

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/329806796>

Health Canada's Wind Turbine Noise and Health Study—A Review Exploring Research Challenges, Methods, Limitations and Uncertainties of Some of the Findings

Article in *Open Access Library Journal* · January 2018

DOI: 10.4236/oalib.1105046

CITATIONS

5

READS

1,120

8 authors, including:



Carmen Krogh

Magentica Research Group

41 PUBLICATIONS 490 CITATIONS

SEE PROFILE



Anne Dumbrille

Fastrack

34 PUBLICATIONS 978 CITATIONS

SEE PROFILE



Robert Mcmurtry

Western University

87 PUBLICATIONS 3,264 CITATIONS

SEE PROFILE

Search 4,241,363 Articles

 All Title Author
 Keywords Abstract

Publish in OALib Journal

ISSN: 2333-9721

APC: Only \$99

Paper Submission

Views	Downloads
75	37

Relative Articles

Framework of Designing an Adaptive and Multi-Regime Prognostics and Health Management for Wind Turbine Reliability and Efficiency Improvement

Human Health, Rights and Wind Turbine Deployment in Canada

Proto-Magnetars as GRB Central Engines: Uncertainties, Limitations, and Particulars

The Design of Vertical Axis Wind Turbine Rotor for Antarctic

Latest Findings on the Health Risks of

Gas Turbine Health State Determination: Methodology Approach and Field Application

Mapping Ontario's Wind Turbines: Challenges and Limitations

Analysis of clinical uncertainties by health professionals and patients: an example from mental health

Open Access Library Journal 5 2018

3

[See all subject areas](#)

Health Canada's Wind Turbine Noise and Health Study—A Review Exploring Research Challenges, Methods, Limitations and Uncertainties of Some of the Findings

DOI: [10.4236/oalib.1105046](https://doi.org/10.4236/oalib.1105046), PP. 1-25Carmen M. Krogh, Anne Dumbrille, [Robert Y. McMurtry](#), Richard James, Robert W. Rand, Michael A. Nissenbaum, Jeffery J. Aramini, Stephen E. Ambrose

Subject Areas: Public Health

Keywords: Wind Turbines, Research Challenges, Research Gaps, Risk of Harm, Adverse Health Effects

Full-Text

Cite this paper

Add to My Lib

Abstract

Background: Risk of harm associated with wind turbines is debated globally. Some people living or working in proximity to wind turbines report adverse health effects such as sleep disturbance, noise annoyance, and diminished quality of life. Due to public concern, Health Canada announced its wind turbine noise and health study which included subjective and objective measurements. Findings were published between 2014 and 2016. In 2018, Health Canada published clarifications regarding the design and interpretation of study conclusions. **Methods:** Methods and subjective/objective findings were reviewed. Peer reviewed publications, conference presentations, judicial proceedings, government documents, and other sources were evaluated and considered in context with advanced methods for investigating reports of adverse health effects. **Objectives:** To review and explore some of the research challenges, methods, strengths and limitations of findings and conclusions. To participate in scientific dialogue and contribute towards an understanding of reported health risks associated with wind turbine noise. **Results:** Wind turbine human health research is challenged by numerous variables. Knowledge gaps and individual human and wind turbine variables are identified. Strengths and advisories of limitations are considered and acknowledged. Health Canada's advisories that its study design does not permit any conclusions about causality and results may not be generalized beyond the sample taken in Canada are supported. Enhanced methods for investigating health outcomes are proposed including establishing referral resources within medical facilities for physicians. It is proposed staffing of the resource center include multidisciplinary teams of physicians, epidemiologists, acousticians and other specialists to investigate suspected wind turbine adverse health effects. **Discussion:** A review and appraisal of some of the research challenges associated with wind turbine human health research are presented. Given the identified methods, research/knowledge gaps, and limitations and cautionary advisories, Health Canada's results should be carefully considered when predicting or protecting from health risks of wind turbine noise.

Cite this paper

Krogh, C. M. , Dumbrille, A. , McMurtry, R. Y. , James, R. , Rand, R. W. , Nissenbaum, M. A. , Aramini, J. J. and Ambrose, S. E. (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>.

References

- [1] CCA (2015) Council of Canadian Academies. Understanding the Evidence. The Expert Panel on Wind Turbine Noise and Human Health, Table 7.1. <https://www.scienceadvice.ca/reports/understanding-the-evidence-wind-turbine-noise/>
- [2] Onakpoya, I.J., O'Sullivan, J., Thompson, M.J. and Heneghena, C.J. (2015) The Effect of Wind Turbine Noise on Sleep and Quality of Life: A Systematic Review



Wind Turbine Blade Design

Limitations and possibilities on health assessment to women in violence situation

More...

