

Response to Senate of Australia February/March 2015

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Preamble

On 24 November 2014, the Senate established the Select Committee into Wind Turbines to inquire into and report on the application of regulatory governance and economic impact of wind turbines. In early February of 2015 Jeanette Radcliffe, Secretary to the Select Committee issues an "Invitation to submit" to me. This witness statement is my formal response to the invitation.

The document is a chronology of my engagement with the issue of adverse health effects in the environs of industrial wind turbines (IWT). Initially interested in having IWT on my property I have come to be very concerned about adverse health effects. Throughout the statement it will become apparent that there are several themes that run through the document highlighting the problems concerning me and that have remain unaddressed over the past decade. Specifically there are issues of:

- Global reports of adverse health effects (AHE)
- Failure of regulations to monitor all qualities of the noise energy produced by IWT
- Failure to monitor exposed people for AHE
- Failure to develop evidence-based regulations for IWT set-backs derived from human health research

The full terms of reference of the Select Committee are to evaluate:

(a) the effect on household power prices, particularly households which receive no benefit from rooftop solar panels, and the merits of consumer subsidies for operators;

(b) how effective the Clean Energy Regulator is in performing its legislative responsibilities and whether there is a need to broaden those responsibilities;

(c) the role and capacity of the National Health and Medical Research Council in providing guidance to state and territory authorities;

(d) the implementation of planning processes in relation to wind farms, including the level of information available to prospective wind farm hosts;

(e) the adequacy of monitoring and compliance governance of wind farms;

(f) the application and integrity of national wind farm guidelines;

(g) the effect that wind towers have on fauna and aerial operations around turbines, including firefighting and crop management;

(h) the energy and emission input and output equations from whole-of-life operation of wind turbines; and

(i) any related matter

1. The purpose of this submission is to address the terms outlined in five sections i.e. b, c, e, f, i. The submission will reflect an engagement that began in 2007 and became focused on health on August 2, 2008. Since that time the author has expended any average of 30 hours per week or approximately 1500 hours per year attending meetings, researching, monitoring and writing on the topic of adverse health effects (AHE) in the environs of industrial wind turbines (IWT – wind turbines are designated as industrial when they are over 100 feet in height and deployed for use at the electrical grid level). As noted above, throughout the years clear themes have emerged in regards to adverse health effects (AHE) based on the global reports of adverse health effects resulting in temporary or permanent home abandonment, the denial of AHE by wind energy proponents, the problem with regulations governing IWT and the failure to monitor exposed people. (see also paragraph 15 below)

2. I am a graduate of the University of Toronto in Medicine in 1965 and a Fellow of the Royal College of Physicians and Surgeons of Canada. I am presently Emeritus Professor of Surgery of the University of Western Ontario and an orthopedic surgeon at the Visiting Specialist Clinic, Prince Edward Family Health Team.

3. During my residency in orthopedic surgery, I spent 2 years in Africa, first in a mission hospital in Sekhukhuniland (South Africa) and then with the Canadian International Development Agency in Uganda. Following my residency, I did a fellowship in hand surgery at the University of Iowa. I started my practice at the former Sunnybrook Hospital (now Sunnybrook Health Centre) in 1975. It was there that I founded and directed Canada's first Trauma Unit and the multi-disciplinary Hand Unit.

4. In 1987, I was appointed Professor and Chair of Surgery at the University of Calgary and Chief of Surgery at Foothills Hospital. In 1992, I became Dean of Medicine at the University of Western Ontario and subsequently Dean of Medicine and Dentistry, a post I held until 1999. In 1999, I became the first Cameron Visiting Chair at Health Canada – a post carrying the responsibility for providing policy advice to the Deputy Minister and Minister of Health for Canada.

5. I was the founding Assistant Deputy Minister of the Population and Public Health Branch of Health Canada (now the Public Health Agency of Canada). I was appointed to the Romanow Commission in 2001 (Royal Commission on the Future of Health Care in Canada) as a Special Advisor to Commissioner Romanow.

6. I was also Special Advisor to the Deputy Minister of Nunavut from December 2002 to August 2003 for the purpose of reviewing the health care system of the Territory.

7. In June of 2003, I received the Presidential Award of Excellence from the Canadian Orthopedic Association. In 2008 I received the James H. Graham Award for career achievements from the Royal College of Physicians and Surgeons of Canada. In 2010 I received the Ontario Medical Association Career Service Award (Emergency Medicine Section).

8. I was named a member of The Order of Canada in 2011. In 2012 I received the Queen Elizabeth II Diamond Jubilee Medal.

9. My present work involves an active clinical practice as well as teaching and research. In October of 2003, I was appointed to the Transition Advisory Board of the incoming Provincial Government of Ontario. I was appointed to the Health Council of Canada from 2003 to 2008. I also maintain active memberships in the Board of the Canadian Index of Wellbeing Project Management Team, as well as the International Advisory Board of the Alberta Bone and Joint Health Institute.

