WCO | WIND CONCERNS ONTARIO

Response to Health Canada's WIND TURBINE NOISE AND HEALTH STUDY

November 25, 2014

Introduction

The people of Ontario have been waiting for more than two years for Health Canada's report on its Wind Turbine Noise and Health Study. On November 6, 2014, a summary of the results were released but still, no report is available or published. Similarly, no article has yet been published and the data and analysis are also not available. Higher research standards are expected for the $2.1-million, publicly-funded study that is completed for Health Canada by Healthy Environments and Consumer Safety, the regulatory body.

It is our view that the issues of process are important as, on the surface, the Health Canada summary report appears to provide contradictory results. In some parts of the study results, it is claimed that no association between wind turbine noise and health effects were found. However, in other parts, high levels of annoyance were significantly linked statistically to wind turbine noises, with this annoyance then being linked to health effects.

In response to the release of the summary, Wind Concerns Ontario (WCO) immediately convened an expert panel[1] of reviewers to analyze the summary report, as well as other available material including a PowerPoint presentation provided to us in a briefing session with Health Canada in Ottawa, on November 7, 2014.

The following report summarizes the conclusions that this panel has reached, based on the available information.

A. Health Risks Confirmed

The preliminary results released by Health Canada indicate that the study has found some important and statistically valid associations between wind turbines and adverse health effects. While other parts of the study reach different conclusions, it is important at the start to review these findings and look at the immediate direction it is providing to the future wind turbine projects.

1.0 Annoyance

[1] The panel consisted of several university professors and researchers with expertise in health research, environment, and physics; an epidemiologist; acoustics specialist; and engineers with specialization in fluid dynamics, sound and vibration.

The key finding of the summary report is the statistical association between increasing levels of wind turbine noise and annoyance. The summary report includes the following statement:

> *Statistically significant exposure-response relationships were found between increasing WTN levels and the prevalence of reporting high annoyance. These associations were found with annoyance due to noise, vibrations, blinking lights, shadow and visual impacts from wind turbines. In all cases, annoyance increased with increasing exposure to WTN levels.*[2]

The Results Overview presented to WCO indicated that 25% of Ontario respondents living close to wind turbines were very annoyed or extremely annoyed by wind turbine noise.[3]

It is noted that the questions dealing with annoyance asked respondents to think about the last 12 months; this perhaps avoids the issues associated with the seasonal trends of wind turbine noise that may have affected questions on other health effects discussed in subsequent sections. Question PNS_Q105 is an example of the wording:

> *Thinking about the last 12 months, when you are at home, how much does noise from wind turbines bother, disturb or annoy you?*[4]

As the respondent is encouraged to think about the past 12 months, there is less need to validate that the predicted levels of wind turbine noise were present in the period covered by the survey. It is reasonable to assume that period involved in the questions appropriately aligns the question with the "yearly average" noise level estimates that are being used as the second variable in the association.

Finding high levels of annoyance with wind turbines links this study to World Health Organization (WHO) research. Though it is not mentioned in the summary that has been released to this point, the WHO considers high levels of annoyance as an adverse health effect. This is an excerpt from the WHO publication *Burden of Disease from Environmental Noise* published in 2011.

> *WHO defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Therefore, a* ***high level of annoyance*** *caused by environmental noise should be considered as one of the environmental health burdens.* [5]

On this basis, the high levels of annoyance identified in the study would seem to qualify as a serious health risk that should require action by provincial and federal health authorities.

