

**Standing Senate Committee on
Energy, the Environment and Natural
Resources**

**Industrial Wind Turbines
and
Health**

Wind Turbines Can Harm Humans

October 18, 2011

**The Society for Wind Vigilance
www.windvigilance.com**

20 Minutes

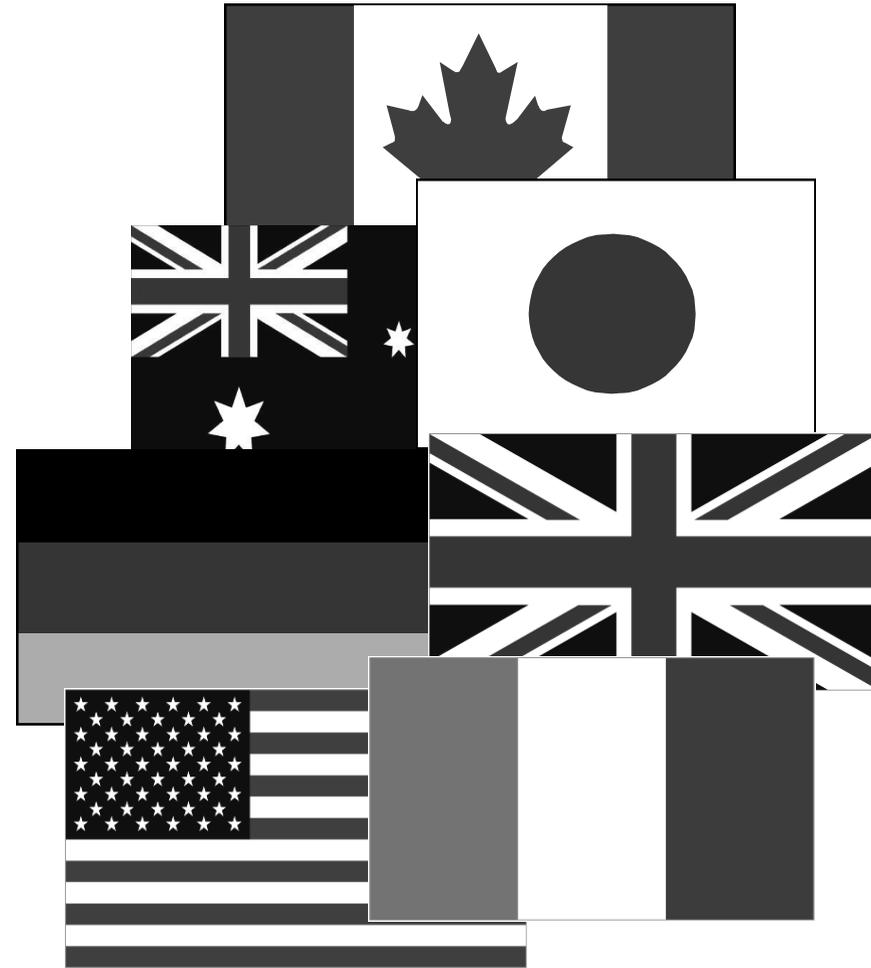
n Setting the stage

n Evidence

n Consequences

n Wrap-up

n *Emphasis sometimes added to original quotes highlighting key points.*



Introductions

n Ms Carmen Krogh

n Ms Beth Harrington

The Society for Wind Vigilance

- n International federation of physicians, acousticians, psychoacousticians, engineers and other professionals
- n Volunteers / self funded
- n Goal – siting of wind turbines to protect health and safety

Setting the stage

Peer reviewed July 20, 2011



n “It is acknowledged that IWTs, if not sited properly, can adversely affect the health of exposed individuals.”

n Krogh CME, Industrial Wind Turbine Development and Loss of Social Justice? August 2011, BSTS <http://bst.sagepub.com/>

Environmental Review Tribunal July 18, 2011

Kent Breeze / Chatham Kent project



Environmental Review
Tribunal

Case Nos.: 10-121/10-122

Erickson v. Director,
Ministry of the Environment

n “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. The debate has now evolved to one of degree.”

n Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment
Environmental Review Tribunal, Decision, p 207

What do we know?

Competing claims



ADDRESSING CONCERNS WITH WIND TURBINES AND HUMAN HEALTH

Revised: April 2009

These findings clearly show that there is no peer-reviewed scientific evidence indicating that wind turbines have an adverse impact on human health.



Safe Environments Program
Regions and Programs Branch, Health Canada
1505 Barrington Street, Suite 1817
Halifax, NS B3J 3Y6

August 6, 2009

ATL-2008/09-006 / OF6-3-107

- Health Canada advises that this statement be revised to indicate that there are peer-reviewed scientific articles indicating that wind turbines may have an adverse impact on human health.