- and Meta-Analysis of Observational Studies. *Environment International*, 82, 1-9.
<http://www.sciencedirect.com/science/article/pii/S0160412015001051> <https://doi.org/10.1016/j.envint.2015.04.014>
- [3] Jeffery, R.D., Krogh, C. and Horner, B. (2013) (Commentary) Adverse Health Effects of Industrial Wind Turbines. *Canadian Family Physician*, 59, 473-475.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3653647/>
- [4] Colby, W., Dobie, R., Leventhall, G., Lipscomb, D., McCunney, R., Seilo, M. and Sondergaard, B. (2009) Wind Turbine Sound and Health Effects: An Expert Panel Review. Pre-pared for American Wind Energy Association and Canadian Wind Energy Association.
http://www.canwea.ca/pdf/talkwind/Wind_Turbine_Sound_and_Health_Effects.pdf
- [5] Freiberg, A., Schefter, C., Girbig, M., Murta, V.C. and Seidler (2018) Health Effects of Wind Turbines in Working Environments: A Scoping Review. *Scandinavian Journal of Work Environment & Health*, 44, 351-369.
[https://www.ncbi.nlm.nih.gov/pubmed/?term=Health effects of wind turbines in working environments](https://www.ncbi.nlm.nih.gov/pubmed/?term=Health+effects+of+wind+turbines+in+working+environments) %E2%80%933 a scoping review
- [6] Kageyama, T., Yano, T., Kuwano, S., Sueoka, S. and Tachibana, H. (2016) Exposure-Response Relationship of Wind Turbine Noise with Self-Reported Symptoms of Sleep and Health Problems: A Nationwide Socioacoustic Survey in Japan. *Noise & Health*, 18, 53-61.
<https://www.ncbi.nlm.nih.gov/pubmed/26960782>
<https://doi.org/10.4103/1463-1741.178478>
- [7] Acoustic Group (2014) Results of an Acoustic Testing Program: Cape Bridgewater Wind Farm.
<https://www.wind-watch.org/documents/results-of-an-acoustic-testing-program-cape-bridgewater-wind-farm/>
- [8] Havas, M. and Colling, D. (2011) Wind Turbines Make Waves: Why Some Residents near Wind Turbines Become Ill. *Bulletin of Science Technology & Society*, 31, 414.
<http://journals.sagepub.com/doi/abs/10.1177/0270467611417852>
<https://doi.org/10.1177/0270467611417852>
- [9] Krogh, C.M.E., Gillis, L., Kouwen, N. and Aramini, J. (2011) WindVOICe, a Self-Reporting Survey: Adverse Health Effects, Industrial Wind Turbines, and the Need for Vigilance Monitoring. *Bulletin of Science Technology & Society*, 31, 334.
<http://bst.sagepub.com/content/31/4/334>
<https://doi.org/10.1177/0270467611412551>
- [10] Pierpont, N. (2009) Wind Turbine Syndrome: A Report on a Natural Experiment. K-Selected Books, Santa Fe, NM.
- [11] Jeffery, R.D., Krogh, M.E. and Horner, B. (2014) (Review) Industrial Wind Turbines and Adverse Health Effects. *Canadian Journal of Rural Medicine*, 19, 21-26.
<http://www.ncbi.nlm.nih.gov/pubmed/24398354>
- [12] Krogh, C.M.E. (2011) Industrial Wind Turbine Development and Loss of Social Justice? *Bulletin of Science Technology & Society*, 31, 321.
<http://journals.sagepub.com/doi/abs/10.1177/0270467611412550> <https://doi.org/10.1177/0270467611412550>
- [13] Ripley Group. Legislative Assembly of Ontario First Session, 39th Parliament. Official Report Journal of Debates (Hansard), Wednesday 15 April 2009. Standing Committee on Green Energy and Green Economy Act, 2009. David Orziatti, Chair, P. G-547.
https://www.ola.org/en/legislative-business/committees/general-government/parliament-39/transcripts/committee-transcript-2009-apr-15#P1296_397237
- [14] Ambrose, S.E., Rand, R.E. and Krogh, C.M.E. (2012) Wind Turbine Acoustic Investigation: Infrasound and Low-Frequency Noise: A Case Study. *Bulletin of Science Technology & Society*.
<http://bst.sagepub.com/content/early/2012/07/30/0270467612455734>
- [15] Rand, R.W., Ambrose, S.E. and Krogh, C.M.E. (2011) Occupational Health and Industrial Wind Turbines: A Case Study. *Bulletin of Science Technology & Society*, 31, 359.