The definition of "highly annoyed" should be provided when the final version of the study is released but for the purposes of this analysis, it has been assumed to be the sum of "very annoyed" and "extremely annoyed" responses to the survey questions. This would seem to align with the much referenced field study in Europe addressed this question as follows: Pedersen et al. (2009) presented

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[2] Health Canada, Preliminary Research Findings, Wind Turbine Noise and Health Study, Summary of Results, November, 2014

[3] Results Overview, Health Canada's Wind Turbine and Noise and Health Study, Fall 2014, pg.11

[4] Health Canada, Questionnaire, Community Noise and Health Study, January 2014

[5] http://www.euro.who.int/__data/assets/pdf_file/0008/136466/e94888.pdf

the results of a 2007 field study in the Netherlands and related it to an earlier Swedish study.[6] Their cohort was asked to report whether they: did not notice, noticed, were slightly annoyed, rather annoyed or very annoyed. The last two categories were then grouped as annoyed. On this basis, and for the combined studies, the fraction annoyed was 26% ± 5% for the range 40 to 45 dBA.

2.0 Applicability of WHO Standard to Wind Turbine Noise

The World Health Organization's Night Noise Guidelines for Europe (2009) were identified as a benchmark for this Health Canada study in the early research design:

> *The WHO's Night Noise Guidelines for Europe (2009) cites sleep disturbance as a potential* ***indirect health impact of environmental noise*** *for yearly averaged night time outdoor sound levels at the residence higher than 40 A-weighted decibels (dBA). It has been reported in some studies that the 40 dBA sound level may be exceeded at some residences, suggesting the potential for sound from wind turbines to disturb sleep among sensitive individuals*[7]

There is no mention in the WHO guidelines of the standard applying to wind turbine noise as it was designed to apply to aircraft, road and rail traffic, industrial and construction noise, neighbours and recreation. In the 2012 preamble to the Health Canada study, Michaud et al. acknowledged that the WHO Night Noise Guidelines are based on transportation noise sources.

However, Michaud et al. then went on to state, without attribution, that "current science shows that the same levels are applicable to noise emitted from wind turbines."[8] **No such current science is available** and none is referenced by Michaud et al. On the contrary, wind turbine noise is generally seen as considerably more annoying than noise from other sources at the same sound pressure level.[9] While the European field studies found annoyance in 20 to 25% of the population for wind turbine noise at the 40 dBA level, Miedema and Vos measured annoyance in the range 2 to 4% for traffic noise at the 40 dBA level.[10] Both the European field studies and the traffic study were peer-reviewed and published in the highly regarded Journal of the Acoustical Society of America. It is noted that no statements linking the WHO Night Noise Standard to wind turbine noise were included in the final research design.

The difference in annoyance between noise from wind turbines and other sources of noise is readily understood.[9] The amplitude modulation draws attention to the noise in the same way that the rotating blades draw the eye. There is the thumping associated with the blades rotating in a vertical wind speed gradient and in turbulent air. There are large low frequency and infrasound components in the acoustic spectrum of the noise.

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[6] Pedersen, E., Van den Berg, F., Bakker, R., and Bouma, J. (2009). Response to Noise from Modern Wind Farms in the Netherlands, J. Acoust. Soc. Am., 126, 634-643.

[7] Health Canada, Background, Health Impacts and Exposure to Sound From Wind Turbines: Updated Research Design and Sound Exposure Assessment, 2012

[8] Health Canada, Health Impacts and Exposure to Wind Turbine Noise: Research Design and Noise Exposure Assessment, 2012

[9] C. D. Hanning and A. Evans (2012) "Wind turbine noise", British Medical Journal 344, e1527.

[10] H. M. Miedema and H. Vos (1998). "Exposure response relationship for transportation noise." Journal of the Acoustical Society of America 104 3432-3445.

The preliminary results of the Health Canada study have now provided additional confirmation that the WHO guidelines are not applicable to wind turbine noise. In the Results Overview provided to WCO, Health Canada reported that annoyance with wind turbine noise was found to begin at lower sound levels (i.e., 35 dBA).[11] The Results Overview specifically highlighted that this is very different than is the situation with aircraft, rail or road traffic which are the subject of the WHO Night Time Noise Standard.

These findings suggest that the Ontario guidelines for audible turbine noise and their related set-backs from occupied residences, can no longer be considered safe; they are based on the 40 dBA standard that is not supported by Health Canada research. Action is needed to be improved to provide adequate protection for residents being exposed to wind turbine noise.