10. I am a founding member of the Evidence Network (2010), an initiative funded by the Canadian Institute for Health Research to provide non-partisan, unbiased research evidence regarding health care in Canada.

2007

11. Initially I was interested in being a host of IWT as my wife and I had acquired a rural acreage. It appeared that it was an opportunity to support a clean, green renewable energy initiative and to realize an income from our property.

12. However we began to research the background on IWT and found that our impression of the uniformly beneficial impacts of IWT were not substantiated (intermittency and unpredictability of wind, noise problems of IWT) and that there were reports of AHE appearing in newspapers and the gray literature.

2008

13. On August 2, 2008 I attended a learned lecture by Dr. John Harrison Professor Emeritus of Physics of Queen's University in Kingston Ontario. As a consultant to the Ontario Government he had warned them of the potential of AHE and noise problems if there were insufficient setbacks of people from IWT. He was able to demonstrate and subsequently publish his reasoning based on fundamental principles of physics.

Harrison John P. Wind Turbine Noise Bulletin of Science Technology & Society 2011 31: 256

14. From that point forward I became more engaged in the issue of AHE and joined an organization Alliance for the Protection of Prince Edward County (APPEC). My membership lasted until June of 2012 when I resigned owing to philosophical differences. APPEC were opposed to IWT in principle whereas I believe they do provide benefit if safely deployed.

15. On November 23, 2008 I brought a deputation forward to the Council of the Municipality of Prince Edward (Appendix i). Several points were made in the deputation that were true then and remain true to this date:

a. There are no evidence-based guidelines derived from human health research for the siting of industrial wind turbines

b. All regulations are based on dBA rating of noise which is insensitive to infrasound and low frequency noise (ILFN)

c. The proponents supporting the wind industry in 2008 claimed it was unnecessary to monitor ILFN, an erroneous claim that continues to be repeated to the present

d. There were wide-spread reports of AHE emanating from physicians and researchers in the US, UK, France and Portugal in 2008 which have expanded to include virtually every country in which IWT have been erected

2009

16. On April 22, 2009 I presented a deputation to the Standing Committee on General Government of the Ontario Legislature regarding Bill 150 , the Green Energy and Green Economy Act. (Appendix ii)

17. The themes of absence of regulation in Canada and Ontario, the importance of ILFN and the emergence of exposed people reporting AHE were emphasized again as was the denial of the importance of ILFN. The deputation included a presentation of over forty cases of AHE which

were submitted to the committee with the attendant detail. (These cases and relevant details were published as part of a larger series,

Carmen M.E. Krogh, Lorrie Gillis, Nicholas Kouwen, and Jeff Aramini WindVOiCe, a Self-Reporting Survey: Adverse Health Effects, Industrial Wind Turbines, and the Need for Vigilance Monitoring Bulletin of Science, Technology & Society August 2011 31: 334-345, doi:10.1177/0270467611412551

18. A proposal was made for third party epidemiological research on the matter of AHE was tabled. Shortly thereafter the Premier of Ontario the Honourable Dalton McGuinty spoke with me about the proposed research and AHE. Subsequently the Ontario government established a competition for a research chair to explore the question. The competition was won by the University of Waterloo.

19. It was also noted during the presentation to the legislative committee that:

The National Academy of Medicine of France has taken note of adverse health events in their report "Repercussions of the Operation of Wind Turbines on the Health of Man" (March 2006). Their recommendation is for a set-back of 1.5 kilometers for 2.5 MW wind turbines from dwellings. They also recommended an epidemiological investigation into the possible medical effects of wind turbines.

20. Proponents of IWT and the industry generally oppose the research as being unnecessary despite the absence of evidence-based guidelines derived from human health research.

2010

21. In 2010 I became the founding chair of the Society for Wind Vigilance, a position held for two years. In the role as chair I oversaw The First International Symposium on the Global Wind Industry and Adverse Health Effects.

<http://www.windvigilance.com/international-symposium/proceedings-first-international-symposium>

22. Representatives of the industry and government were specifically invited as were other interested parties and the general public. The outcome of the symposium emerged in the Bulletin of Science, Technology and Society with a special issue featuring papers from the meeting.

<http://bst.sagepub.com/content/31/4.toc>

23. The articles again affirmed the fundamental issues of the absence of human health research to provide evidence-based guidelines for safe siting of IWT, the failure to monitor for ILFN and

its importance, the existence of AHE and the short-comings of existing regulations. In addition the vulnerability of children was described (Arline L Bronzaft) as well as the basic science underpinnings of ILFN and its effect on the human inner ear (A. Salt and J. Kaltenbach).