Freedom of Information

Ontario MOE field officers 2010

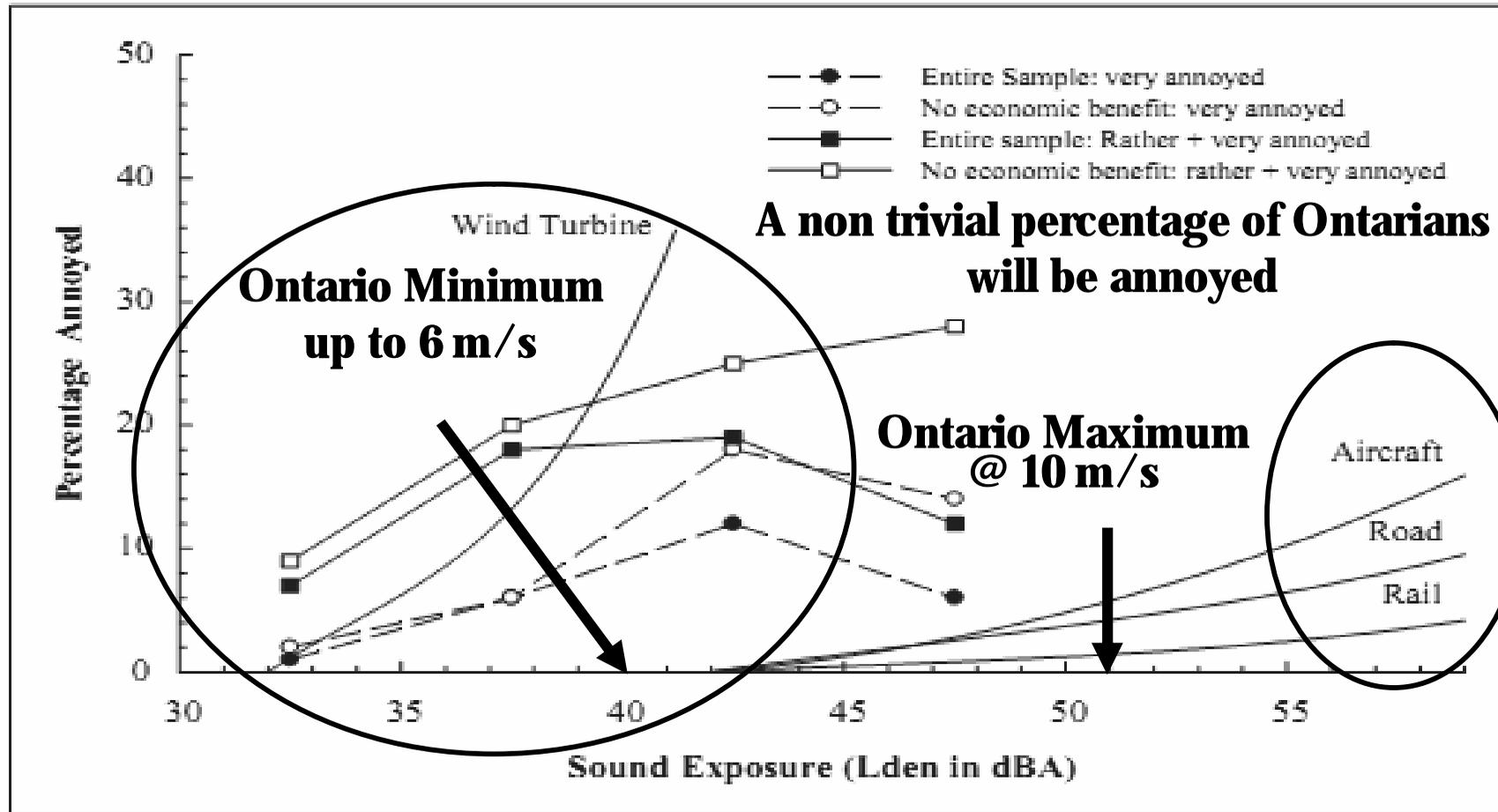
n “It appears compliance with the minimum setbacks and the noise study approach currently being used to approve the siting of WTGs **will result or likely result in adverse effects...**”

n MOE memorandum, Ontario Senior Environmental Officer, April 9, 2010

WHO 40 dBA guideline - not for wind turbines

- n WHO guidelines based on noise research related to
 - n Road
 - n Rail
 - n Aircraft
- n Not based on wind turbine noise
 - n Daniel Shepherd and Rex Billington, Mitigating the Acoustic Impacts of Modern Technologies: Acoustic, Health, and Psychosocial Factors Informing Wind Farm Placement, published online 22 August 2011 Bulletin of Science Technology & Society, DOI: 10.1177/0270467611417841
 - n Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment, Transcript of Dr. G. Rachamin, Mar, 4, 2011, p. 212, l. 2 to l. 16

Peer reviewed studies: turbines more annoying



An opinion on the likely health impacts of wind turbine noise in relation to the proposed Chatham-Kent wind farm installation. Author: Daniel Shepherd, PhD, 17 January 2011

32 dBA supported - peer reviewed 2011



In my opinion, based on my training, experience, measurements, and observations, serious harm to health occurs when a susceptible individual is so beset by the noise in question that he or she suffers recurring sleep disturbance, anxiety, and stress. The markers for this are (a) a sound level of LAeq **32dB** outside the residence and (b) above the individual's threshold of hearing inside the home.

ⁿ Thorne, B. (2011). The problems with noise numbers for wind farm noise assessment. Bulletin of Science, Technology & Society, 31, 262-290.



Freedom of Information

Ontario MOE field officers 2010

n “... the setback distances should be calculated using a sound level limit of **30 to 32 dBA** at the receptor, instead of the 40 dBA sound level limit.”

n MOE memorandum, Ontario Senior Environmental Officer, April 9, 2010

AWEA-CanWEA Panel Review 2009

Wind Turbine Sound and Health Effects An Expert Panel Review

Prepared by (in alphabetical order):

W. David Colby, M.D.
Robert Dobie, M.D.
Geoff Leventhall, Ph.D.
David M. Lipscomb, Ph.D.
Robert J. McCunney, M.D.
Michael T. Seilo, Ph.D.
Bo Søndergaard, M.Sc.

Prepared for:
American Wind Energy Association
and
Canadian Wind Energy Association
December 2009

- n Wind turbine sound/noise may cause
 - n Annoyance [p. 5-3]
 - n Sleep disturbance [p. 4-3]
 - n Stress (sleep disturbance, headache, tinnitus, ear pressure, vertigo, nausea, visual blurring, tachycardia, irritability, concentration, memory, panic attacks, internal pulsation, and quivering = well-known stress effects of exposure to noise) [p. 4-3, 4-9, 4-10]
 - n Colby, W. D., Dobie, R., Leventhall, G., Lipscomb, D. M., McCunney, R. J., Seilo, M. T., & Søndergaard, B. (2009). Wind turbine sound and health effects: An expert panel review 2009. Prepared for American Wind Energy Association and Canadian Wind Energy Association. Retrieved from http://www.canwea.ca/pdf/talkwind/Wind_Turbine_Sound_and_Health_Effects.pdf

CanWEA President 2010

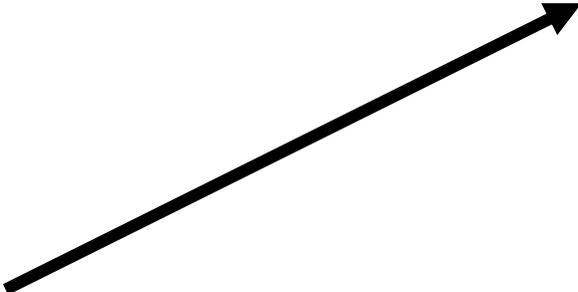
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Bo Søndergaard, M.Sc.