3.0 Relationship of High Annoyance to Health Effects

The summary report goes further in confirming the WHO assessment that high annoyance is an adverse health effect recognized by finding statistically valid links to both self-reported health effects and some measured health conditions. The following findings are drawn from the summary released:

- *'WTN annoyance was found to be statistically related to several self-reported health effects including, but not limited to, blood pressure, migraines, tinnitus, dizziness, scores on the PSQI, and perceived stress.*
- *WTN annoyance was found to be statistically related to measured hair cortisol, systolic and diastolic blood pressure.*
- *The above associations for self-reported and measured health endpoints were not dependent on the particular levels of noise, or particular distances from the turbines"*[12]

In the report, Health Canada makes other statements about "Community Annoyance" and it will be interesting to see how the peer-review process addresses those questions relative to the links that are reported in the summary findings as being statistically valid.

B. Impact of Study Design on Other Results

While the summary report finds some statistically valid links between wind turbines and some health issues, other sections of the report provide conflicting results with some sections finding no association between wind turbines and health issues. The following section provides some comments on the methodology used in the study and sources of potential bias that could contribute to these conflicting results. Wind Concerns Ontario hopes that the peer-review process will address these concerns, and help resolve the conflicting results in the report.

1. Infrasound vs. Audible Noise

Current investigations by acousticians underway in Ontario homes most affected by wind turbine noise are focusing on infrasound as it is generally now believed to be the main cause of health effects from wind turbines. Other factors may contribute, but the main cause is infrasound.

[11] Results Overview, Health Canada's Wind Turbine and Noise and Health Study, Fall 2014, pg. 11.
[12] Health Canada, Preliminary Research Findings, Wind Turbine Noise and Health Study, Annoyance and Health, November, 2014

In this context, it is not surprising that the Health Canada study did not find a strong association between health effects and wind turbine noise, as defined by Health Canada, as the Health Canada definition primarily focused on the audible range of noise spectrum. Current work underway in homes affected by wind turbines may well support this conclusion, but the final report should be adjusted to include revised definitions to indicate that the study was testing the association between **audible noise** and various health effects. Finding no association between audible wind turbine noise and various types of health effects do not preclude the impact of other sound pressure waves that were not included in the study analysis.

Infrasound in problem homes has been shown to have most of its energy below approximately 3 Hz with the dominant energy appearing at 0.7 Hz (+/- 0.1 Hz), 1.4 Hz (+/-0.2Hz), 2.1 Hz (+/- 0.3Hz) and 2.8 Hz (+/- .4Hz). According to the Results Overview provided to WCO, all of these frequencies are below the lowest frequency considered in the study. This summary indicated that for both the LFN recordings and the infrasound that the lowest frequency recorded or considered for prediction purposes was above 6 Hz. The dBC weighting is only specified down to 10 Hz.[13]

The Results Overview provided to WCO also proposed that an indoor limit of between 60 and 65 dBC be adopted for noise sources that operate in a rural environment. [14] Measurements in the vacant homes show un-weighted levels of infrasound over 50 dB. The health impact of this level of sound pressure waves was sufficient to force residents to relocate. The standard proposed by Health Canada would allow noise emissions that are at least 30 dB higher than is present in these homes.

If Health Canada, in its role as a health regulator, is going to set limits for low frequency noise and infrasound, it should be completing testing in homes where residents are experiencing problems to validate the baseline. Without this follow-up, Health Canada is not acting properly to protect the health of Canadians. People who have lived with wind turbine noise emissions would say that the limit should not be based on whether or not the noise level rattles light-weight structures, but, rather, reflect the frequency and sound pressure level at which sound pressure waves can cause pulsing sensations in bodies of humans exposed to it.