- <https://doi.org/10.1177/0270467611417849>
<http://bst.sagepub.com/content/31/5/359>
- [16] Swinbanks, M. (2015) Direct Experience of Low-Frequency Noise and Infrasound within a Windfarm Community. 6th International Meeting on Wind Turbine Noise, Glasgow, 20-23 April 2015.
<https://www.wind-watch.org/documents/direct-experience-of-low-frequency-noise-and-infrasound-within-a-windfarm-community/>
- [17] Abbasi, M., Monazzam, M.R., Ebrahim, M.H., Zakerian, S.A., Dehghan, S.F. and Akbarzadeh, A. (2016) 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, 91-98.
<http://journals.sagepub.com/doi/abs/10.1177/0263092316628714>
<https://doi.org/10.1177/0263092316628714>
- [18] Abbasi, M., Monazzam, M.R., Akbarzadeh, A., Zakerian, S.A. and Ebrahim, M.H. (2015) Impact of Wind Turbine Sound on General Health, Sleep Disturbance and Annoyance of Workers: A Pilot-Study in Manji Wind Farm, Iran. *Journal of Environmental Health Science & Engineering*, 13, 71.
<https://jehse.biomedcentral.com/articles/10.1186/s40201-015-0225-8>
<https://doi.org/10.1186/s40201-015-0225-8>
- [19] Abbasi, M., Monazzam, M.R., Zakerian, S.A. and Yousefzadeh, A. (2015) Effect of Wind Turbine Noise on Workers' Sleep Disorder: A Case Study of Manjil Wind Farm in Northern Iran. *Fluctuation and Noise Letters*, 14, Article ID: 1550020.
<https://www.worldscientific.com/doi/abs/10.1142/S0219477515500200>
<https://doi.org/10.1142/S0219477515500200>
- [20] Inagaki, T., Li, Y. and Nishi, Y. (2015) Analysis of Aerodynamic Sound Noise Generated by a Large Scaled Wind Turbine and Its Physiological Evaluation. *International Journal of Environmental Science and Technology*, 12, 1933-1944.
<https://link.springer.com/article/10.1007%2Fs13762-014-0581-4>
<https://doi.org/10.1007/s13762-014-0581-4>
- [21] Nissenbaum, M.A., Aramini, J.J. and Hanning, C.D. (2012) Effects of Industrial Wind Turbine Noise on Sleep and Health. *Noise & Health*, 14, 237-243.
[https://www.ncbi.nlm.nih.gov/pubmed/?term=Effects of industrial wind turbine noise on sleep and health](https://www.ncbi.nlm.nih.gov/pubmed/?term=Effects+of+industrial+wind+turbine+noise+on+sleep+and+health)
<https://doi.org/10.4103/1463-1741.102961>
- [22] Michaud, D.S., Keith, S.E., Feder, K., Soukhovtsev, V., Marro, L., Denning, A., et al. (2013) Self-Reported and Objectively Measured Health Indicators among a Sample of Canadians Living within the Vicinity of Industrial Wind Turbines: Social Survey and Sound Level Modelling Methodology. *Noise News International*, 21, 122-131.
https://docs.wind-watch.org/NNI_2013_Dec_HC-methodology.pdf
<https://doi.org/10.3397/1.37023117>
- [23] Health Canada. Environmental & Workplace Health (July 10, 2012) Notice to Stakeholders—Health Canada Wind Turbine Noise and Health Study.
<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/consultations/notice-stakeholders-health-canada-wind-turbine-noise-health-study-2012-health-canada-consultation.html>
- [24] Michaud, D.S., Feder, K., Keith, S.E., Voicescu, S.A., Marro, L., Than, J., et al. (2016) Exposure to Wind Turbine Noise: Perceptual Responses and Reported Health Effects. *The Journal of the Acoustical Society of America*, 139, 1443-1454.
<https://asa.scitation.org/doi/10.1121/1.4942391>
<https://doi.org/10.1121/1.4942391>
- [25] Health Canada. Environmental and Workplace Health (November 6, 2014) 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>
- [26] Keith, S.E., Feder, K., Voicescu, S.A., Soukhovtsev, V., Allison, D., Tsang, J., et al.