2011

24. In the spring of 2011 an Environmental Review Tribunal heard an appeal against a proposed wind farm in south-western Ontario.

(Appeal for Renewable Energy Approval issued to Kent Breeze Corp. and MacLeod Windmill Project Inc. (Kent Breeze Wind Farms) c/o Suncor Energy Services Inc., EBR Registry Number 011-1039Chatham-Kent)

I appeared as an expert witness for the appellants. My witness statement is attached (Appendix iii). This statement is the most detailed representation of my concerns and among others makes a particularly important point about the need to consider “Indirect Pathway” for adverse health effects. (p. 12). *I urge the Select Committee to note this point as IWT proponents have recurrently attempted to discount indirect pathways to AHE which is simply an untenable position.*

25. The appeal was not successful however the tribunal commented:

Precautionary measures should be taken to minimize the risk that renewable energy projects in some locations will simply sacrifice one value (e.g., an environmental amenity or public health) for another (e.g., reduction in the use of fossil fuels).

and

While the Appellants were not successful in their appeals, the Tribunal notes that their involvement and that of the Respondents, has served to advance the state of the debate about wind turbines and human health. This case has successfully shown that the debate should not be simplified to one about whether wind turbines can cause harm to humans. The evidence presented to the Tribunal demonstrates that they can, if facilities are placed too close to residents.

26. In the course of the procedure the respondents brought forward no evidence that would ameliorate concerns about ILFN, the absence of evidence-based guidelines for the siting of IWT or the existence of adverse health effects such as sleep disturbance and psychological distress. On the contrary the latter problems were acknowledged but trivialized by identifying the effects as mere “annoyance”. Conversely the WHO has affirmed that annoyance is an AHE.

https://mail-attachment.googleusercontent.com/attachment/u/0/?ui=2&ik=0647305144&view=att&th=13959df212fadd8d&attid=0.1&disp=vah&zw&saduie=AG9B_P-5_cqTUrTgP-hoRJO70_w&sadet=1426426825904&sadat=ANGjdJ_6VkUoeuztRAq69QPJrOlqRZ7NPejRqX_q0UcyotwQxMp4Nltur7lhmvc&sads=-NHsE8ooh68NzwnN-flK3x01CWk

27. Later in 2011 the Auditor General of Ontario Report, December 5, 2011 was issued. The report is insightful and revealing in the analysis of the Green Energy and Green Economy Act in the province of Ontario.

http://www.auditor.on.ca/en/reports_en/en11/303en11.pdf

There were many important observations including that fact that, “no independent, objective, expert investigation had been done to examine the potential effects of renewable-energy policies on prices, job creation, and greenhouse gas emissions;” and “no thorough and professional cost/benefit analysis had been conducted to identify potentially cleaner, more economically productive, and cost-effective alternatives to renewable energy, such as energy imports and increased conservation.” (P. 97) This finding serves to underline the importance of the Select Committee seeking third party evaluation of the social and economic impacts of renewable energy and wind energy in particular. (See also “Summary” paragraph 54).

28. Two other findings also merit the Select Committee’s attention;

The power-generating capacity of current wind and solar technology is much lower than other energy sources, as illustrated in Figure 10. Wind generators operate at 28% capacity factor but have only 11% availability at peak demand due to lower wind output in the summer. P. 111

In 2010, 86% of wind power was produced on days when Ontario was already in a net export position. P. 112

Excerpts from the report are attached as Appendix iv and the full section of the Auditor General’s report on Renewable Energy is attached as Appendix v.

2012

29. In March of 2012 an editorial in the leading British Medical Journal (BMJ) was published about adverse health effects and industrial wind turbines.

Hanning C, Evans A, *BMJ* 2012;344:e1527 doi: 10.1136/bmj.e1527, 8 March 2012 p. 1.
[attached as Appendix vi]

In the editorial it was noted that sleep is fundamental to health and well-being;

The evidence for adequate sleep as a prerequisite for human health, particularly child health, is overwhelming. Governments have recently paid much attention to the effects of environmental noise on sleep duration and quality, and to how to reduce such noise.¹ However, governments have also imposed noise from industrial wind turbines on large swathes of peaceful countryside.

30. The editorial concluded;

Robust independent research into the health effects of existing wind farms is long overdue, as is an independent review of existing evidence and guidance on acceptable noise levels.

31. This represents a continuation of the pattern of physicians advocating for health and well-being, physicians who are from a number of countries including France, US, Canada and the UK. These physicians are on the record calling for independent research into AHE in the environs of IWT. Proponents for IWT have not supported the independent research.