It is also important to note that the magnitude of the infrasound emitted by any given wind turbine is physically dependent on the power level at which the subject turbine is actually operating. That is, the infrasound emission is dependent on the actual torque being delivered to the generator inside the nacelle from the wind turbine blades themselves. This is directly proportional only to the electrical power being generated at the exact time. Simply having the wind turbine rotating does not mean that infrasound is being emitted because the infrasound is a direct result of the pressure differential across the turbine blades interacting with the tower. This pressure differential is dependent on the amount of power the turbine is delivering which could be zero even if the turbine is rotating at normal speed (i.e., if the turbine is disconnected from the grid, it will not generate any power or infrasound), the turbine could still generate noise, but very little infrasound.

[13] Results Overview, Health Canada's Wind Turbine and Noise and Health Study, Fall 2014, pg. 5.
[14] Results Overview, Health Canada's Wind Turbine and Noise and Health Study, Fall 2014, pg. 16.

Since turbine power level is not monitored or recorded by the acoustics people as a part of the measurement of infrasound, it is in fact impossible for any statistical model to predict the infrasound levels generated by any other turbine at any distance at any time.

2. Effect of Seasonality

Based on the information released in the summary, the study largely uses **estimates** of yearly averages for the wind turbine noise that the house receives as a surrogate for **actual** noise exposure that the participants living in the house will be exposed.

The research design supports this approach by outlining the challenges in measuring actual noise at a large number of participant locations as follows:

> *Due to the large number of subjects, sound exposures will be based on predictions. A sub-sample of measurements will be taken at each selected site to validate predictions. This approach is considered preferable due to the technical limitations of measurement. Modeling is considered more accurate in representing average wind turbine sound levels than discrete measurements, which are sensitive to fluctuating variables and do not discern between sources of sound. If measurements were to be used instead of predictions, using the current design, measurements would have to be taken at each receptor and in all four seasons under all relevant weather conditions, which is not feasible in the present study. For these reasons, measurements are often more difficult to carry out in addition to the error and uncertainty levels associated with direct measurements. Predictions, on the other hand, have more general applicability, have relevant factors built into the prediction model and are more feasible in large scale studies.*[15]

This assessment recognizes the seasonal nature of wind turbine noise in Ontario where turbines only operate at 30% of rated capacity as the wind resource is variable. In the fall and spring periods, winds in Ontario tend to be stronger for extended periods than in the summer months.

The questionnaire design does not always recognize the seasonal nature of wind turbine noise and respondents are asked about their experiences over the past **30 days** for many of the key attributes in sections dealing with quality of life, perceived stress and the Pittsburgh Sleep Quality analysis. Comparing these responses against **yearly averages** of calculated wind turbine noise is misleading unless steps are taken to validate that the yearly averages are representative of the noise experienced in the 30-day time period covered by many questions in the questionnaire.

The results released do not provide information on the time period when the actual questionnaires were administered, and no information is provided on the steps taken to validate that the estimated wind turbine noise during the period covered by the questions reflected the actual situation experienced by the respondent. (One participant in the survey living in Chatham-Kent has come forward to a local media outlet following the release of the Health Canada summary, indicating that she was questioned during the summer months when there are fewer problems with wind turbine noise. She said her response to the questions would have been very different had the timeframe referred to periods when the wind turbines were actually operating.)

[15] Health Canada, Wind Turbine Sound Characterization, Health Impacts and Exposure to Sound From Wind Turbines: Updated Research Design and Sound Exposure Assessment, 2012

Similar issues need to be addressed relative to the information obtained from the Sleep Actimetry portion of the study. As participants were only given the measurement device to wear for seven (7) days, there is an even larger risk that some or all of the study period will include times when winds were not sufficient to generate the predicted level of wind turbine noise. No information was provided in the summary results that indicate that participants who wear the sleep measurement devices during periods when the predicted noise levels were not present were removed from the study sample.

