

Health Impacts of Industrial Wind Turbines

Williamsville, State of New York

Submission by: Carmen Krogh

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*In 1999, the World Health Organization (WHO) defined noise as “unwanted sound”.
While sound meters can measure sound, unwanted sound is perceived by humans as noise.*

Dear Senator Rob Ortt,

Thank you for the opportunity to share information related to adverse health effects associated with living in close proximity to industrial wind energy facilities (IWTS).

This submission is public and may be shared.

As background, I am a retired pharmacist, a full time volunteer and have been researching this topic since October 2008.

For your interest I am providing a summary of the peer reviewed and published papers in scientific journals and the papers presented during noise and other conferences for which I am an author/co-author. Also included are a brief summary of other activities such as invited talks at Canadian legislative and Senate hearings, universities and other venues. See attached.

Krogh: Brief Bio

Carmen M Krogh is a full time volunteer and published researcher regarding health effects and industrial wind energy facilities and shares information with communities; individuals; federal, provincial and public health authorities, wind energy developers; the industry; and others. An author and a co-author of peer reviewed articles and conference papers presented at wind turbine and other conferences. Ms Krogh has acted as a peer reviewer for a scientific journal. A retired pharmacist whose career includes: senior executive positions at a teaching hospital (Director of Pharmacy); a drug information researcher at another teaching hospital; a Director of a professional organization; a Consultant at the Bureau of Human Prescription Drugs (Health Canada); and Director (A) at Health Canada (Pest Management Regulatory Agency). The former Director of Publications and Editor in Chief of the *Compendium of Pharmaceuticals and Specialties (CPS)*, the book used by physicians, nurses, and health professionals for prescribing information in Canada. The US *Physicians Desk Reference (PDR)* is a publication similar to the Canadian *CPS*.

1. Introduction

While the topic of adverse health effects associated with living near industrial wind turbines (IWTs) is debated internationally, research indicates neighbors from around the world living in the vicinity of wind facilities are reporting harm to human health. A Decision (2010) of an Ontario Environmental Review Tribunal stated that “wind turbines can cause harm to humans.” The Tribunal heard testimony under oath from 26 expert witnesses, some of whom were from the international community.

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.¹

Government records provided through requests under Ontario’s Freedom of Information legislation revealed that between 2006 to the end of 2016, families submitted 4,562 IWT noise Incident Reports. In 35% of the cases, government staff included reports of adverse health effects from IWT noise. A published review indicates that “Despite unresolved knowledge gaps and official records of complaints, WT projects continue to operate and others continue to be proposed near family homes”.²

Based on the number of complaints it appears this would support the “degree” has reached its threshold for action and applying a precautionary approach.

Conducting human health IWT research is challenging. In 2013, Health Canada conducted a large scale \$2.1 million Wind Turbine Noise and Health study. While the Health Canada study results have been used to support IWT development in other jurisdictions,^{3,4} Health Canada has provided advisories regarding the application of its findings. These cautions should be shared with decision-making authorities and consideration given to evidence which indicates taking a precautionary approach before approving additional IWT projects.

For example, Health Canada cautioned that regarding the study design:

- results will not provide a definitive answer on their own⁵

And that:

- results may not be generalized to areas beyond the sample as the wind turbine locations in this study were not randomly selected from all possible sites operating in Canada
- this design does not permit any conclusions to be made with respect to causality
- results should be considered in the context of all published peer-reviewed literature on the subject⁶

A published peer reviewed paper considers the complexity of this topic and explores the various research challenges, limitations and uncertainties of some of Health Canada's findings.⁷

2. Definition of Health

The World Health Organization states:

All countries which are Members of the United Nations may become members of WHO by accepting its Constitution.

The Constitution of the World Health Organization (WHO) defines health:

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.⁸

The commonly reported symptoms associated with living near IWTs include adverse effects related to physical, mental and social well-being.