Prepared for:
American Wind Energy Association
and
Canadian Wind Energy Association

December 2009



n “The study does acknowledge that wind turbines can be annoying, the sound of wind turbines can be annoying for some individuals and that may cause them to feel some stress etcetera,…”

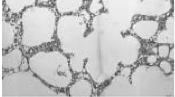
n Hornung, R. (2010, March 4). Interview on Business News Network (Video). Retrieved from <http://watch.bnn.ca/clip272347>

Wind Turbine Noise Conference 2011

n “The main effect of daytime wind turbine noise is **annoyance**. The night time effect is **sleep disturbance**. These may lead to **stress** related illness in some people.”

n Fourth International Meeting on Wind Turbine Noise, Rome Italy 12-14 April 2011
Wind Turbine Noise 2011 – Post conference report

Noise Annoyance

- n 1.   COMMUNITY NOISE ANNOYANCE The most common effect of community noise is annoyance, which is considered an adverse health effect by the World Health Organization. But noise may also
- n 2. “... noise-induced **annoyance is an adverse health effect.**”
- n 3. “...chronic severe **annoyance** induced by neighbour noise must be classified as a serious health risk for adults.”
- n 4. “... **annoyance** can connote more than a slight irritation; it can mean a significant degradation in the quality of life. This represents a degradation of health in accordance with the WHO’s definition of health ...”
- n 5. “...reputable research has shown that noise **annoyance is an adverse health effect** that can result from wind farms, as it can result in effects such as negative emotions and sleep disturbance.”

References for slide on annoyance

- n 1. Health Canada. (2005). Community noise annoyance. Retrieved from <http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/life-vie/community-urbain-eng.php#he>
- n 2. Michaud, D. S., Keith, S. E., & McMurchy, D. (2005). Noise annoyance in Canada. *Noise Health*, 7, 39-47
- n 3. Maschke, C., & Niemann, A. (2007). Health effects of annoyance induced by neighbour noise. *Noise Control Engineering Journal*, 55, 348-356.
- n 4. Suter, A. H. (1991). Noise and its effects. Administrative Conference of the United States. Retrieved from <http://www.nonoise.org/library/suter/suter.htm>
- n 5. General Purpose Standing Committee No. 5 Rural wind farms Ordered to be printed 16 December 2009 according to Standing Order 231, Australia

Ontario Environmental Review Tribunal witness confirmed

n Some people **will be** annoyed or highly annoyed at the presence of sound from wind turbines.

n Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment -Transcript of Dr. G. Leventhall, Mar, 11, 2011, Witness for Suncor Energy

Final Draft MOE (Ontario) report - December 2010



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LOW FREQUENCY NOISE AND INFRASOUND ASSOCIATED WITH WIND TURBINE GENERATOR SYSTEMS A LITERATURE REVIEW

Ontario Ministry of the Environment RFP No. OSS-078696

FINAL DRAFT

Ontario Ministry of the Environment
2 St. Clair Avenue West, Floor 12
Toronto, ON M4V 1L5

SUBMITTED BY:
Howe Gastmeier Chapnik Limited
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2000 Argenta Road, Plaza 1, Suite 203
Mississauga, ON L5N 1P7

Brian Howe, MEng, MBA, PEng
Principal

December 10, 2010

**Prepared for
and submitted
as evidence by
Ministry of the
Environment ***

* MOE Disclosure Document # 34 - Erickson v.
Director, Ministry of the Environment (10-121 and 10-
122)

Final Draft MOE (Ontario) report - December 2010

n “The audible sound from wind turbines, at the levels experienced at typical receptor distances in Ontario, is nonetheless **expected to result in a non-trivial percentage of persons being highly annoyed.** As with sounds from many sources, research has shown that annoyance associated with **sound from wind turbines can be expected to contribute to stress related health impacts in some persons.**”

n Low frequency Noise and Infrasound Associated with Wind Turbine Generation Systems, A Literature Review, Ontario Ministry of Environment RFP Final Draft December 2010

What are the symptoms?

Stress – Ontario Environmental Review Tribunal witness *

- n Pierpont defined the symptoms of the Wind Turbine Syndrome as: “...sleep disturbance, headache, tinnitus, ear pressure, dizziness, vertigo, nausea, visual blurring, tachycardia, irritability, problems with concentration and memory, and panic attack episodes associated with sensations of internal pulsation or quivering when awake or asleep.” **
- n I am happy to accept these symptoms, as they have been known to me for many years as the symptoms of extreme psychological **stress** from environmental noise, particularly low frequency noise. **

- n Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment Transcript of Dr. G. Leventhall, Mar, 11, 2011, *
- n Leventhall, H.G., (2009). Wind Turbine Syndrome - An appraisal. Testimony before the Public Service Commission of Wisconsin, PSC Ref#121877 20 October 2009, Submitted as Suncor ERT Exhibit 55, Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment **

WindVOiCe self reporting vigilance monitoring



- n Follows principles Health Canada's *Canada Vigilance Programs* *
- n Consumers encouraged to self report adverse reactions (prescription / consumer products / vaccines / other)
- n Continues for the life of the product
 - n Krogh, CME, et al (2011), WindVOiCe, a Self-Reporting Survey: Adverse Health Effects, Industrial Wind Turbines, and the Need for Vigilance Monitoring, *Bulletin of Science Technology & Society* 2011 31: 334, DOI: 10.1177/0270467611412551, <http://bst.sagepub.com/content/31/4/334>
 - n Health Canada *Canada Vigilance Programs* www.healthcanada.ca *

