

WCO | **WIND CONCERNS ONTARIO**

Evaluating Ontario Regulations for Siting Turbines
in Context of
Findings from the Health Canada Study

December 3, 2014

Executive Summary

- The Ontario Ministry of the Environment and Climate Change regulates wind turbines in Ontario based on a series of regulations dating back to 2009 when Ontario had only 690 wind turbines in operation.
- Based on the turbines being installed at that time, the minimum setback distance for wind projects was established at 550 metres; the distance that was deemed necessary to ensure noise levels do not exceed 40 decibels at the nearest residence.
- Health Canada studied wind projects in 2013 to assess the effects of wind turbine noise on nearby residents.
- Findings from the study released November 6 indicate that the standards for noise levels need to be tightened to 35 decibels to fully protect human health.
- Similarly, the data indicates the setback between the nearest residence needs to be increased to 1,300 metres, based on noise level predictions used in the Health Canada study.

1.0 Background

Current Ontario regulations related to wind turbine placement were created in 2008/2009 and their ability to protect Ontario residents from adverse health effects was apparently confirmed by a 2010 report from Dr. Arlene King, then Ontario's Chief Medical Officer of Health. Dr. King's report claimed to be a review of existing scientific evidence on wind turbine noise; it identified the need for further study in various areas.

Health Canada's study of Wind Turbine Noise and Health released on November 6 for the first time provides data from field studies of wind turbine projects in Ontario and PEI that can be used to evaluate Ontario's noise standards.

The following document compares the existing regulations in Ontario with the findings in the reports recently released by Health Canada and recommends actions for both the federal and Ontario governments.

2.0 Current Ontario Noise Regulations for Wind Farms

2.1. Noise Guideline for Wind Farms

In October 2008, Ontario took its first step to regulate wind turbine placement by publishing "Noise Guidelines for Wind Farms" which set out instructions for proponents of wind projects being developed in Ontario to apply existing published MOE NPC rules to their projects. This document established the following dBA limits for wind turbines projects in Class 3 or rural areas shown in the following table¹:

¹ Ontario, Ministry of the Environment, Noise Guidelines for Wind Farms, Queen's Printer for Ontario, October 2008, page 6.

Table 1: Summary of Sound Level Limits for Wind Turbines

Wind Speed (m/s) at 10 m height	4	5	6	7	8	9	10
Wind Turbine Sound Level Limits Class 3 Area, dBA	40.0	40.0	40.0	43.0	45.0	49.0	51.0

As shown in the table, the sound limits ranged from the lowest level of 40 dBA which are allowed at wind speeds of 4 metres/second up to a maximum value of 51.0 dBA which are allowed with wind speeds 10 metres per second and above.

The Noise Guidelines also set out very specific instructions for completing these tests and the formats for noise reporting that were to be submitted to the Ministry of the Environment as part of an application to proceed with a wind turbine project. The guidelines did not contain a specific setback distance from receptors – that was to be determined by assessment of the noise emitted by the wind turbine.

2.2. Renewable Energy Approvals

The second step in regulating wind turbines came in 2009 when the Ontario government issued Regulation 359/09 which set out the process for Renewable Energy Approvals under the *Environmental Protection Act*. In the initial draft released for comment on June 10, setbacks of 550 metres from all receptors were proposed along with property line setbacks of turbine hub height plus blade length. The wind power development lobby organization, the Canadian Wind Energy Association (CanWEA), immediately objected to these new guidelines, arguing that they would “jeopardize over three-quarters of all ‘construction ready’ wind projects in Ontario.”² Instead, CanWEA recommended property lines setbacks of blade length plus 10 metres³ and if the government still wanted to enact a mandatory specific setback, CanWEA proposed that the 550 metres only apply to non-participating receptors. CanWEA then stated that this approach “represents a reasonable and scientifically-sound solution that achieves the government’s goal of having minimum setbacks and allows development to continue while safeguarding the interests of the public in areas where investment and jobs are desperately needed in Southern Ontario’.⁴ CanWEA provided no justification supporting their statements that these setbacks were a “scientifically-sound” solution.

The Ontario government provided no scientific support for Regulation 359/09 but the government included the following rules which largely align with the position recommended by CanWEA:

53.2 b) the distance between the centre of the base of the wind turbine and any public road rights of way or railway rights of way is equivalent to, at a minimum, the length of any blades of the wind turbine, plus 10 metres

² Robert Hornung, Letter to Ministers Gerretsen and Smitherman, July 7, 2009, Comment ID 122973 to EBR Registry Number 010-6516, page 1.

³ Ibid, page 3.

⁴ Ibid, page 5.