32. The pattern of engagement of IWT physician advocates is different. They are generally paid for their work, which is to critique the research methodology of cross-sectional studies exploring AHE near wind energy installations. Nonetheless Medical Officer of Health Dr. Hazel Lynn and Dr. I. Arra did a review of the existing literature which has shown a correlation between AHE and noise levels near wind farms. They identified no studies in which there was an absence of correlation.

<http://waubrafoundation.org.au/resources/association-between-wind-turbine-noise-and-human-distress/>

33. The standard for acceptable methodology however is unevenly applied by these commentators. In the first instance they make no mention of the fact that there are all peer review publications demonstrate a correlation between AHE and living in proximity to IWT and no publications that show the opposite. In addition they do not address the many questions that have been raised by some observers such as the Auditor General of Ontario in 2011 about the dearth of evidence for the merits of wind energy (or other renewables) as the most cost-effective option for reduction in the use of fossil fuels. Since there is a pressing need for alternatives to fossil fuel consumption in order to combat climate change one is left wondering why such cost-effective options as conservation, receives relatively little attention.

2013

34. One publication, a review of the literature (Health effects and wind turbines: A review of the literature Loren D Knopper and Christopher A Ollson Environmental Health 2011 10:78) was advanced by a developer proposing an industrial wind project on Amherst Island in response to concerns raised by the local community about adverse health effects. Early in 2013 I assisted the community (pro bono) with a detailed commentary about the paper which was deeply flawed (Appendix vii). The conclusions of my review were;

1. While Knopper and Ollson are well qualified academically, they have committed errors of omission and commission identified throughout the text of this commentary as well as inaccuracies in the use of references.
2. Bias has been suggested by Knopper and Ollson description of experts testifying on behalf of complainants of adverse health effects from the wind industry installations as “known advocates who oppose wind energy development” (p. 7/84) in spite of the fact (revealed in testimony at the Environmental Review Tribunal, Ontario (2011) Chatham Kent which Dr. Ollson attended) that physicians such as Hanning and Nissenbaum have a professional responsibility to be health advocates.
3. Knopper and Ollson have inappropriately attributed adverse health effects reported by complainants as a matter of “indirect effects of visual and attitudinal cue” (p. 9/86) in the absence of direct clinical evaluation or testing of complainants by health care professionals and clinical scientists.
4. The stance of the wind energy proponents is accurately represented by Knopper and Ollson that in the author’s opinion: “To date, no peer reviewed scientific journal articles demonstrate a causal link between people living in proximity to modern wind turbines, the noise (audible, low frequency noise, or infrasound) they emit and resulting physiological health effects.” (p. 8/85). However the absence of evidence is no reason to conclude no harm exists since there is a shortfall in the relevant research.
5. The possible violation of human rights noted by Hadden (2008) in a presentation to a UK parliamentary committee and the subsequent publication of Curt Devlin.

<http://www.publications.parliament.uk/pa/ld200708/ldselect/ldconaf/195/195we34.htm>

<http://www.windturbinesyndrome.com/2013/wind-energys-natural-experiment-on-humans-violates-nuremberg-code-curt-devlin/>

6. As scholars with academic credentials Knopper and Ollson had an ethical responsibility to update and address the short-comings of their paper and evolving evidence.

7. The Knopper and Ollson (2011) paper falls short as an objective literature review and does not advance the understanding of global reports of adverse health effects in the environs of wind turbines.

2014

35. Since 2011 and the publication of “Toward a Case Definition of Adverse Health Effects in the Environs of Industrial Wind Turbines” the intention was to update with a definitive paper based on the utility of the proposed criteria and feed-back from clinicians and exposed people. As a consequence and with the collaboration of independent researcher Carmen Krogh an update was published October 8, 2014 “Diagnostic criteria for adverse health effects in the environs of wind turbines” in the Journal of the Royal Society of Medicine (Vol.5 No.10).

<http://shr.sagepub.com/content/5/10/2054270414554048.full>

36. The criteria have proven useful in clinical practice for the intended purpose of assisting in the correct diagnosis of AHE but also to prevent over-diagnosis. In addition suggestions are made for a research agenda for objective confirmation of the diagnosis. If people do in fact satisfy the criteria in practical terms AHE owing to exposure to IWT exist unless proven otherwise. I commend these criteria to the Senate Select Committee.

37. In addition the autumn of 2014 saw the release of the “Health Canada Wind Turbine Noise and Health Study”. The Canadian Medical Association Journal invited Ms. Carmen Krogh and me to submit a commentary (peer reviewed) which was published on line. (Appendix vii, see also

<http://cmajblogs.com/health-canada-and-wind-turbines-too-little-too-late/>

38. The commentary constitutes the simplest and most up-to-date summary of the health advocacy group’s position on IWT and AHE and is attached. Some points merit particular emphasis.

a. Recently on November 6, 2014, HC posted on its website preliminary results of its HC Study. Wind turbine noise “... annoyance was found to be statistically related to several self-reporting health effects including, but not limited to, blood pressure, migraines, tinnitus, dizziness, scores on the PSQI, and perceived stress” as well as related to “measured hair cortisol, systolic and diastolic blood pressure.”