Peer Reviewed 2011



WindVOiCe sleep disturbance by distance

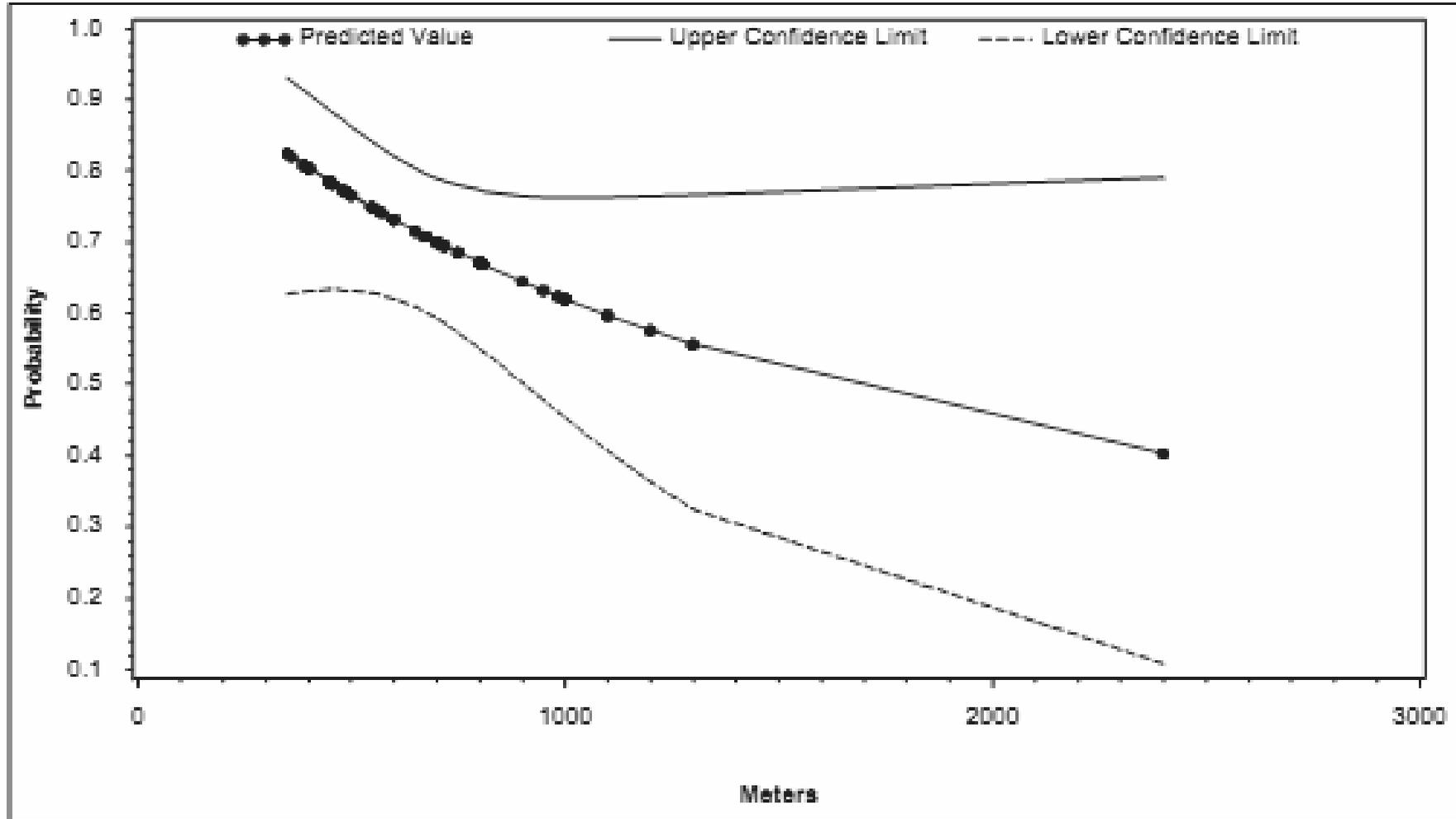


Figure 7. Predicted probability of sleep disturbance by distance to industrial wind turbine (95% upper and lower confidence limits) Proc Genmod (logit link; binomial distribution). Sleep = ln(distance) + sex + intercept. $p(\ln \text{ distance}) = .1015$.