3. Commonly reported symptoms

It is compelling that based on global contacts with those living in proximity to IWTs, the reported symptoms are consistent. Examples of commonly reported physical and mental symptoms include sleep disruption/disturbance; cardiac effects such as palpitations and arrhythmia, high blood pressure, tightness in the chest; headache and migraine, and head pressure; tinnitus, ear pressure and pain; nausea, vomiting, vertigo and dizziness; effects on vision and women's menstrual cycle; cognitive dysfunction, memory loss, confusion and dis-orientation; vibratory sensations of the body; discomfort of bowel and stomach; and psychological distress related to mood disorders, stress, depression and anxiety. Effects on social well-being are also comparable and include negative outcomes on family and community relationships; sentiments of losses related to trust, betrayal, hopelessness, and lack of confidence in government processes and systems families expected would protect them.

In some cases, the adverse health effects have led to some families vacating/abandoning their homes.^{9, 10, 11}

Research indicates that occupational exposure of technicians and consultants working in the wind energy industry are also reporting similar adverse effects.^{12, 13, 14, 15, 16, 17}

Typically, workers are protected from exposures such as noise, vibration and other emissions through occupational legislation. Families who are exposed for long periods of time in their home – potentially up to 24/7 to similar conditions do not have the benefit of these regulations.

4. Plausible causes

Research indicates plausible causes include effects of both inaudible and audible noise including noise annoyance,^{18, 19, 20, 21} and electrical fields²² such as radiofrequency/electromagnetic energy (RF/EMF).^{23, 24, 25} Inaudible noise includes low frequency noise (LFN) which is typically less than 200 Hz with infrasound less than 20 Hz.²⁶

LFN from an IWT was investigated by Kelley in 1982.²⁷ Regarding IWT-related LFN and infrasound, author James explored the historical evidence about what was known during the 1970s to 1990s. Research indicated that IWT noise was “more likely to be an indoor problem than an outdoor problem” and concluded there was

sufficient research and history to link the sensitivity of some people to inaudible amplitude-modulated infra and low-frequency noise to the type of symptoms described by those living near industrial wind turbines.²⁸

Concerns about LFN and infrasound have been expressed by an IWT manufacturer. The Minister of Environment (Denmark) was advised in communiqué that as a result of new proposed LFN regulations there was “fear” of “irreparable damage” to their industry. Additional concerns indicated that when combined with other markets copying the new regulations, effects could be “extremely damaging to the prospects of further popularization of land-based wind energy”. The communiqué concluded that the proposed LFN “limit values” could affect the firm’s business within Denmark and globally.²⁹

A cooperative measurement survey conducted in 2012 at a wind energy facility stated in its report:

The four investigating firms are of the opinion that enough evidence and hypotheses have been given herein to classify LFN and infrasound as a serious issue, possibly affecting the future of the industry³⁰

Following the measurement survey, in 2014 the Brown County Board of Health unanimously approved a motion which declared the IWTs at Shirley Wind project to be “a Human Health Hazard” for “(residents, workers, visitors, and sensitive passersby) who are exposed to infrasound/Low Frequency Noise and other emissions potentially harmful to human health.”³¹

One LFN researcher stated IWTs are becoming “bigger, more powerful resulting in the relative amount of low frequency noise being higher for the larger (2.3–3.6 MW) than the smaller turbines (less than 2 MW) and the difference is statistically significant”.³² As a result, it is suggested neighbors are likely to be at higher risk from LFN effects.