<http://www.hc-sc.gc.ca/ewh-semt/noise-bruit/turbine-eoliennes/summary-resume-eng.php>

b. In 2009, the Canadian Wind Energy Association (CanWEA) sponsored a literature review which acknowledges the reported symptoms such as headaches, nausea, tinnitus, vertigo and state they "... are not new and have been published previously in the context of "annoyance" ..." and are the "... well-known stress effects of exposure to noise.."

Colby, W. D., Dobie, R., Leventhall, G., Lipscomb, D. M., McCunney, R. J., Seilo, M. T., & Søndergaard, B., Wind Turbine Sound and Health Effects: An Expert Panel Review, Washington, DC: American Wind Energy Association and Canadian Wind Energy Association. (2009).

c. The World Health Organization (WHO) acknowledges noise induced annoyance to be a health effect and the results of WHO research "...confirmed, on an epidemiological level, an increased health risk from chronic noise annoyance"

http://www.euro.who.int/_data/assets/pdf_file/0017/43316/E92845.pdf

and other researchers concur:

Niemann H, Bonnefoy X, Braubach M, Hecht K, Maschke C, Rodrigues C, Robbel N. Noise-induced annoyance and morbidity results from the pan-European LARES study. Noise Health 2006;8:63-79

In summary the Health Canada study, (including a coordinated press release with the industry) has once again established a correlation between AHE and noise exposure from IWT. This untoward effect is attempted to be trivialized by labeling it as "annoyance". Annoyance is an adverse health effect leading to increased risk to health as confirmed by WHO and others as it involves sleep disturbance with all its sequelae as well as stress and psychological distress.

39. The Auditor General of Ontario released another report on December 9, 2014 which commented on hydro bills faced by Ontario consumers:

"The total Global Adjustment paid by Ontario ratepayers has grown from \$654 million in 2006 to \$7.7 billion in 2013. More contracted generators, *especially producers of higher-priced renewable power*, will soon be coming online, so the total Global Adjustment is expected to increase even more. Between 2006 and 2015, the 10-year cumulative actual and projected Global Adjustment stands at about \$50 billion, equivalent to almost five times the 2014 provincial deficit of \$10.5

billion. In essence, the \$50 billion is an extra payment covered by ratepayers over and above the actual market price of electricity." (p. 368, emphasis added)

2015

40. A literature review was published by R J McCunney et al "Wind turbines and health: a critical review of the scientific literature" in November 2014 in the Journal of Occupational and Environmental Medicine [JOEM 56(11)]. A response to the article has been submitted to JOEM and has been accepted for publication by JOEM. For information the article "Wind turbines and adverse health effects a second opinion" is attached as Appendix viii. Many of the claims made by McCunney et al do not withstand critical appraisal.

41. It would be possible to reduce or eliminate the boundless discourse of dueling experts by conducting the appropriate third party research as has been cited since 2006 and personally since 2008. There are competing views, both cannot be true but it is only those concerned about AHE who support this approach. Wind energy proponents have regularly and publicly resisted this option. As internationally renowned acoustician Paul D Schomer published (Acoustics Today, 9(4) p.9, October 2013)

Duke Energy was asked to turn on and off their wind turbines for a small research project funded by the state of Wisconsin. But Duke Energy, the world's largest energy provider, said they could not participate because of the lost revenue from the eight turbines that make up this small farm.

This response effectively characterizes wind energy proponents' reaction to research that might well resolve the debate about AHE in the environs of IWT.

42. The McCunney et al study was funded by the wind industry as noted in the article as follows;

The Canadian Wind Energy Association (CanWEA) funded this project through a grant to the Department of Biological Engineering of the Massachusetts Institute of Technology (MIT). In accordance with MIT guidelines, members of the CanWEA did not take part in editorial decisions or reviews of the manuscript. Drs McCunney, Mundt, Colby, and Dobie and Mr Kaliski have provided testimony in environmental tribunal hearings in Canada and the USA. The Massachusetts Institute of Technology conducted an independent review of the final manuscript to ensure academic independence of the commentary and to eliminate any bias in the interpretation of the literature. All six

coauthors also reviewed the entire manuscript and provided commentary to the lead author for inclusion in the final version.

The authors declare no conflicts of interest.

The claim of no conflict of interest is odd under the circumstances considering the lead author has been paid by the industry for his appearances at tribunals and has used the paper to buttress his expert witness claims. In addition and in common with other physician experts testifying for wind energy proponents none to my knowledge have had a clinical engagement with any person exposed to IWT who has AHE.

