expeditiously.**

We commend Health Canada for committing to this undertaking and we trust that, by incorporating our suggestions into the study design, an objective scientifically valid conclusion will result.