- (2016) Wind Turbine Sound Power Measurements. *The Journal of the Acoustical Society of America*, 139, 1431-1435.
<https://asa.scitation.org/doi/full/10.1121/1.4942405>
<https://doi.org/10.1121/1.4942405>
- [27] Keith, S.E., Feder, K., Voicescu, S.A., Soukhovtsev, V., Allison, D., Tsang, J., et al. (2016) Wind Turbine Sound Pressure Level Calculations at Dwellings. *The Journal of the Acoustical Society of America*, 139, 1436-1442.
<https://asa.scitation.org/doi/abs/10.1121/1.4942404>
<https://doi.org/10.1121/1.4942404>
- [28] Michaud, D.S., Feder, K., Keith, S.E., Voicescu, S.A., Marro, L., Than, J., et al. (2016) Effects of Wind Turbine Noise on Self-Reported and Objective Measures of Sleep. *Sleep*, 39, 97-109.
https://www.researchgate.net/publication/283447420_Effects_of_Wind_Turbine_Noise_on_Self-Reported_and_Objective_Measures_of_Sleep
<https://doi.org/10.5665/sleep.5326>
- [29] Michaud, D.S., Feder, K., Keith, S.E., Voicescu, S.A., et al. (2016) Self-Reported and Measured Stress Related Responses Associated with Exposure to Wind Turbine Noise. *The Journal of the Acoustical Society of America*, 139, 1467-1479.
<https://asa.scitation.org/doi/abs/10.1121/1.4942402>
<https://doi.org/10.1121/1.4942402>
- [30] Michaud, D.S., Keith, S.E., Feder, K., Voicescu, S.A., Marro, L., Than, J., et al. (2016) Personal and Situational Variables Associated with Wind Turbine Noise Annoyance. *The Journal of the Acoustical Society of America*, 139, 1455-1466.
<https://asa.scitation.org/doi/abs/10.1121/1.4942390>
<https://doi.org/10.1121/1.4942390>
- [31] Voicescu, S.A., Michaud, D.S., Feder, K., Marro, L., Than, J., Guay, M., et al. (2016) Estimating Annoyance to Calculated Wind Turbine Shadow Flicker Is Improved When Variables Associated with Wind Turbine Noise Exposure Are Considered. *The Journal of the Acoustical Society of America*, 139, 1480-1492.
<https://asa.scitation.org/doi/abs/10.1121/1.4942403>
<https://doi.org/10.1121/1.4942403>
- [32] Feder, K., Michaud, D.S., Keith, S.E., Voicescu, S.A., Marro, L., Than, J., et al. (2015) An Assessment of Quality of Life Using the WHOQOL-BREF among Participants Living in the Vicinity of Wind Turbines. *Environmental Research*, 142, 227-238.
<https://www.sciencedirect.com/science/article/pii/S0013935115300189>
<https://doi.org/10.1016/j.envres.2015.06.043>
- [33] Michaud, D.S., Feder, K., Voicescu, S.A., Marro, L., Than, J., Guay, M., Lavigne, E., et al. (2018) Clarifications on the Design and Interpretation of Conclusions from Health Canada's Study on Wind Turbine Noise and Health. *Acoustics Australia*, 46, 99-110.
<https://link.springer.com/article/10.1007/s40857-017-0125-4>
<https://doi.org/10.1007/s40857-017-0125-4>
- [34] Michaud, D.S., Feder, K., Keith, S.E., Voicescu, S.A., Marro, L., Than, J., Guay, M., Denning, A., et al. (2018) Corrigendum: Effects of Wind Turbine Noise on Self-Reported and Objective Measures of Sleep. *Sleep*, 41, zsy037.
<https://academic.oup.com/sleep/article/41/5/zsy037/4954221>
<https://doi.org/10.1093/sleep/zsy037>
- [35] Michaud, D.S., Feder, K., Keith, S.E., Voicescu, S.A., et al. (2016) Erratum: Exposure to Wind Turbine Noise: Perceptual Responses and Reported Health Effects [*J. Acoust. Soc. Am.* 139(3), 1443-1454 (2016)]. *The Journal of the Acoustical Society of America*, 139, 2457.
<https://asa.scitation.org/doi/10.1121/1.4964754>
- [36] Michaud, D.S., Keith, S.E., Feder, K., Voicescu, S.A., et al. (2016) Erratum: Personal and Situational Variables Associated with Wind Turbine Noise Annoyance [*J. Acoust. Soc. Am.* 139(3), 1455-1466 (2016)]. *The Journal of the Acoustical Society of America*, 140, 2234.
<https://doi.org/10.1121/1.4963838>
- [37] Health Canada. Environmental & Workplace Health (2013) 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
- [38] MOECC (April 2018) Ministry of Environment and Climate Change, Ontario, Canada. Personal Correspondence.
- [39] Jasper County Planning & Development (September 21, 2018) Review of Proposed Revisions to the Jasper County Zoning Ordinance Section 20.30.170 WFO District Development Standards. Rensselaer, Indiana, USA.
- [40] AUC (Alberta Utilities Commission November 22, 2017) AUC 22563, Volume 2. Proceeding ID No. 22563. Capital Power's Request for Approval to Construct and Operate a 148-Megawatt Wind Power Plant and a 240-Kv Substation to be called Goldeye 620s Substation, Collectively Designated as Halkirk 2 Wind Power Project In the County of Paintearth. November 22, 2017, Red Deer, Alberta. Testimony by C. Ollson (For Capital Power Corporation), previously sworn/affirmed.
- [41] Brown County Human Services Commission. Brown County Special Event (September 12, 2017). Wisconsin, USA. Presentation by Dr. Robert McCunney. <http://bccrwe.com/27>
<https://www.youtube.com/watch?v=2kvoZO-DEho&feature=youtu.be>
- [42] State of New York Department of Public Service (July 20, 2017) In the Matter of: Case 14-F-0490, Application by Cassadaga Wind LLC for a Certificate of Environmental Compatibility and Public Need Pursuant to Article 10 of the New York State Public Service Law for the Cassadaga Wind Project, Towns of Charlotte, Cherry Creek, Arkwright, and Stockton, Chautauque County. Evidentiary Hearing—14-F-0490-7-20-2017. Thursday July 20, 2017. Sinclairville, New York. Dakin P. Lecakes, DPS, Administrative Law Judge and P. Nicolas Garlick, DEC Administrative Law Judge. Sworn testimony of Dr. Robert McCunney.
- [43] Commonwealth of Massachusetts Superior Court (2016) Case No. 1472CV0003. Vol. 5. Barnstable, ss. Superior Court. Town of Falmouth, Plaintiff, vs. Town of Falmouth Zoning Board of Appeals, and Matthew Mcnamara, Patricia Johnson, Kenneth Foreman, Edwin Zylinski, David Haddad and Mark Cool as members of the Falmouth Zoning Board of Appeals; and Barry Funfar and Diane Funfar, Defendants. Before the Honorable Cornelius J. Moriarty II, Associate Justice of the Superior Court (November 23, 2016) Barnstable, Massachusetts Vol 5. p. 16 I. 20. Sworn testimony by Dr Robert McCunney.
- [44] State of Vermont Public Utility Commission (December 2, 2016) Sworn Testimony by Christopher Ollson, PhD. Ollson Environmental Health Management. Addressing Wind Turbine Health Concerns. http://puc.vermont.gov/sites/psbnew/files/doc_library/rulemaking-5700-dps-oehm-presentation-12-2-16.pdf
- [45] ERT (Environmental Review Tribunal May 11, 2015) Ontario, Canada. Proceeding Commenced under Section 142.1(2) of the Environmental Protection Act, R.S.O. 1990, c.E.19, as amended Douglas Edward Dingeldein v Director, Ministry of the Environment and Climate Change. Case No. 15-011. Subject of appeal: Renewable Energy Approval for Grey Highlands Zero Emission People Wind Farm. Sworn testimony by Dr Robert McCunney.
- [46] Superior Court of Justice Divisional Court-Ontario (2014) Dixon v. Director, Ministry of the Environment, 2014 ONSC 7404 Divisional Court Files Nos.: 2055/14, 2056/14 and 2073/14. Date: 20141229 Marrocco A.C.J.S.C., J. Henderson and D. Brown JJ. Court File No. 2055/14, between: Scotty Dixon, Jennifer Dixon, Thomas Ryan and Catherine Ryan Appellants and the Director, Ministry of the Environment and St. Columban Energy LP Respondents. Court File No. 2056/14 and between: Shawn Drennan and Tricia Drennan Appellants and The Director, Ministry of the Environment and K2 Wind Ontario Inc., operating as K2 Wind Ontario Limited Partnership Respondents, Court File No. 2073/14 and between: Kenneth George Kroepin and Sharon Anne Kroepin Appellants and The Director, Ministry of the Environment and SP Armow Wind Ontario GP Inc. as general partner for and on behalf of SP Armow Wind Ontario LP Respondents. Heard at London: November 17, 18, 19 and 20, 2014.
- [47] MG Acoustics (February, 2014) Analysis, Modeling, and Prediction of Infrasound and Low Frequency Noise from Wind Turbine Installation. Phase 1: PEI Site Final Report. <https://docs.wind-watch.org/WT-ILFN-Phase-1-PE-Final-Report-Redacted.pdf>
- [48] MG Acoustics (February, 2014) Analysis, Modeling, and Prediction of Infrasound and Low Frequency Noise from Wind Turbine Installation. Phase 2: Southern