3. Consideration of Wind Direction

The relative locations of the home being studied and the wind turbine(s) are also critical considerations as the majority of the infrasound from wind turbines emanates from the down-wind side of the turbine. For this reason, the absence of information on wind direction in the analysis released as part of this study of wind turbine noise is an important gap. Only homes down-wind of a wind turbine can be expected to have a correlation between health issues and wind turbines. Considering upwind homes in the statistical analysis only dilutes the statistical validity of the samples where there is a connection.

4. Accuracy of Wind Turbine Audible Noise Modeling

The accuracy of the sound models used to predict wind turbine noise is a key concern as follow up compliance testing shows a substantial variation between measured sound pressure levels being up to 15 dBA above the predicted levels. The research design indicated that this would be validated as part of the Health Canada study: "*The predicted levels will be validated by at least one acoustical measurement at each survey location for each model of wind turbine to which the survey subjects are exposed."*[16]

The summary gives almost no useful information on the measured turbine noise so it is not possible to review the results of this validation work. The compliance testing work suggests that the models currently available are too simple to capture all of the variables involved in measuring wind turbine noise. The fact that noise passes through a real environment with hilly topography blocking and amplifying sounds, with nearby buildings blocking and deflecting sound, and with variable surface conditions are all factors that are ignored in the assessment process used by Ontario's Ministry of the Environment. The Heath Canada study only considers noise from the closest wind turbine while many homes in Ontario are exposed to cumulative noise from multiple wind turbines. The available models are not capable of capturing the impact of wind turbine sound pressure waves being affected by a downstream wind turbine and emitted towards the receptor/home.

5. Treatment of Vacant/Demolished Homes

Studies provided to Health Canada in 2012 as part of the public consultation on the study design provide documentation of situations where problems with the noise emissions from wind turbines caused families to move out of their homes, leaving behind structures that remain vacant. Some have been purchased by wind power developers and are demolished.

The approach used by Health Canada in this study would be comparable to an investigation of sensitivity to peanuts by exposing a population without their consent by infiltrating the air and water with peanut allergen and then coming back a month or a year later to study the effects on the remaining residents.

[16] Health Canada, Wind Turbine Sound Modeling, Health Impacts and Exposure to Sound From Wind Turbines: Updated Research Design and Sound Exposure Assessment, 2012

Those most at risk or severely affected have died or left the area and therefore introduced bias into the study. The analogy may seem absurd but it is exactly how residents of rural Ontario were treated with wind turbine projects and the Health Canada study.

It is acceptable to have a purposive sample for study but there must be justification, and there must be a focus on the group that is relevant.

The results of the study indicated that there was no follow-up on the 336 homes vacant or demolished homes that were included in the sample selected for the study. This approach was justified as necessary to protect the integrity of the random sample, even though the approach used by Health Canada introduced an important bias into the study from the perspective of those who are familiar with the people and events that have occurred within the project area.

This process gap is a particular concern to Dr. Hazel Lynn who as Medical Officer of Health for Grey-Bruce has been at the front line of dealing with the health issues related to wind turbines. She says, "when you look at some of the surveys that have the most specific information it's the people who are so distressed they have to move away that actually are the most sensitive to these things. So to exclude them from a study doesn't really make sense to me."[17] "Although the wind folks would pooh-pooh those people (who have moved away) as being especially difficult, I think they are especially sensitive and if you are living in a place where you are afraid to go to sleep at night then you are going to move. Obviously this study didn't pick up any of those folks."[18]

Migration in and out of areas of interest in epidemiological studies is not abnormal but should be accounted for if it could influence the study outcome – as appears to be the case in this study particularly as the 336 or 27% of the remaining sample were eliminated through this process. The decision to exclude vacant and demolished homes introduces potential for substantial bias in the study. For this reason, the homes removed from the sample need to be assessed in terms of distance from turbines and the potential for turbine noise impact. This would indicate appropriate rigor in the study, and is to be hoped for in future releases of information, and the full report.