For the record I am unaware of any physician (myself included) who has published in regards to AHE in the environs of IWT receiving any financial assistance or benefit, directly or indirectly for their publications or for their expert testimony.

43. An abstract was submitted to the Acoustical Society of America (ASA) meeting regarding the Bradford Hill Criteria of Causation as applied to IWT and AHE. The response from the ASA follows;

It is our pleasure to inform you that your abstract titled **Do wind turbines cause adverse health effects? A review of the evidence** has been accepted for lecture presentation at the 169th Meeting of the Acoustical Society of America in Pittsburgh, Pennsylvania on **May 21, 2015**, in session **4aNS, Wind Turbine Noise I**. The session will be held from **8:30 AM - 11:40 AM**.

44. The paper attached in full as Appendix ix. The highlights of the paper are

Bradford Hill's Criteria of Causation number nine and include

- a. Strength of Association - seven citations are provided demonstrating this criteria including dose-response relationships between noise intensity and incidence of complaints.
- b. Consistency – eight citations are provided which demonstrate a consistent pattern of adverse health effects such as sleep disturbance and stress, among different samples of populations in various locations exposed to a variety of noise energies of IWT.
- c. Specificity – a minority portion of populations in the environs of IWT are regularly adversely effected and experience relief when removed from the IWT. The precise inclusion criteria for diagnosis of AHE are found in JRSMO, McMurtry R, Krogh C October 8, 2014 Diagnostic criteria for adverse health effects in the environs of wind turbines, 5 (10)
- d. Temporality – in humans the effect follows exposure to the noise energy of IWT with dose response curve. Five further citations are provided.

There is also animal data – chickens, cattle, mink, goats, emus and horses have all been reported to have demonstrated teratogenesis and other adverse effects.

e. Biological Gradient – greater exposure has led to greater incidence of the adverse effects

f. Plausibility – a plausible mechanism between the cause i.e. IWT noise signal with a significant ILFN component and the effect of sleep disturbance, stress and psychological distress.

g. Coherence – there is coherence between epidemiological studies demonstrating AHE in humans and laboratory experiments in animals (mice and geese).

h. Experimental Evidence – there is evidence from clinical experiments with infrasound as well as animal experiments cited above.

i. Analogous Evidence – other senses are harmed by unperceived stimuli such as radiation, odorless or invisible gases i.e. the IWT noise need not be audible to cause a pathophysiological response.

In short each of the criteria are satisfied with a number of citations in each instance which are presented in detail in Appendix ix.

45. Recently Dr. Steven Cooper released his work in relationship to the Cape Bridgewater in which 6 people were exposed to IWT operations and their responses tracked. The study was facilitated by the rare and laudable cooperation of the wind energy company which enabled a study of exposure with and without turbines operating and in each phase of their operations i.e. start-up, shut-down and other changes of operation.

As acoustical experts Schomer and Hessler observed;

Cooper examines three possible inputs: sound level of the receivers (six subjects), the vibration levels at the receivers, and the power output of nearby turbines. Cooper's outputs are the periodic observations by each subject as to the degree by which they feel they are being affected by wind turbines, specifically at the time they are giving these observations. The cause and effect is found between the input, the turbine power, and the outputs, subject's judgements as to the degree they are being affected at the time.

And subsequently

The results are that there is a cause and effect relationship between turbine power output and subject response, and, at the same time there is no correlation between subject response and either sound level or vibration level. These results show that there

is a non-visual, non-audible pathway by which wind turbine emissions can cause some specific effects in some people.

And finally

Some may ask, this is only 6 people, why is it so important? The answer is that up until now windfarm operators have said there are no known cause and effect relations between windfarm emissions and the response of people living in the vicinity of the windfarm other than those related to visual and/or audible stimuli, and these lead to some flicker which is treated, and “some annoyance with noise.” This study proves that there are other pathways that affect some people, at least 6. The windfarm operator simply cannot say there are no known effects and no known people affected. One person affected is a lot more than none; the existence of just one cause-and-effect pathway is a lot more than none. It only takes one example to prove that a broad assertion is not true, and that is the case here. Windfarms will be in the position where they must say: “We may affect some people.” And regulators charged with protecting the health and welfare of the citizenry will not be able to say they know of no adverse effects. Rather, if they choose to support the windfarm, they will do so knowing that they may not be protecting the health and welfare of all the citizenry.

46. In short Cooper’s work has shown that there is a direct, demonstrable pathway by which IWT probably has an adverse effect on peoples’ health. The mechanism arises in the ILFN range and is not dependent upon audibility. The results confirm what I and many other researchers have claimed about the necessity of measuring ILFN and monitoring exposed people.