- Ontario Site. Final Report.
<https://docs.wind-watch.org/WT-ILFN-Phase-2-ON-Final-Report-Redacted.pdf>
- [49] Barlas, E., Zhu, W.J., Shen, W.Z. and Andersen, S.J. (2016) Wind Turbine Noise Propagation Modelling: An Unsteady Approach. The Science of Making Torque from Wind, (TORQUE 2016) IOP Publishing. Journal of Physics: Conference Series, 753, Article ID: 022003.
http://orbit.dtu.dk/files/127151921/Wind_turbine_noise_propagation_modelling.pdf
- [50] Iannace, G. (2018) Wind Turbines Noise Measurements inside Homes. Building Acoustics, 25, 339-350.
<http://journals.sagepub.com/action/doi?AllField=Wind+turbines+noise+measurements+inside+homes&SeriesKey=buaa>
<https://doi.org/10.1177/1351010X18792884>
- [51] Schmidt, J.H. and Klokke, M. (2014) Health Effects Related to Wind Turbine Noise Exposure: A Systematic Review. PLoS ONE, 9, e114183.
<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0114183>
<https://doi.org/10.1371/journal.pone.0114183>
- [52] Gortsasa, T.V., Triantafyllidis, T., Chrisopoulou, S. and Polyzos, D. (2017) Numerical Modelling of Micro-Seismic and Infrasonic Noise Radiated by a Wind Turbine. Soil Dynamics and Earthquake Engineering, 99, 108-123.
<https://www.sciencedirect.com/science/article/pii/S026772611730297X>
<https://doi.org/10.1016/j.soildyn.2017.05.001>
- [53] AAT, Administrative Appeals Tribunal (December 4, 2017) Waubra Foundation vs ACNC. Decision & Reasons, Summary of the Effect of the Medical and Scientific Evidence.
<https://waubrafoundation.org.au/wp-content/uploads/2017/12/Decision-4-Dec-17.pdf>
- [54] DEIF Inc. (nd) SCADA Systems for Wind Turbine Control.
<https://www.deif.com/wind-power/solutions/scada-systems>
- [55] Michaud DS (May 26, 2016) An Evaluation of How Nightly Variations in Wind Turbine Noise Levels Influence Wrist Actigraphy Measured Sleep Patterns. Abstract. 171st Meeting of the Acoustical Society of America, Salt Lake City, Utah, USA.
- [56] Michaud, D.S. (May 25, 2016) An Evaluation of How Nightly Variations in Wind Turbine Noise Levels Influence Wrist Actigraphy Measured Sleep Patterns. Slide Presentation. 171st Meeting of the Acoustical Society of America, Salt Lake City, Utah, USA.
- [57] Penton, R.L. S. and Arnold, L. (2016) Principal, Acoustics Noise and Vibration. Novus Environmental, January 4, 2016. CAW Wind Turbine Acoustical Measurements Saugeen Shores, Ontario.
- [58] Bray, W. and James, R. (2011) Dynamic Measurements of Wind Turbine Acoustic Signals, Employing Sound Quality Engineering Methods Considering the Time and Frequency Sensitivities of Human Perception. NOISE-CON 2011, Portland, Oregon, USA, 25-27 July 2011.
<https://docs.wind-watch.org/Bray-James-11-07-25-Dynamic-measurement-of-wind-turbine-noise.pdf>
- [59] B. Walker, George, F., Hessler, D.M., Rand, R. and Schomer, P. (2012) A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasonic at the Shirley Wind Farm in Brown County, Wisconsin. Report Number 122412-1 (Issued: December 24, 2012). Cooperative Measurement Survey.
<https://puc.sd.gov/commission/dockets/electric/2018/EL18-003/testimony/testimony/mogen/Noise%20Exhibit%204.pdf>
- [60] Persson Waye, K., Clow, A., Edwards, S., Hucklebridge, F. and Rylandera, R. (2003) Effects of Nighttime Low Frequency Noise on the Cortisol Response to Awakening and Subjective Sleep Quality. Life Sciences, 72, 863-875.
<http://docs.wind-watch.org/Persson-Waye-LFN-cortisol-2002.pdf>
[https://doi.org/10.1016/S0024-3205\(02\)02336-6](https://doi.org/10.1016/S0024-3205(02)02336-6)
- [61] Karlan, J.L., Frostell, A., Theodorsson, E. and Faresjo, T. (2011) Cortisol in Hair Measured in Young Adults—A Biomarker of Major Life Stressors? BMC Clinical Pathology, 11, 12.
<https://bmclinpathol.biomedcentral.com/articles/10.1186/1745-2975-11-12>