Peer Reviewed 2011

WindVOiCe headaches by distance

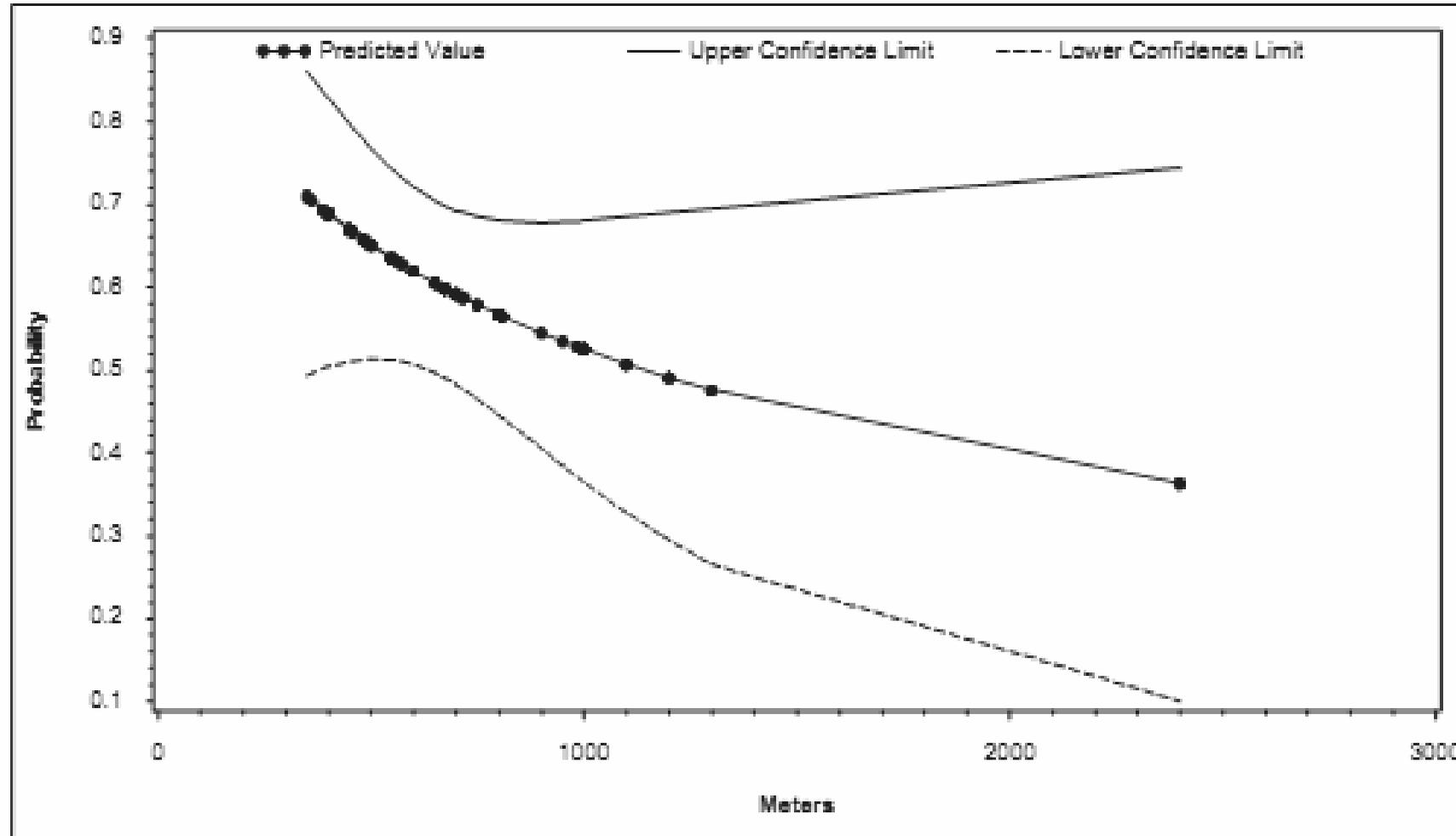


Figure 9. Predicted probability of headaches by distance to industrial wind turbine (95% upper and lower confidence limits)
Proc Genmod (logit link; binomial distribution). Headaches = $\ln(\text{distance}) + \text{sex} + \text{intercept}$. $p(\ln \text{ distance}) = .1837$.

What are the plausible causes?

Plausible causes of health effects

- n Amplitude modulation [1, 2, 3]
- n Lack of night time abatement [1]
- n Audible low frequency noise [4]
- n Inaudible low frequency noise/infrasound [5, 6]
- n Tonal noise [7]
- n Stray voltage [8]
- n Visual impacts [4, 9]
 - n shadow flicker
 - n flashing lights

References for plausible causes

- n 1. Pedersen, E., Bakker, R., Bouma, J., & van den Berg, F. (2009). Response to noise from modern wind farms in the Netherlands. *Journal of the Acoustical Society of America*, 126, 634-643
- n 2. Colby, W. D., Dobie, R., Leventhall, G., Lipscomb, D. M., McCunney, R. J., Seilo, M. T., & Søndergaard, B. (2009). Wind turbine sound and health effects: An expert panel review 2009. Prepared for American Wind Energy Association and Canadian Wind Energy Association. Retrieved from http://www.canwea.ca/pdf/talkwind/Wind_Turbine_Sound_and_Health_Effects.pdf
- n 3. Leventhall, G. (2006). Infrasound from wind turbines: Fact, fiction or deception. *Canadian Acoustics*, 34, 29-36.
- n 4. Minnesota Department of Health. (2009). Public health impacts of wind turbines. Retrieved from <http://www.health.state.mn.us/divs/eh/hazardous/topics/windturbines.pdf> Audible / inaudible low frequency noise
- n 5. Salt, A. N., & Hullar, T. E. (2010). Responses of the ear to low frequency sounds, infrasound and wind turbines. *Hearing Research*, 268, 12-21. doi:10.1016/j.heares.2010.06.007
- n 6. Salt, AN, and Kaltenbach, JA, (2011) Infrasound From Wind Turbines Could Affect Humans, *Bulletin of Science Technology & Society* 2011 31: 296, DOI: 10.1177/0270467611412555
- n 7. Howe Gastmeier Chapnik Limited. (2010, December). Low frequency noise and infrasound associated with wind turbine generator systems: A literature review (Final draft, Rfp No. Oss-078696). Mississauga, Ontario, Canada: Ministry of the Environment.
- n 8. Magda Havas and David Colling, Wind Turbines Make Waves: Why Some Residents Near Wind Turbines Become Ill, DOI: 10.1177/0270467611417852 published online 30 September 2011 *Bulletin of Science Technology & Society*
- n 9. National Research Council. (2007). Committee on environmental impacts of wind-energy projects. *Environmental impacts of wind energy projects*. Washington, DC: National Academies Press.

What are authorities saying?

Economic and social - property values

n “We will see in the course of this hearing that lots of people are worried about windmills. They may not like the noise, they may think the noise makes them sick, but really **what makes them sick is just the windmills being on the land because it does impact their property values.** That’s what makes them sick is that, you know, they’ll get less money for their properties, and that’s what’s causing all this **annoyance** and frustration and all of that.”

n Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment, Transcript of Frederika M. Rotter, Counsel for the Director, Ministry of the Environment, February 1, 2011, Volume 1, p. 91, l. 24)

Ontario Minister of Health Matthews December 2010

n “There is no evidence, whatsoever, that there is an issue related to turbines”

n Heath, C. (2010, December), Health minister visits Clinton FHT. *Clinton News Record*