Noise annoyance has been acknowledged as an adverse health effect. For example, the Canadian Wind Energy Association and American Wind Energy Association stated in a

report by an Expert Panel that the symptoms identified by Dr. N. Pierpont as Wind Turbine Syndrome³³ are not new and have been published previously in the context of “annoyance” and are the “well known stress effects of exposure to noise”.³⁴

There are many studies relating to the effects of noise annoyance in general. Health Canada states “The most common effect of community noise is annoyance, which is considered an adverse health effect by the World Health Organization.”³⁵ Other references acknowledge “annoyance” as an adverse health effect.^{36,37} A study “confirmed, on an epidemiological level, an increased health risk from chronic noise annoyance”.³⁸ Another study stated the result “confirms the thesis that for chronically strong annoyance a causal chain exists between the three steps: health – strong annoyance – increased morbidity.”³⁹

Regarding exposure to EMF, Dr. R. Bray, a physician and specialist in environmental health noted that the combination of symptoms “has been described by Pierpont as ‘wind turbines syndrome’ and elsewhere as vibroacoustic disease”, Dr Bray advised:

A significant impact on human health from IWTs can also result from electromagnetic pollution” and that “ground current or stray voltage in areas extending kilometers beyond individual IWT sites can contribute to electromagnetic injury and sensitivity to electromagnetic emissions.”⁴⁰

A review considers the risk factors associated with RF/EMF and IWTs. It indicates that “physicians and health practitioners will likely be presented with increasing numbers of patients with multi-system complaints which may be diagnostically challenging.”⁴¹

5. Diagnostic methods for physicians

There are several diagnostic tools available which assist physicians to diagnose patients who are living near IWTs. In one case, diagnostic categories and criteria guide the physician towards an investigative process specific to IWTs.⁴² Both the Austrian Medical Association’ diagnostic tool considers EMF exposure⁴³ and the Castelo Branco protocol helps physicians to investigate effects from EMF emissions in general.⁴⁴

IWT guidelines typically do not consider EMF/RF emissions and as result, compliance requirements are usually lacking for these categories.

6. Conclusion

In 1999, the World Health Organization (WHO) defined noise as “unwanted sound”.⁴⁵ While sound meters can measure sound, unwanted sound is perceived by humans as noise.

A peer reviewed publication comments that unwanted sound (noise) is a large concern for wind turbines and stresses the importance of taking into account perceived concerns of communities.⁴⁶

Noise related adverse health effects in general have been known for many years.^{47, 48} A review comments “reliance on wind energy in Europe has increased which has “resulted in higher public annoyance in the EU” and that WHO was considering new evidence related to effects such as:

annoyance, cardiovascular effects, obesity and metabolic effects (such as diabetes), cognitive impairment, sleep disturbance, hearing impairment and tinnitus, adverse birth outcomes, quality of life, mental health, and wellbeing.⁴⁹

Regarding IWTs, there are numerous pre- and post-implementation knowledge gaps which have yet to be resolved. Examples include IWT-specific front end research and monitoring programs such as:

- Metrics for audible and inaudible noise such as outcomes of intensity and length of time of exposure;
- Vigilance monitoring and long term surveillance;
- Outcomes of acute and chronic exposure to audible and inaudible noise (LFN/infrasound), tonal, RF/EMF energy; visuals (flashing lights/shadow flicker) and other;
- Social-economic monitoring regarding effects on rural communities and residents;
- Risk of exposure for those with pre-existing medical conditions (cardiac, immune disorders, migraine and other) and vulnerable population groups (children, elderly, and those with special needs); and
- Prevalence monitoring of those who have vacated/abandoned their homes.

While my focus is on human health, I also have an interest regarding risk to domestic pets and animals, wildlife, birds, marine and aquatic life. IWT specific studies on other species are limited. Since observational studies typically are used to monitor these species, it can take many years to determine the effects.

Another point involves the opportunity for informed consent. I have briefly commented on various knowledge gaps and potential risks to health. In Canada, government has approved IWT deployment of “IWTs despite municipal governments having declared their jurisdictions to be unwilling hosts”.^{50, 51} It is proposed that:

Individuals have a right to make informed decisions about their health, and potential risks to health should be fully disclosed. Individuals should not be exposed to industrial wind turbines without their informed consent.