1186/1472-6890-11-12

<https://doi.org/10.1186/1472-6890-11-12>


- [62] Sauvé, B., Koren, G., Walsh, G., Tokmakejian, S. and Van Uum, S.H. (2007) Measurement of Cortisol in Human Hair as a Biomarker of Systemic Exposure. *Clinical and Investigative Medicine*, 30, E183-E191. https://www.researchgate.net/publication/5951333_Measurement_of_cortisol_in_human_Hair_as_a_biomarker_of_systemic_exposure
- [63] Albar, W.F., Russell, E.W., Koren, G., Rieder, M.J. and van Uum, S.H. (2013) Human Hair Cortisol Analysis: Comparison of the Internationally-Reported ELISA Methods. *Clinical and Investigative Medicine*, 36, E312-E316. <https://www.ncbi.nlm.nih.gov/pubmed/24309228>
- [64] Pieterse, B., Bower, T. and Michaud, D. (February 12, 2012) Health Canada's Policy and Research Approach to Wind Turbines. Healthy Environments and Consumer Safety Branch, Health Canada. Science Advisory Board (SAB) Meeting Proceedings. <https://www.canada.ca/en/health-canada/services/science-research/reports-publications/science-advice-decision-making/science-advisory-board-meeting-february-1-2-2012.html>
- [65] Lee, D.Y., Kim, I.E. and Choi, M.H. (2015) Technical and Clinical Aspects of Cortisol as a Biochemical Marker of Chronic Stress. *BMB Reports*, 48, 209-216. https://www.google.com/url?sa=t&source=web&cd=12&ved=2ahUKEwiMk8zVlc_cAhXLHDQIHadMA6wQFjALegQIBhAB&url=https%3A%2F%2Fwww.ncbi.nlm.nih.gov%2Fpmc%2Farticles%2FPMC4436856%2F&usq=AOvVaw0QGSdiKiEKkgE4PV_GCn2Z <https://doi.org/10.5483/BMBRep.2015.48.4.275>
- [66] Wester, V.L. and van Rossum, E.F.C. (2015) Special Section View, Clinical Applications of Cortisol Measurements in Hair. *European Journal of Endocrinology*, 173, M1-M10. <http://www.eje-online.org/content/173/4/M1.long> <https://doi.org/10.1530/EJE-15-0313>
- [67] Russell, E., Kirschbaum, C., Laudenslager, M., Stalder, T., de Rijke, Y., van Rossum, E.F.C., et al. (2015) Toward Standardization of Hair Cortisol Measurement: Results of the First International Interlaboratory Round Robin. *Therapeutic Drug Monitoring*, 37, 71-75. https://journals.lww.com/drug-monitoring/Abstract/2015/02000/Toward_Standardization_of_Hair_Cortisol.10.aspx <https://doi.org/10.1097/FTD.0000000000000148>
- [68] Gow, R., Thomson, S., Rieder, M., Van Uum, S. and Koren, G. (March 2010) An Assessment of Cortisol Analysis in Hair and Its Clinical Applications. *Forensic Science International*, 196, 32-37. <http://www.sciencedirect.com/science/article/pii/S0379073809005416> <https://doi.org/10.1016/j.forsciint.2009.12.040>
- [69] Pereg, D., Chan, J., Russell, E., Berlin, T., Mosseri, M., Seabrook, J.A., Koren, G. and Van Uum, S.H. (2013) Cortisol and Testosterone in Hair as Biological Markers of Systolic Heart Failure. *Psychoneuroendocrinology*, 38, 2875-2882. <https://www.sciencedirect.com/science/article/pii/S0306453013002655> <https://doi.org/10.1016/j.psyneuen.2013.07.015>
- [70] Grine, A. and Rackley, S. (nd) Presumptive and Confirmatory Forensic Tests. https://www.sog.unc.edu/sites/www.sog.unc.edu/files/course_materials/Presumptive%20and%20Confirmatory%20Forensic%20Tests.pdf
- [71] FDA (Food and Drugs Administration December 28, 2016) Food and Drugs Administration Warns of False Positive Results with Zika Test. Results from ZIKV Detect Assay Require Confirmatory Testing. *Managed Care Magazine*. <https://www.managedcaremag.com/news/fda-warns-false-positive-results-zika-test>
- [72] CDC. Centers for Disease Control and Prevention Zika MAC-ELISA Updated: May 3, 2017). Fact Sheet for Healthcare Providers: Interpreting Zika MAC-ELISA Test Results. <https://www.cdc.gov/zika/pdfs/interpreting-zika-mac-elisa-results.pdf>
- [73] Report and Independent Review (December 15, 2015) Report of the Motherisk Hair Analysis and Independent Review. The Honourable Justice Susan Lang,