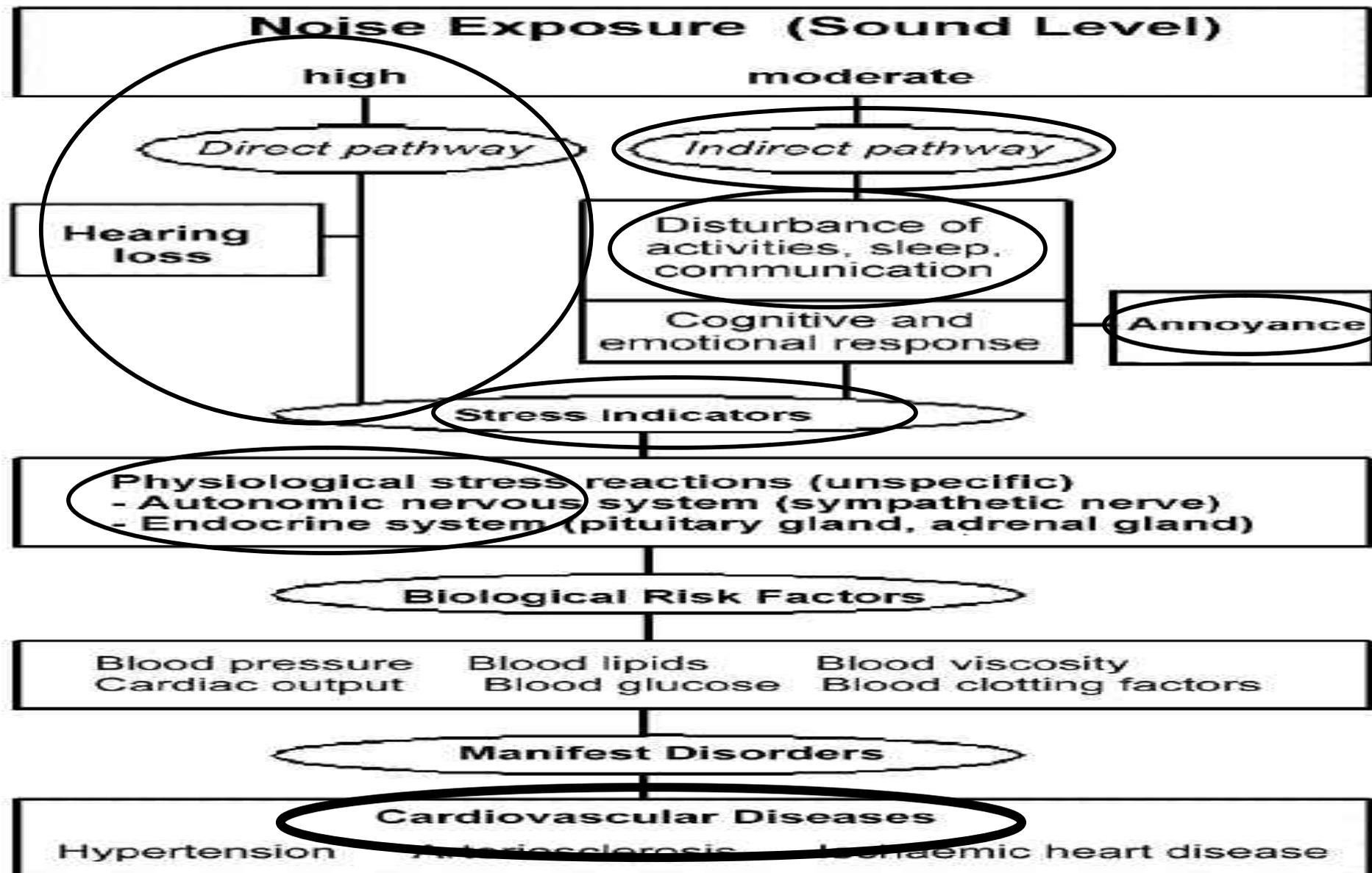
[http://www.clintonnewsrecord.com/ArticleDisplay.aspx?
e=2891265](http://www.clintonnewsrecord.com/ArticleDisplay.aspx?e=2891265)

Ontario Chief Medical Officer of Health May 2010

n “While some people living near wind turbines report symptoms such as dizziness, headaches, and sleep disturbance, the scientific evidence available to date does not demonstrate a **direct** causal link between wind turbine noise and adverse health effects.”

n Chief Medical Officer of Health. The potential health impact of wind turbines.
http://www.health.gov.on.ca/en/public/publications/ministry_reports/wind_turbine/wind_turbine.pdf

WHO - peer reviewed 2009

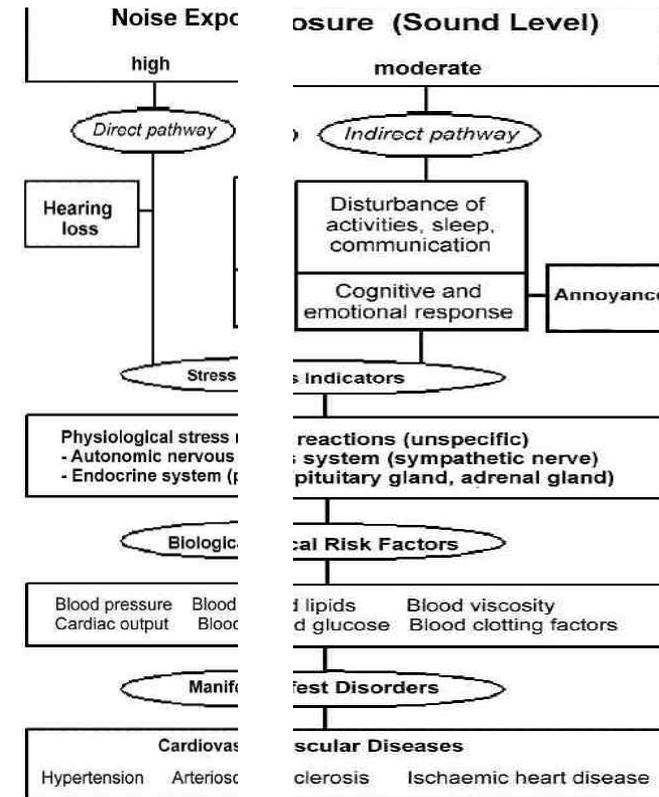


Ontario Chief Medical Officer Health author *

The Potential Health Impact of Wind Turbines

CMOH report only
looked at direct links *

CMOH author
agrees with schema *



n Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment Transcript of Dr. G. Rachamin, Mar, 4, 2011 p. 211, p 216 *

Ontario Environmental Review Tribunal Decision



Environmental Review
Tribunal

Case Nos.: 10-121/10-122

Erickson v. Director,
Ministry of the Environment

- n Tribunal expressed concerns :
- n “...about the Director’s apparent lack of consideration of indirect health effects and the need for further work on the MOE’s practice of precaution...”
- n Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment Environmental Review Tribunal, Decision, p 206