Individuals continue to be exposed without consent, and have formed part of the sample pool of potential subjects from which researchers have drawn data and/or biological samples for government sponsored IWT health studies.⁵²

In a keynote speech during a 1968 Conference on Noise as a Public Health Hazard, Dr. William H. Stewart, the former Surgeon General of the United States stated:

Must we wait until we prove every link in the chain of causation? In protecting health, absolute proof comes late. To wait for it is to invite disaster or to prolong suffering unnecessarily.⁵³

Thank you for this opportunity to share a brief summary of information for your consideration. If I can assist, I am available at: Cell 613 312 9663.

Respectfully submitted,

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K0J2A0

Attachment:

Summary Krogh references July 2019

References

¹ Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment. Environmental Review Tribunal, Decision, p 207

² Krogh CM, Wilson EJ and Harrington ME (2019). Wind Turbine Incident/Complaint Reports in Ontario, Canada: A Review—Why Are They Important?. Open Access Library Journal, 6, e5200. doi: <http://dx.doi.org/10.4236/oalib.1105200>

³ Alberta Utilities Commission. AUC 22563, Volume 2, November 22, 2017. Testimony by C Ollson, PhD, pg 229. PDF copy available on request.

⁴ Commonwealth of Massachusetts, Superior Court. Case No. 1472CV0003. November 23, 2016 Barnstable, Massachusetts. Cross-examination of R McCunney, by Atty. Senie. PDF copy available on request.

⁵ Health Canada (2013). Environmental & Workplace Health. Consultations. Health Impacts and Exposure to Sound from Wind Turbines: Updated Research Design and Sound Exposure Assessment. <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/consultations/health-impacts-exposure-sound-wind-turbines-updated-research-design-sound-exposure-assessment.html>

⁶ Health Canada (November 6, 2014). Environmental and Workplace Health. Wind Turbine Noise and Health Study: Summary of Results. <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/noise/wind-turbine-noise/wind-turbine-noise-health-study-summary-results.html>

⁷ Krogh CM, Dumbrille A, McMurtry RY, James R, Rand RW, Nissenbaum MA, Aramini JJ and Ambrose SE (2018). Health Canada's Wind Turbine Noise and Health Study—A Review Exploring Research Challenges, Methods, Limitations and Uncertainties of Some of the Findings. Open Access Library Journal, 5, e5046. doi: <http://dx.doi.org/10.4236/oalib.1105046>. Journal link: http://www.oalib.com/articles/5301313#.XBr6_PSno9M

⁸ Constitution of the World Health Organization. https://www.who.int/governance/eb/who_constitution_en.pdf

⁹ Krogh CME, Industrial Wind Turbine Development and Loss of Social Justice? Bulletin of Science Technology & Society 2011 31: 321, DOI: 10.1177/0270467611412550, <http://bst.sagepub.com/content/31/4/321>

¹⁰ Jeffery RD, Krogh CME, and Horner B, (Review) Industrial wind turbines and adverse health effects Can J Rural Med 2014;19(1) <http://www.ncbi.nlm.nih.gov/pubmed/24398354>

¹¹ Krogh C. Industrial wind turbines can harm humans (June 18, 2015). Ideacity, Toronto, Ontario, Canada. <http://www.ideacityonline.com/video/carmen-krogh-wind-turbines-can-harm-humans/>