- Independent Reviewer.
<https://www.attorneygeneral.jus.gov.on.ca/english/about/pubs/lang/>
- [74] Statement of Claim. Koskie Minsky LLP (January 20, 2015) Statement of Claim Issued in SickKids "Motherisk" Lab Class Action. Minsky LLP and Sutts, Strosberg LLP Have Issued a Statement of Claim.
<https://kmlaw.ca/cases/motherisk-class-action/>
- [75] Slominski, R., Rovnaghi, C.R. and Anand, K.J.S. (2015) Methodological Considerations for Hair Cortisol Measurements in Children. *Therapeutic Drug Monitoring*, 37, 812-820.
https://journals.lww.com/drug-monitoring/Abstract/2015/12000/Methodological_Considerations_for_Hair_Cortisol.17.aspx
<https://doi.org/10.1097/FTD.0000000000000209>
- [76] Krogh, C.M. and Aramini, J.J. (July 2017) Project Title: Investigating the Relationship between Noise and Other Exposures and Associated with Living within 10 km of an Industrial Wind Energy Facility, Status Update: Research Data Center (RDC). Wind Action. Status: Aramini-Krogh Project to Evaluate Health Canada Wind Turbine Noise and Health Study.
<http://www.windaction.org/posts/47021-status-aramini-krogh-project-to-evaluate-health-canada-wind-turbine-noise-and-health-study>
- [77] ATIP (2016) Access to Information and Privacy Request. Health Canada Wind Turbine Noise and Health Study, Request for Raw Data Elements.
- [78] ATIP (2015) Access to Information and Privacy Request. Health Canada Wind Turbine Noise and Health Study, Request for Raw Data Elements.
- [79] Barry, R., Sulsky, S.I. and Kreiger, N. (June 2018) Using Residential Proximity to Wind Turbines as an Alternative Exposure Measure to Investigate the Association between Wind Turbines and Human Health. *The Journal of the Acoustical Society of America*, 143, 3278-3282.
<https://docs.wind-watch.org/Residential-proximity-wind-turbine-health-exposure.pdf>
<https://doi.org/10.1121/1.5039840>
- [80] Federal Court of Canada (July 9, 2018) Mr. Justice Grammond. Dockets: T-335-17, T-336-17. Ottawa, Ontario, Canada. Citation: 2018 FC 710. *Doshi v. Attorney General of Canada*.
- [81] Rideout, K., Copes, R. and Bos, C. (January 2010) Wind Turbines and Health. National Collaborating Centre for Environmental Health.
http://www.nccch.ca/sites/default/files/Wind_Turbines_January_2010.pdf
- [82] CMOH (May 2010) The Potential Health Impact of Wind Turbines. Chief Medical Officer of Health Report.
http://www.health.gov.on.ca/en/common/ministry/publications/reports/wind_turbine/wind_turbine.pdf
- [83] Krogh, C. and Horner, B. (2017) Human Health, Rights and Wind Turbine Deployment in Canada. *Open Journal of Social Sciences*, 5, 166-185.
https://file.scirp.org/pdf/JSS_2017051714591773.pdf
<https://doi.org/10.4236/jss.2017.55012>
- [84] Jarošinska, D., Héroux, M.-È., Wilkhu, P., Creswick, J., Verbeek, J., Wothge, J. and Paunovic, E. (2018) Development of the WHO Environmental Noise Guidelines for the European Region: An Introduction. *International Journal of Environmental Research and Public Health*, 15, 813.
<https://doi.org/10.3390/ijerph15040813>
- [85] Poulsen, A.H., Raaschou-Nielsen, O., Pena, A., Hahmann, A.N., Nordsborg, R.B., Ketzler, M., Brandt, J. and Sorensen, M. (2018) Short-Term Nighttime Wind Turbine Noise and Cardiovascular Events: A Nationwide Case-Crossover Study from Denmark. *Environment International*, 114, 160-166.
<https://www.sciencedirect.com/science/article/pii/S0160412017317889>
<https://doi.org/10.1016/j.envint.2018.02.030>
- [86] Kasprzak, C. (2014) The Influence of Infrasound Noise from Wind Turbines on EEG Signal Patterns in Humans. *Acta Physica Polonica A*, 125, A20-A23.
<http://docs.wind-watch.org/Kasprzak-2014-infrasound-wind-turbines-EEG.pdf>
<https://doi.org/10.12693/APhysPolA.125.A-20>
- [87] Weichenberger, M., Bauer, M., Kühler, R., Hensel, J., Forlim, C.G., Ihlenfeld, A., et al. (2017) Altered Cortical and Subcortical Connectivity Due to Infrasound Administered near the Hearing Threshold—Evidence from fMRI. *PLoS ONE*, 12,