6. Inclusion of Participants Receiving Benefits

The study included 110 participants (or 9% of the total sample) who acknowledged receipt of direct or indirect personal benefits from the wind turbine project. The summary results indicated that:

> *Annoyance was significantly lower among the 110 participants who received personal benefit, which could include rent, payments or other indirect benefits of having wind turbines in the area e.g., community improvements.*[19]

It is not a surprise that the study encountered people who were benefiting from the turbine project as people who have leased land to the wind turbine company are generally the most likely to remain in their communities after the turbines start operation. Most turbine leases contain clauses that prevent

[17] Comments by Dr. Lynn as quoted by Janice MacKay, Grey-Bruce Medical Officer Reacts To Health Turbine Study, CKNX News, Blackburn News, November 12, 2014

[18] Comments by Dr. Lynn as quoted by Rob Gowan, Those who move away not part of turbine study, Owen Sound Sun-Times, November 7, 2014

[19] Health Canada, Preliminary Research Findings, Wind Turbine Noise and Health Study, Summary of Results, November, 2014

the leaseholders from making statement about turbine operations. They are also under substantial community pressure to avoid admitting to any problems related to wind turbines. For this reason, it is not surprising that the study found significantly lower annoyance among study participants who received benefits.

The more important question is the degree to which the inclusion of these biased participants diluted the responses from non-benefiting participants. The final study should remove the benefiting participants from the sample and rerun the tests without including this biased group.

7. Study Fails to Meet Stated Sample Size and Target Statistical Power Calculations

The Updated Research Design and Sound Exposure Assessment established specific targets for the sample size of the study to ensure that the results were valid. The following statement set out very specific targets for the sample size needed to detect sleep disturbance.

> *As sleep disturbance is a frequent health complaint associated with WTN in observational and case studies, one of the primary research objectives in the study is to quantify the magnitude of sleep disturbance due to WTN. There are currently no population-based normative data that are derived from actimetry from communities exposed to WTS. Therefore, statistical power in the study is based on reported sleep disturbance. Estimated sleep disturbance in the general adult population is approximately 10% (Riemann et al., 2011; Tjepkema, 2005), with some estimates as high as 40% (National Sleep Foundation, 2005). In calculating the sample size needed for statistical power to detect a sleep disturbance in this study, the conservative estimate of 10% will be used. Based on a sample of 2000 dwellings and assuming that 20% of the sample live in close proximity to wind turbines (at 40 dBA or above) investigators will be able to detect at least a 7% difference in prevalence rates between the general population and the sample of individuals living in closest proximity to wind turbines, with a 5% false positive rate and a power of 80%.*
>
> *This sample size calculation incorporates the following assumptions: a) there will be an 80% occupancy rate for dwellings in rural areas and b) there will be a 70% participation rate for sleep actimetry. A sample size of 1800 dwellings would be required, however given the possibility that not all assumptions may be met and that prevalence rates will be adjusted for other covariates in a logistic regression model (for example gender, age, receiving financial benefit, house construction type among others), the sample has been increased to 2000 dwellings. Based on the estimated sample size of 2000 dwellings, all other objective endpoints should be equally predicted with similar confidence. Other studies that have used actimetry to characterize aircraft sound impacts on sleep are based on far fewer subjects (Passchier-Vermeer et al., 2002; Fidell et al., 1995; Horne et al., 1994; Ollerhead et al., 1992).*[20]

Based on the information provided in the summary, 1,570 locations were included in the study and the number of participants in the study is shown as 1,234. The actual study sample does not appear to meet

[20] Health Canada, Statistical Power, Health Impacts and Exposure to Sound From Wind Turbines: Updated Research Design and Sound Exposure Assessment, 2012

the statistical sample requirements required to establish a statistical power of 80% set out in the Research Design.

No details of the analyses completed for the study and no confidence limits have been provided for the analyses of "reported sleep disturbance" analyses and "all other objective endpoints" in summary report. Since the study appears to have failed to meet its own sample size and target power calculations, there is reason to question where the study has the statistical power to discern the prevalence of the key outcomes as identified in the protocol.