-
- ¹² Inagaki T and Nishi Y, Analysis of aerodynamic sound noise generated by a largescaled wind turbine and its physiological evaluation, *Int. J. Environ. Sci. Technol.* (2015) 12:1933–1944 DOI 10.1007/s13762-014-0581-4
- ¹³ Ambrose SE, Rand RW and Krogh CME, Wind Turbine Acoustic Investigation: Infrasound and Low-Frequency Noise--A Case Study, *Bulletin of Science Technology & Society* published online 17 August 2012 DOI: 10.1177/0270467612455734
- ¹⁴ Swinbanks M. Direct experience of low-frequency noise and infrasound within a windfarm community. Paper - 6th International Meeting on Wind Turbine Noise, April 2015.
- ¹⁵ Abbasi M, Monnazzam MR, Zakerian SA, and Yousefzadeh A, (April 2015). Effect of Wind Turbine Noise on Workers' Sleep Disorder: A Case Study of Manjil Wind Farm in Northern Iran, *Fluct. Noise Lett.* 14, 1550020 (2015) [15 pages] DOI: 10.1142/S0219477515500200 (0.3 to 0.66)
- ¹⁶ Abbasi M, Monnazzam MR, Zakerian SA, and Yousefzadeh A, (April 2015) Effect of Wind Turbine Noise on Workers' Sleep Disorder: A Case Study of Manjil Wind Farm in Northern Iran, *Fluct. Noise Lett.* 14, 1550020 (2015) [15 pages] DOI: 10.1142/S0219477515500200
- ¹⁷ Abbasi M, Monazzam MR, Ebrahim MH, Zakerian SA, Dehghan SF, Akbarzadeh A, Assessment of noise effects of wind turbine on the general health of staff at wind farm of Manjil, Iran. *Journal of Low Frequency Noise, Vibration and Active Control.* 35(1) 2016 91-98, DOI: 10.1177/0263092316628714
- ¹⁸ Cooperative Measurement Survey (2012). A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin. Report Number 122412-1 (Issued: December 24, 2012). Revised. Prepared Cooperatively By: Channel Islands Acoustics, Camarillo, CA, Principal: Dr. Bruce Walker; Hessler Associates, Inc., Haymarket, VA, Principals: George F. and David M. Hessler; Rand Acoustics, Brunswick, ME Principal: Robert Rand; Schomer and Associates, Inc., Champaign, IL Principal: Dr. Paul Schomer.
<https://puc.sd.gov/commission/dockets/electric/2018/EL18-003/testimony/testimony/mogen/Noise%20Exhibit%204.pdf>
- ¹⁹ Euronoise 2018 - Conference Proceedings The Inaudible Soundscape of a Wind farm Euronoise2018 Proceedings Steven Cooper The Acoustic Group Pty Ltd, Australia
- ²⁰ Pedersen, E., & Persson Waye, K., "Wind Turbine Noise, Annoyance and Self-Reported Health and Well Being in Different Living Environments", *Occupational and Environmental Medicine*, 64, 480-486, (2007)
- ²¹ Jeffery RD, Krogh CME, and Horner B, (Review) Industrial wind turbines and adverse health effects *Can J Rural Med* 2014;19(1) <http://www.ncbi.nlm.nih.gov/pubmed/24398354>
- ²² Riina I. Bray, BAsc, MSc, MD, FCFP, MHSc. Medical Director, Environmental Health Clinic, Women's College Hospital, Assistant Professor, Department of Family and Community Medicine, University of Toronto. Cross-Appointment Dalla Lana School of Public Health.
- ²³ Krogh CM, Harrington MEB. Wind Turbine Electromagnetic Energy: Exploring Risk of Harm to Human Health. *Altern Ther Health Med.* 2019 May;25(3):32-38. PMID: 31160544. DOI: <https://www.ncbi.nlm.nih.gov/pubmed/31160544>
- ²⁴ Havas M and Colling D (2011). Wind Turbines Make Waves: Why Some Residents Near Wind Turbines Become Ill. *Bulletin of Science Technology & Society* 2011 31: 414. DOI: 0.1177/0270467611417852. <http://journals.sagepub.com/doi/abs/10.1177/0270467611417852>
- ²⁵ McCarty DE, Carrubba S, Chesson AL, Frilot C, Gonzalez-Toledo E and Marino AA, 2011. "Electromagnetic Hypersensitivity: Evidence for a Novel Neurological Syndrome," *Informa HealthCare, International Journal of Neuroscience*, 2011. Dec;121(12):670-6. doi: 10.3109/00207454.2011.608139. PMID: 21793784. Epub 2011 Sep 5. <https://www.ncbi.nlm.nih.gov/pubmed/21793784>
- ²⁶ Alves-Pereira M, Krogh C, Bakker HCH, Sommers SR and Rapley BI. Infrasound and Low Frequency Noise Guidelines: Antiquated And Irrelevant for Protecting Populations. 26th International Congress on Sound and Vibration, Montreal, Quebec, Canada. July 7-11, 2019.
- ²⁷ Kelley ND, Hemphill RR and McKenna HE. A Methodology for Assessment of Wind Turbine Noise Generation. *Journal of Solar Energy Engineering.* May 1982, Vol. 104/119.
- ²⁸ James RR, 2012. Wind Turbine Infra and Low-Frequency Sound: Warning Signs That Were Not Heard. *Bulletin of Science, Technology & Society.* 32(2) 108 –127.
- ²⁹ Certified Translation. Correspondence to K Effemann, Minister of Environment, Denmark, June 29, 2011. Signed by D Engel, Chief Executive Officer, Vestas Wind Systems A/S. PDF copy available on request.