Correspondence from Federal Officials 2009

- n ‘...conclusively demonstrated from exposure to wind turbine noise is an increase in self-reported annoyance and complaints (i.e., headaches, nausea, tinnitus, vertigo).’ *

- n ‘...the need for additional epidemiological investigations and evidence has been identified.’ **
 - n July 30, 2009 Minister of Labour regarding Health Canada’s examination of scientific literature *
 - n Aug 5, 2009 Letter David Butler-Jones, MD, MHSc, CCFP, FRCPC, FACPM Chief Public Health Officer, Public Health Agency of Canada **

Chief Executive Officer of National Health and Medical Research Council 2011

n “We certainly do not believe that this question has been settled. That is why we are keeping it under constant review. That is why we said in our review that we believe authorities must take a precautionary approach to this.”

n Chief Executive Officer of National Health and Medical Research Council, The social and economic impact of rural wind farms: Public hearing before the Senate Community Affairs References Committee, Commonwealth of Australia (2011, May 17). Retrieved from http://www.aph.gov.au/senate/committee/clac_ctte/impact_rural_wind_farms/index.htm³⁹

Health Canada – Minister of Health September 2011

n “At this time there is insufficient scientific evidence demonstrating a link between exposure to wind turbine noise and harm to human health which would justify the Department invoking the precautionary principle.”

n Correspondence Sept 27, 2011 Minister of Health, Leona Aglukkaq

WHO on precaution

n “In all cases, noise should be reduced to the lowest level achievable in a particular situation. Where there is a reasonable possibility that public health will be damaged, **action should be taken to protect public health without awaiting full scientific proof.**”

n World Health Organization. (1999). Guidelines for community noise. Geneva; OMS,1999, 94 p. Ilus, Authors: Berglund, B., Lindvall, T., Schwela, D. H.



Developments down under



- n Peer reviewed articles recommend 2 km minimum setback (without consent) [1, 2]

- n Proposed 2 km minimum setbacks (without consent) [3, 4]
 - n 1. Thorne, B. (2011). The problems with noise numbers for wind farm noise assessment. *Bulletin of Science, Technology & Society*, 31, 262-290.
 - n 2. Evaluating the impact of wind turbine noise on health-related quality of life by Daniel Shepherd, David McBride, David Welch, Kim N. Dirks, Erin M. Hill. *Noise & Health*, September-October 2011, 13:54,333-9
 - n 3. Advisory Note 36, August 2011-10-04Amendment VC82 Changes to wind energy facility provisions State Government Victoria Planning Provisions, Australia
 - n 4. General Purpose Standing Committee No. 5 INQUIRY INTO RURAL WIND FARMS Media release Wednesday 16 December 2009, Australia

Australia - Senate Committee – 2011



The Senate

Community Affairs
References Committee

The Social and Economic Impact of Rural Wind Farms

June 2011

n “The Committee recommends that the Commonwealth Government initiate as a matter of priority thorough, **adequately resourced epidemiological and laboratory studies** of the possible effects of wind farms on human health.”

n The Social and Economic Impact of Rural Wind Farms, June 23 2011
[http://www.aph.gov.au/senate/committee/clac ctte/impact rural wind farms/submissions.htm](http://www.aph.gov.au/senate/committee/clac_ctte/impact_rural_wind_farms/submissions.htm)

What are the consequences?

Health impacts Ontario

peer reviewed 2011



- n “My research demonstrates that **IWTs were initially welcomed** into communities. The reported adverse impacts were unexpected..”

- n “In addition to physiological and psychological symptoms there are individuals reporting adverse impacts, including **reduced well-being, degraded living conditions, and adverse societal and economic impacts**. These adverse impacts culminate in expressions of a loss of fairness and social justice.”

n Krogh CME, Industrial Wind Turbine Development and Loss of Social Justice? August 2011, BSTS <http://bst.sagepub.com/>

Health impacts New Zealand

- peer reviewed 2011



- n “... wind turbines were **initially welcomed** by many communities due to their environmental credentials...”

- n “... residents living within 2 km of a turbine installation reporting **lower overall quality of life, physical quality of life, and environmental quality of life**. Those exposed to turbine noise also reported significantly lower sleep quality ...”
 - n Evaluating the impact of wind turbine noise on health-related quality of life by Daniel Shepherd, David McBride, David Welch, Kim N. Dirks, Erin M. Hill. *Noise & Health*, September-October 2011, 13:54,333-9

La Gaspésie, Quebec



Courtesy of Eco Awareness Society, Nova Scotia



**TERRE
CITOYENNE**

Certification

2011-03-11

We, the undersigned, Dr. Linda Bernier, Dr. Céline Cotte, Dr. Louis Auger, hereby certify that a petition was signed by 52 physicians in Québec, entitled:

Petition for health: Industrial wind turbines in inhabited areas.

Given the risks and potential negative effects of industrial wind turbines on the health of human beings living near these installations, we the undersigned have signed the above petition in order to request that the Government of Québec put a halt to any and all projects being planned or under way, in inhabited areas, until such time as the research is sufficiently advanced to enable our health authorities to determine beyond doubt what is the safe offset distance that must separate such a wind turbine from a residence.