This type of validation is a core part of the peer-review process and a reason why the findings should not have been released until validated in a peer-review process and the study accepted for publication in an academic journal.

8. Exclusion of Children from Study

The study design excluded children under the age of 18. No children were included in any portion of the study, despite the fact that children are a vulnerable population. Aside from being in the developmental stage of life where environmental factors can affect health in the short and long term, children are dependent on the decisions of others and cannot remove themselves from situations. Normally Health Canada requires data on children for other studies, such as approval of pharmaceuticals; capturing some information on health conditions (e.g., hair samples to measure cortisol levels) would have been appropriate for this study.

9. Identification of Study Locations

In the study design, it was stated that the "rationale for both the provincial and community selection will be provided upon completion of the study" as earlier release would introduce an awareness bias into study. The study has been completed but the information on the study locations still has not been released which prevents the proper evaluation of the study results. The following factors raise concerns.

Age of Turbine Project – Turbine projects start affecting the host community shortly after the project is announced. These changes accelerate after the projects become operational and people start to experience the actual sound pressure waves being generated by the project. Those most seriously affected start to move out within six months after the project becomes operational and these changes continue over the following year. As the project matures, this process continues meaning that only those individuals who are not affected by the noise emissions from the wind turbine project continue to live in the area.

Turbine Size –Without information on the size of the turbines in the study areas, it is not possible to properly evaluate the applicability of the study results to projects currently under development in Ontario. For example, during the Stakeholder Meeting with Wind Concerns, Health Canada indicated that the majority of the turbines studied in PEI were 600kw installations. These turbines have height and noise emission characteristics from the 2.5 MW turbines that are more extensive in Ontario. Both turbines will have different impacts on their surrounding communities than the 3.0 MW turbines more recently planned for Ontario.

Variation in Annoyance - Some statistically different findings were reported between PEI and Ontario were reported in the study but it is not possible to determine if this is due to a variation in

pre-conceived attitudes toward turbines, to different noise output characteristics from different sizes of wind turbines, or different geographic environments for the projects that either create higher levels of ambient noise or topography that masks the turbine noise from the residents.

10. Study Conclusions

The summary released by Health Canada draws very specific conclusions from the study that suggests the absence of links between wind turbine noise and specific health issues:

> *The following were not found to be associated with WTN exposure:*
> *• Self-reported sleep (e.g., general disturbance, use of sleep medication, diagnosed sleep disorders);*
> *• Self-reported illnesses (e.g., dizziness, tinnitus, prevalence of frequent migraines and headaches) and chronic health conditions (e.g., heart disease, high blood pressure and diabetes); and*
> *• Self-reported perceived stress and quality of life.*[21]

These conclusions significantly conflict with other results from the study that found connections to other health effects. This section has outlined a number of questions about the methodology used to reach the above conclusions. It is expected that in the peer-review process that steps will be taken to correct these issues and close the gap between the conflicting perspectives.

C. Objectives of Study

When the research study was announced in 2012, Health Canada was very careful to limit the expectations of the study. It was being undertaken to strengthen the evidence base for government and other stakeholders, but it was not designed to provide definitive answers on health issues related to wind turbines. In particular, the study design specifically stated: *"this design does not permit any conclusions to be made with respect to causality".*[22]

The summary report has a different perspective on the findings. After the study was completed, it was the *"results"* that did *"not permit any conclusions about causality"*[23], suggesting that study itself was unable to prove causality.