47. Nocebo effect

Expert witnesses for wind energy proponents have interpreted the reports of AHE as being a “nocebo effect”. It is revealing to search the literature for commentary on what the origin of the nocebo effect is. To that end the following foundational paper was identified;

Nonspecific medication side effects and the Nocebo phenomenon Arthur J Barsky et al, JAMA, Feb 6, 2002 Vol. 287 No 5 p. 622

Side effects occurring in patients taking active medication may be divided into two types. “Specific side effects” are symptoms or physiological changes that result directly from the specific biological and pharmacological activity of the drug and tend to be dose-dependent and predictable. “Nonspecific side effects” are symptoms or

physiological changes that cannot be explained on the basis of known pharmacology of the drug and are idiosyncratic and not dose-dependent.

and

The term nocebo was originally coined to distinguish noxious or distressing effects of placebo from its beneficial therapeutic effects. In this article it will be used broadly to refer to all distressing symptoms that accompany placebo administration

The deployment of the term “nocebo effect” (NE) by wind energy proponents is inappropriate and misleading, unless they claim IWT are in fact placebos, that is they cause no harm and there is no need for any regulations.

48. The implications of the claim of NE having explanatory power for AHE are worth considering further.

a. NE is a descriptor that arose out of drug trials when test subjects experienced adverse reactions to placebo.

b. It is not a diagnosis commonly employed in mainstream clinical practice. For example in 50 years of clinical practice as a physician and orthopedic surgeon I have neither made the diagnosis nor had it ascribed to one of my patients.

c. The diagnosis cannot be made until other causes are excluded in a systematic fashion.

d. To ascribe NE to a person complaining of adverse health effects (AHE) in the absence of a full history, physical, laboratory, imaging or other relevant investigations does not meet the standard of practice of medicine.

e. The use of NE in relationship to people exposed to industrial wind turbine (IWT) noise while simultaneously negating efforts to conduct research into the causation of the complaints of these AHE is not a defensible standard of practice for medical doctors or other health care professionals.

f. In the absence of definitive third party research into the causation of AHE in the environs of IWT the use of NE to explain the complaints of people exposed to IWT by unlicensed individuals is neither responsible nor defensible.

g. The adverse health reactions experienced by people in the environs of IWT are not idiosyncratic or unpredictable and have been found to be dose-dependent as found in the following 2 studies;

Response to noise from modern wind farms in The Netherlands Pedersen et al J. Acoust. Soc. Am. 2009 Vol.126

no2 <http://umcg.wewi.eldoc.ub.rug.nl/FILES/root/pubs/2009/JAS0006341/JAS0006341.pdf>

Effects of industrial wind turbine noise on sleep and health. Nissenbaum M A, Aramini J J, Hanning C D. Noise and Health, Vol. 14 No. 60. 2012 p.237-2432<http://www.noiseandhealth.org/article.asp?issn=1463->

h. Individuals who satisfy the diagnostic criteria of McMurtry and Krogh predictably worsen with proximity to IWT and improve when removed from the environs. These are not the characteristics of a Nocebo Effect.

Diagnostic criteria for adverse health effects in the environs of wind turbines JRSMOpen October 5, 2014 5(10) <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4221978/>

i. Chronic sleep disruption a common complaint among exposed people is a serious AHE undermining cardiovascular health (Munzel et al) and altering gene expression (Moller-Levet et al). Dismissing the global reports of sleep disruption as “nocebo effect” is not defensible.

Munzel T, Goril T, Babisch W, Basner M, Cardiovascular effects of environmental noise exposure European Heart Journal (2014) 35, 829–836 doi:10.1093/eurheartj/ehu030
Summary The role of noise as an environmental pollutant and its impact on health are being increasingly recognized. Beyond its effects on the auditory system, noise causes annoyance and disturbs sleep, and it impairs cognitive performance. Furthermore, evidence from epidemiologic studies demonstrates that environmental noise is associated with an increased incidence of arterial hypertension, myocardial infarction, and stroke.

Moller-Levet CS; Archer SN; Bucca, G; Laing EE; Slak A; Kabiljo R; Lo JCY.; Santhi N; von Schantz M; Smith CP.; and Derk-Jan D Effects of insufficient sleep on circadian rhythmicity and expression amplitude of the human blood transcriptome Published online before print February 25, 2013, doi:10.1073/pnas.1217154110 PNAS (Proceedings of the National Academy of Sciences) February 25, 2013 201217154 <http://www.pnas.org/content/early/2013/02/20/1217154110> Abstract (Excerpt) Insufficient sleep and circadian rhythm disruption are associated with negative health outcomes, including obesity, cardiovascular disease, and cognitive impairment, but the mechanisms involved remain largely unexplored. ... Biological processes affected

included chromatin modification, gene expression regulation, macromolecular metabolism, and inflammatory, immune and stress responses.