-
- ³⁰ Report Number 122412-1. Issued: December 24, 2012. Revised: A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin. Prepared Cooperatively By: Channel Islands Acoustics, Camarillo, CA, Principal: Dr. Bruce Walker; Hessler Associates, Inc., Haymarket, VA, Principals: George F. and David M. Hessler; Rand Acoustics, Brunswick, ME Principal: Robert Rand; Schomer and Associates, Inc. Champaign, IL Principal: Dr. Paul Schomer.
- ³¹ Brown County board of health resolution requesting emergency state aid for families suffering around industrial wind turbines. Rowe, MA: National Wind Watch; 2012. <http://docs.wind-watch.org/Brown%20County%20Board%20of%20Health%20Resolution%20011012.pdf>
- ³² Møller H and Pedersen CS, Low-frequency noise from large wind turbines Section of Acoustics, Aalborg University, Denmark, Acoustical Society of America [DOI: 10.1121/1.3543957] J. Acoust. Soc. Am. 129 (6), June 2011 PACS number(s): 43.50.Rq, 43.28.Hr, 43.50.Cb, 43.50.Sr [ADP] Pages: 3727–3744
- ³³ Pierpont N. Wind turbine syndrome: a report on a natural experiment. Santa Fe, NM: K-Selected Books; 2009.
- ³⁴ Colby W, Dobie R, Leventhall G, Lipscomb D, McCunney R, Seilo M and Søndergaard B (2009). Wind turbine sound and health effects: An expert panel review. Prepared for American Wind Energy Association and Canadian Wind Energy Association. Retrieved June 10, 2018: http://www.canwea.ca/pdf/talkwind/Wind_Turbine_Sound_and_Health_Effects.pdf
- ³⁵ Health Canada, Community Noise Annoyance, Its Your Health, (2005, September)
- ³⁶ Pedersen, E., & Persson Waye, K., “Wind Turbine Noise, Annoyance and Self-Reported Health and Well Being in Different Living Environments”, Occupational and Environmental Medicine, 64, 480-486, (2007) doi:10.1136/oem.2006.031039
- ³⁷ General Purpose Standing Order Committee No. 5 Rural wind farms Ordered to be printed 16 December 2009 according to Standing Order 231, Australia
- ³⁸ 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
- ³⁹ Niemann Dr Hildegard, Maschke Dr Christian, LARES Final Report Noise Effects and Morbidity, World Health Organization, (2004)
- ⁴⁰ Riina I. Bray, BAsc, MSc, MD, FCFP, MHSc. Medical Director, Environmental Health Clinic, Women’s College Hospital, Assistant Professor, Department of Family and Community Medicine, University of Toronto. Cross-Appointment Dalla Lana School of Public Health.
- ⁴¹ Krogh CM, Harrington MEB. Wind Turbine Electromagnetic Energy: Exploring Risk of Harm to Human Health. Altern Ther Health Med. 2019 May;25(3):32-38. PMID: 31160544. DOI: <https://www.ncbi.nlm.nih.gov/pubmed/31160544>
- ⁴² Robert Y McMurtry and Carmen ME Krogh, Diagnostic criteria for adverse health effects in the environs of wind turbines. JRSO Open 2014 5:1-5 DOI: 10.1177/2054270414554048 PMID: 25383200 [PubMed] PMCID: PMC4221978 <http://shr.sagepub.com/> <http://shr.sagepub.com/content/5/10/2054270414554048> <http://www.ncbi.nlm.nih.gov/pubmed/?term=Diagnostic+criteria+for+adverse+health+effects+in+the+environs+of+wind+turbines>
- ⁴³ Guideline of the Austrian Medical Association for the diagnosis and treatment of EMF-related health problems and illnesses (EMF syndrome). Consensus paper of the Austrian Medical Association’s Working Group AG-EMF. <http://electromagnetichealth.org/wp-content/uploads/2012/04/EMF-Guideline.pdf>
- ⁴⁴ Castelo Branco NAA, Alves-Pereira M, Pimenta AM, Ferreira JR. (2015). Clinical Protocol for Evaluating Pathology Induced by Low Frequency Noise Exposure. EuroNoise,2015. May 31 to June 3, Maastricht
- ⁴⁵ WHO (1999). World Health Organization. Edited by Berglund B, Lindvall T, Schwela DH. Guidelines for Community Noise. Part 5. Noise management. Retrieved August 8, 2018: <http://www.who.int/docstore/peh/noise/Comnoise-5.pdf>
- ⁴⁶ Saavedra RC and Samanta B, 2015. Noise and Vibration Issues of Wind Turbines and Their Impact – A Review. Wind Engineering Volume 39, No. 6, 2015 PP 617-626
- ⁴⁷ Krogh C. Harm from Wind Turbines: What has been known for decades (May 7, 2014). University of Waterloo Seminar. Ontario, Canada. <http://new.livestream.com/itmsstudio/events/2968290>