Despite this limitation in the research design, the summary released by Health Canada draws very specific conclusions from the study. Canadians trust Health Canada to make regulatory decisions based on valid evidence. The manner in which Health Canada has moved from referencing the constraints of the study **design** and assigned the limitation to the **results** of the study, and then proceeded to draw very specific conclusions about association between wind turbine noise and various medical conditions undermines that confidence of Canadians. It is reasonable to assume that these flaws will be corrected

[21] Health Canada, Self-Reported Questionnaire Results Wind Turbine and Noise and Health Study, Summary of Results, November, 2014
[22] Health Canada, Research Outcomes and Limitations, Health Impacts and Exposure to Sound From Wind Turbines: Updated Research Design and Sound Exposure Assessment, 2012
[23] Health Canada, Preliminary Research Findings, Wind Turbine Noise and Health Study, Summary of Results, November, 2014

in the peer-review process but it will be difficult to undo the damage caused by the release of the preliminary results and the preparation of a pamphlet for circulation that builds on these errors.

The most immediate impact is on those people who have been affected by wind turbine noise. Once again a government agency charged with protecting their health is minimizing the public's perception of the adverse impacts without scientific justification.

C. Premature Release of Summary Report

The feedback from the expert panel assembled by WCO has raised a number of issues with the report and its conclusions. This feedback plus the conflicting results from various parts of the study should have suggested that Health Canada go slow in releasing the results of their research. Instead, the process used by Health Canada to release a summary of the study is contrary to established protocols for scientific research.

Normally studies are released when the peer-review process is complete and the study is published in a peer-reviewed literature. The data and analysis on which the study is based are also generally released at the same time as the report is published in order to allow the conclusions to be confirmed. This process gap is particularly concerning given the apparent contradictions in the findings coming out of the study. Normally these contradictions would be resolved through the peer-review process.

The Health Canada website claims that it depends on a strong foundation of science and research to fulfill its mission to help Canadians maintain and improve their health. The approach used by Health Canada for this study raises very serious questions about commitments to proper scientific research.

The pamphlet summarizing the report was prepared for use on the website and also for distribution by mail in the subject areas (in place of personal appearances by the study team, as might be expected) in turbine affected areas. It makes several statements about the results but only in fine print at the end correctly indicates that "*these results are considered preliminary until published in the peer-reviewed scientific literature*." [24]

The pamphlet produced by Health Canada also makes several unsubstantiated and inappropriate claims about the study given that it has not been peer-reviewed or published in a recognized journal. The following statement represents a particular risk to Health Canada's reputation:

> *The Wind Turbine Noise and Health Study is a landmark study and the most comprehensive of its kind. Both the methodology used and the results are significant contributions to the global knowledge base and examples of innovative, leading-edge research.*[25]

If Health Canada was concerned about its reputation as a leading health organization, it would be more appropriate to wait until the peer-review process is complete before claims of that nature are made on

[24] Health Canada, Preliminary Research Findings, Wind Turbine Noise and Health Study, Summary of Key Findings, November, 2014

[25] Health Canada, Preliminary Research Findings, Wind Turbine Noise and Health Study, Summary of Key Findings, November, 2014

behalf of this study. The pamphlet is already being distributed by a number of companies proposing wind turbine projects in rural Ontario to support their projects.

Wind Concerns Ontario recommendations

Wind Concerns Ontario, as a coalition of community groups and individuals in Ontario concerned about the impact of industrial-scale wind turbine and wind power generation projects on the environment and human health, is disappointed that the Health Canada study seems to be a lost opportunity to truly investigate the source of the hundreds upon hundreds of complaints that the government department admits it receives, and are the source of the need to do a study.

While the study does link wind turbines to some serious health effects, the conflicting nature of the results and the numerous questions about the research process and data analysis, lead WCO to recommend:

- Health Canada should remove the summary findings from the Health Canada website in their current version
- Health Canada should release the final report only after it has gone through the normal peer-review process and been accepted for publication in a recognized academic journal
- Health Canada should return to the study areas and present the study findings in a series of public meetings, as befitting a publicly-funded research project
- Health Canada should rescind the “pamphlet” in its current form and if such a publication is deemed necessary, remove the claims about the “comprehensive” nature of the study, and further, affix the disclaimer more prominently.

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