49. Northern Ireland Assembly (NIA) Inquiry into Wind Energy January 29, 2015

While the NIA committee was also supportive of the concept of renewable energy there were a number of recommendations made that echo the position outlined in this witness statement.

50. For example the problem of inadequate regulations was addressed as follows in Recommendation 10;

The issue of wind turbine noise was the most contentious aspect of the inquiry. The wind industry is of the view that the current guidelines (ETSU-97) are adequate for regulating noise limits, but other stakeholders overwhelmingly cited this as their most pressing area of concern. After considering the evidence from its specialist advisor, the Committee agreed that the use of the ETSU-97 guidelines should be reviewed on an **urgent** basis by the Department and that more appropriate guidance should be put in place. (emphasis added)

51. Later in recommendation 28 and 31 the same theme recurred underlying the fact that there are no evidence-based guidelines derived from human health research for set-backs of IWT.

The second term of reference of the inquiry focuses on wind turbine noise and separation distances from dwellings. This has been the most emotive aspect of the inquiry as many submissions detail the adverse impact perceived noise from wind turbines is having on the respondents' day to day lives. From the evidence put before the Committee, it seems apparent that current guidelines in respect of permissible levels of noise are no longer adequate and that the research evidence available has increased significantly since 1997. **The Committee therefore recommends that the Department should review the use of the ETSU-97 guidelines on an urgent basis, with a view to adopting more modern and robust guidance for measurement of wind turbine noise, with particular reference to current guidelines from the World Health Organisation.** [emphasis has not been added in this or subsequent quotes of the NIA committee report]

There are no generally agreed separation distances in other jurisdictions and the lack of prescription has given rise to a great deal of criticism from respondents.

52. The need for independent research was once again emphasized in recommendation 11 of NIA committee;

The Committee has also recommended that the Department should establish procedures for monitoring wind turbine noise on an on-going basis and should work to establish independent research evidence on the long-term impact of this noise.

This recommendation is crucial as the need for post-installation monitoring of noise is identified as essential as is the monitoring of the health of exposed people, something that has been neglected in Ontario. Recommendation 29 states;

The Committee recommends that the [government] Department should bear responsibility for ensuring that arrangements be put in place for on-going long-term monitoring of wind turbine noise.

53. It is clear that the NIA committee has reached the same conclusions as have been suggested in this submission and by this author since 2008.

54. Summary

a. Adverse health effects (AHE) have been reported globally in the environs of Industrial Wind Turbines for more than 30 years with both the older downwind designs and newer upwind designs of industrial wind turbines (IWT).

b. The wind energy proponents (WEP) have denied AHE instead referring to “annoyance” as the effects that some people exposed to IWT report. “Annoyance” however in the context of IWT noise exposure is a non-trivial effect which includes sleep disruption, stress and psychological distress.

c. “Annoyance” is recognized by the World Health Organization as an adverse health effect which is a risk factor for serious chronic disease including cardiovascular disease and cancer.

- d. Experts retained by the WEP have preferred the diagnosis of “nocebo effect” to explain the AHE but the claim does not withstand critical scrutiny as there is a dose-response effect with exposure to IWT and a clear correlation between exposure and AHE.
- e. The regulations surrounding noise exposure are based upon out-of-date standards (ETSU-97) that fail to evaluate infrasound and low frequency noise (ILFN) which research has shown to be the probable source of AHE. The issue of ILFN as a problem has been confirmed by many observers including government consultants in Ontario, Canada.
- f. Setbacks for IWT are highly variable across jurisdictions and have no evidence-base in human health research.
- g. There is an urgent need for human health research to provide evidence-based guidelines for noise exposure generated by IWT.
- h. The call for third party research evaluating human health impacts has been made by many medical researchers and commentators over the long term but has not been supported by WEP.
- i. There is an urgent need to monitor the health effects of people exposed to IWT over time which has been absent across jurisdictions and generally resisted by WEP.
- j. An analysis by third party evaluators of the economic and social benefit of wind energy is needed as suggested by the findings of the Auditor General of Ontario, Canada and the Northern Ireland Assembly committee.
- k. There is a need to heed the observations and advice of the WHO:

"Noise is an underestimated threat that can cause many short-term and long-term health problems. Among these problems are: sleep disturbance; cardiovascular effects; poorer work or school performance; hearing impairment including tinnitus; aberrations in social behaviour such as aggressiveness and passivity; pain and hearing fatigue; speech problems; and hormonal responses (stress hormones) and their consequences on human metabolism, and immune system problems." [WHO/Europe: Noise 2011; see also the WHO NNG Europe.]

and

“Ensure that economic and social policy responses to climate change and other environmental degradation take into account health equity” WHO 2008, Closing the Gap in a Generation p.4. [http://www.who.int/social_determinants/thecommission/finalreport/en/]

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