Wolf Island, Ontario



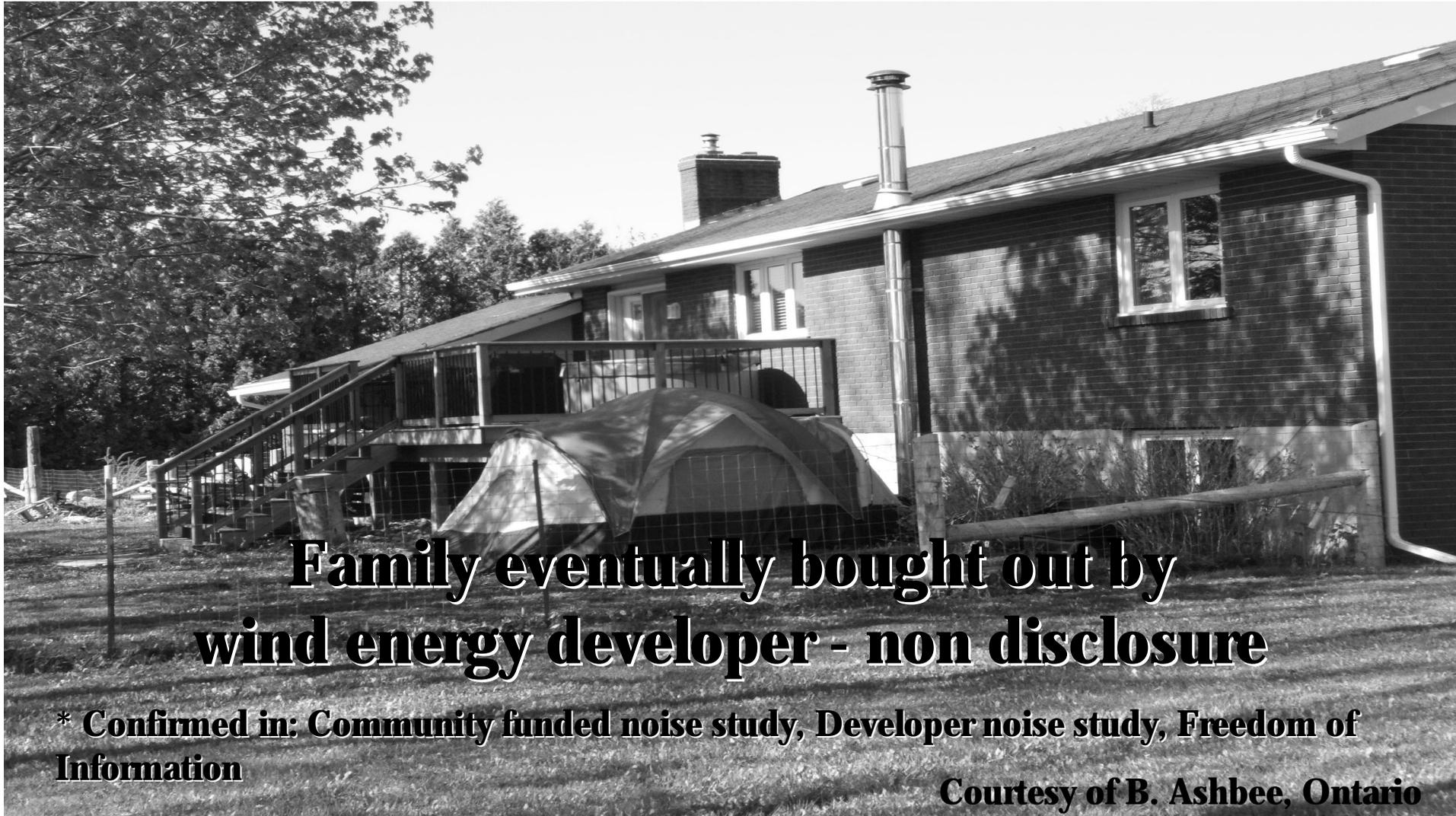
Courtesy of L. Gillis, Ontario

Low frequency noise induced annoyance

n “Those exposed may adopt protective strategies, such as sleeping in their garage if the noise is less disturbing there. Or they may sleep elsewhere, returning to their own homes only during the day.”

n Leventhall HG. Low frequency noise and annoyance. Noise Health [serial online] 2004 [cited 2009 Dec 31];6:59-72. Available from: <http://www.noiseandhealth.org/text.asp?2004/6/23/59/31663>

Escaping wind turbine LFN * – 5 shut down at night



**Family eventually bought out by
wind energy developer - non disclosure**

*** Confirmed in: Community funded noise study, Developer noise study, Freedom of
Information**

Courtesy of B. Ashbee, Ontario

Impact statement – now bought out

n “I am a teacher, we are driven from our home of 31 years and I have to teach the social marketing about wind turbines to our youth”

n Personal interview September / October 2010



Impact statement - abandoned home

n “I am forced to sit back and say nothing as my own teachers teaches my classmates and peers that wind energy is flawless...I am forced to live away from home with my grandmother.

...I can never go home.”

n Personal communication September / October 2010



Ripley delegation part 1

n “Sleep deprivation; sleep disturbances; poor-quality sleep; humming in the head by the ears; edginess; a feeling as if you’ve had five cups of coffee; bad temper; heart palpitations; heaviness in the chest; pains in the chest like needles; increased blood pressure, 217 over 124; uncontrollable ringing in the ears; earaches; sore eyes, like you have sand in them; digestive problems which continued for months; headaches which caused you to be bedridden; the sensation of your skin crawling or being bitten by bugs; sore joints; nosebleeds; sores on feet that would not heal until you moved out of your home”

n Hansard. (2009, April 15). Legislative assembly, first session, 39th parliament première session, official report. Standing Committee on Green Energy and Green Economy Act. p. G-547)

Ripley delegation part 2

n “We begged for sleep, and four families were billeted by the wind company from their homes for 90 to 180 days in motels, hotels and a rooming house.”

n Note: Five families were eventually bought out by the developer 2011

n Hansard. (2009, April 15). Legislative assembly, first session, 39th parliament première session, official report. Standing Committee on Green Energy and Green Economy Act. p. G-547)



Courtesy of the Ripley families

Wrap up

WHO - definition of health

- n “Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” *

- n Canadian federal, provincial, and territorial governments and health officials have accepted WHO’s definition of health **
 - n World Health Organization. (1948). Preamble to the constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946 *
 - n Health Canada, 2004, *Canadian handbook on health impact assessment: Vol.1. The basics*. A report of the Federal/Provincial/ Territorial Committee on Environmental and Occupational Health.
<http://www.who.int/hia/tools/toolkit/whohia063/en/index.html> **

Conclusion

- n Before proceeding further:
 - n Conduct clinical / laboratory studies for siting
 - n Conduct research on environment / endangered species
 - n Establish vigilance monitoring and long term surveillance
 - n Provide resolution / restitution for existing sites

For more information
www.windvigilance.com

Peer reviewed references:
Overview of abstracts and citations
provided in an attachment