⁴⁸ WHO (1999). World Health Organization. Edited by Berglund B, Lindvall T, Schwela DH. Guidelines for Community Noise. Part 5. Noise management. Retrieved August 8, 2018:

<http://www.who.int/docstore/peh/noise/Comnoise-5.pdf>

⁴⁹ Krogh CM, Dumbrille A, McMurtry RY, James R, Rand RW, Nissenbaum MA, Aramini JJ and Ambrose SE (2018). Health Canada's Wind Turbine Noise and Health Study—A Review Exploring Research Challenges, Methods, Limitations and Uncertainties of Some of the Findings. Open Access Library Journal, 5, e5046. doi: <http://dx.doi.org/10.4236/oalib.1105046>. Journal link:

http://www.oalib.com/articles/5301313#.XBr6_PSno9M

⁵⁰ Ferguson E. (2016) No “Veto” for Areas Opposed to Energy Projects, Kingston

Whig-Standard. <http://www.thewhig.com/2016/03/31/no-veto-for-areas-opposed-to-energy-projects>

⁵¹ Wind Concerns Ontario. Not a Willing Host (2017). <http://www.windconcernsontario.ca/not-a-willing-host/>

⁵² Krogh, C. and Horner, B. (2017) Human Health, Rights and Wind Turbine Deployment in Canada. Open Journal of Social Sciences , 5, 166-185. <https://doi.org/10.4236/jss.2017.55012>

⁵³ Bronzaft AL, 2011. The Noise From Wind Turbines: Potential Adverse Impacts on Children's Well-Being. DOI: 10.1177/0270467611412548. Bulletin of Science Technology & Society 2011 31: 291. <http://bst.sagepub.com/content/31/4/291> .