- e0174420.
<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0174420>
<https://doi.org/10.1371/journal.pone.0174420>
- [88] Cooper, S.E. and Chan, C. (2017) Subjective Perception of Wind Turbine Noise—The Stereo Approach. *Proceedings of Meetings on Acoustics*, Vol. 31, New Orleans, Louisiana.
<http://acousticalsociety.org/>
- [89] Fredianelli, L., Carpita, S. and Licitra, G. (2018) A Procedure for Deriving Wind Turbine Noise Limits by Taking into Account Annoyance. *Science of the Total Environment*, 648, 728-736.
<https://www.sciencedirect.com/science/article/pii/S0048969718330717?via%3Dihub>
<https://doi.org/10.1016/j.scitotenv.2018.08.107>
- [90] WHO (2018) World Health Organization. Environmental Noise Guidelines for the European Region. Dr Zsuzsanna Jakab. WHO Regional Director for Europe. Regional Office for Europe.
http://www.euro.who.int/__data/assets/pdf_file/0008/383921/noise-guidelines-eng.pdf
- [91] WCO. Wind Concerns Ontario (July 17, 2018) Ottawa Area Community Ramps up Wind Farm Fight.
<https://ottawawindconcerns.com/tag/ontario-ministry-of-environment/>
- [92] North Stormont v. Ontario, Ministry of Environment and Climate Change (June 20, 2018) Case 18-028, Ontario Environmental Review Tribunal. Renewable Energy Approval Appeal. Nation Rise Wind Power Project. North Stormont, Ontario. Witness Statement by Wilson JE.
- [93] GEA (Green Energy and Green Economy Act, 2009) S.O. 2009, c. 12-Bill 150, Ontario, Canada. An Act to Enact the Green Energy Act, 2009 and to Build a Green Economy, to Repeal the Energy Conservation Leadership Act, 2006 and the Energy Efficiency Act and to Amend Other Statutes. Schedule G, 48.
<https://www.ola.org/sites/default/files/node-files/bill/document/pdf/2009/2009-05/bill---text-39-1-en-b150ra.pdf>
- [94] BioInitiative Working Group. Sage, C. and Carpenter, D.O., Eds. (December 31, 2012) BioInitiative Report: A Rationale for Biologically-Based Public Exposure Standards for Electromagnetic Radiation. Appendix 20-B. Standards of Evidence for Decision making Differs among Professions Pg 7, 8 Appendix III for Levels of Proof Schema.
<http://www.bioinitiative.org/>
- [95] ATIP (2012) Access to Information and Privacy request. Health Canada. Innovation and Technology: Ensuring Health Benefits and Managing Risks for Canadians. Presentation by Paul Glover, Director General, Safe Environments Programme. AWMA Conference Calgary, September 16, 2005.
- [96] ATIP (2012) Access to Information and Policy request. Health Canada Policy and Research Approach for Wind Turbine Noise. A Presentation to the Science Advisory Board. Policy.
- [97] Berglund, B., Lindvall, T. and Schwela, D.H., Eds. (1999) Guidelines for Community Noise. Part 5. Noise Management. WHO, World Health Organization.
<https://www.who.int/docstore/peh/noise/Comnoise-5.pdf>
- [98] McMurtry, R.Y. and Krogh, M.E. (2014) Diagnostic Criteria for Adverse Health Effects in the Environs of Wind Turbines. *JRSM Open*, 5.
<http://shr.sagepub.com>
[http://www.ncbi.nlm.nih.gov/pubmed/?term=Diagnostic criteria for adverse health effects in the environs of wind turbines](http://www.ncbi.nlm.nih.gov/pubmed/?term=Diagnostic+criteria+for+adverse+health+effects+in+the+environs+of+wind+turbines)
<https://doi.org/10.1177/2054270414554048>
- [99] 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>

[Full-Text](#)

0 Comments OALIB_Open Access Library  Login ▾

 Recommend  Tweet  Share Sort by Best ▾



Start the discussion...

LOG IN WITH

OR SIGN UP WITH DISQUS 

Name

Be the first to comment.

ALSO ON OALIB_OPEN ACCESS LIBRARY

The elliptic quantum algebra $U_{q,p}(\hat{sl}_N)$ and its ...

1 comment • 2 years ago

essay writing — This elliptic quantum algebra and its vertex operators seems confusing but still, there might be ...

Implementations of ICT Innovations: A Comparative Analysis in terms ...

1 comment • 2 years ago

Plato Republic-law of kamaat — world of ict should be used to propagate the GOSPEL

Nasal septum perforation in patient with pyoderma gangrenosum

1 comment • 3 years ago

Romaine Go1 — Thoughtful analysis ! BTW if you want a CA SS-8572 , my wife filled out and faxed a fillable ...

Minimal access mediastinal surgery: One or two lung ventilation?

1 comment • 2 years ago

Rickie Paradise — my business partner was needing PA DoR REV-1220 AS earlier today and saw a website that ...

 Subscribe  Add Disqus to your siteAdd DisqusAdd

 Disqus Disqus Disqus Disqus