*54.1 no person shall construct, install or expand a wind turbine ...unless the centre of the base of the wind turbine is located at a distance of at least 550 metres from all noise receptors*⁵

The sound level limits do not apply to “participating receptors i.e., a property that is associated with the Wind Farm by means of a legal agreement with the property owner for the installation and operation of wind turbines or related equipment located on that property.”⁶

2.3. Chief Medical Officer of Health’s Report

The first assessment of the health impact of wind turbines by the Ontario government came in 2010, when a literature review was issued by Ontario’s Chief Medical Officer of Health, Dr. Arlene King. This is the third piece of documentation that continues to drive the evaluation of wind turbine projects today.

The report supported Ontario’s minimum setback for wind turbines of 550 metres from receptors on the following basis:

*“modelling of sound produced by wind turbines and are intended to limit sound at the nearest residence to no more than 40 dB. This limit is consistent with limits used to control noise from other environmental sources. It is also consistent with the night-time noise guideline of 40 dB that the World Health Organization (WHO) Europe recommends for the protection of public health from community noise. According to the WHO, this guideline is below the level at which effects on sleep and health occurs.”*⁷

While the report also acknowledged the existence of key data gaps relative to noise levels in the areas around wind turbines that needed to be addressed, no studies of these issues have ever been undertaken, more than four years later. The CMOH report continues to be a critical piece of documentation used by the government to prove that the Ontario government has enacted a regulatory regime that protects the health of residents living near wind turbines.

In the recent Ontario Superior Court hearing in London for the case of *Drennan et al. v. Suncor Energy Inc. et al.*, the lawyer representing the Ministry of the Environment and Climate Change emphasized this report’s focus on the WHO’s Night Noise Standard of 40 dBA as proof that Ontario regulatory process offered necessary protection. Any noise below 40 dBA was safe and, even though the MOE allows noise levels up to 51 dBA, only noise levels above 40 dBA were causes for concern.

3.0 World Health Organization – Night Noise Standard

The World Health Organization’s (WHO) Night Noise Guidelines for Europe, identified as the key health benchmark for Dr. King’s report, was issued in 2009. They leveraged existing medical evidence on linkages between sleep and health to understand the night noise to health by assessing the impact of noise on sleep which in turn could be linked to health concerns. The study focused on noise in urban environments with a particular emphasis on road traffic and airport noise. They determined that road

⁵ Ontario Regulation 359/09, Updated to include O Reg 131/14, Service Ontario e-laws, May 2014.

⁶ Ontario, Ministry of the Environment, Noise Guidelines for Wind Farms, Queen’s Printer for Ontario, October 2008, pages 4& 13.

⁷ Dr. Arlene King, Chief Medical Officer of Health, The Potential Health Impact of Wind Turbines, May 2010, pg.8.

traffic noise with its low volumes per event but high frequency of events had different impacts than airport noise with its high volume per event but a low frequency of events.⁸

The study identified 40 dB as the lowest observed adverse health effect level for night noise. At 55 dB, cardiovascular events became a major public health concern. In the recommendations, the guidelines go on to state that closer examination of the precise impact will be necessary in the range between 30 dB and 55 dB as much will depend on the detailed circumstances of each case.⁹

In the WHO guidelines, no consideration was given to a noise source, like a wind turbine, which generates high levels of per event and continue over extended periods. This noise characteristic suggests that the effect on sleep could be substantially different than the road traffic and airport noise that was the subject of the studies behind the WHO Guidelines.

The WHO also acknowledged that the levels mentioned in the report do not take background noise into account. They do not note that background noise could obscure the effect of the lower end of the scale. This then influences the lowest level where an effect starts to occur.¹⁰

4.0 Other Approaches

4.1 Recognizing Wind Turbine Noise as Different

Since the publication of Dr. King's report, there have been a number of studies published in the literature that question the applicability of the WHO Night Time Noise Standard to wind turbine noise. Wind turbine noise is generally seen as considerably more annoying than noise from other sources at the same sound pressure level.¹¹ 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.¹²

When evaluating other noise sources, the Ontario MOE makes adjustments for the special qualities of noise as outlined in NPC-104. This adjustment was not included in the Ontario MOE Noise Guidelines because:

"Any tonal character associated with the wind turbine noise is generally associated with maintenance issues."¹³

The real concern with wind turbine noise is its cyclic variation which covered in NPC-104 but ignored in the Ontario Noise Guidelines. Normally NPC-104 requires that:

"If a sound has an audible cyclic variation in sound level such as beating or other amplitude modulation then the observed value shall be increased by 5."¹⁴

⁸ World Health Organization, Night Noise Guidelines for Europe, 2009, page XV.

⁹ Ibid, page XVI.

¹⁰ Ibid, Section 1.3.6.

¹¹ C. D. Hanning and A. Evans (2012) "Wind turbine noise", British Medical Journal 344, e1527.

¹² H. M. Miedema and H. Vos (1998). "Exposure response relationship for transportation noise." Journal of the Acoustical Society of America 104 3432-3445.

¹³ Ontario, Ministry of the Environment, Noise Guidelines for Wind Farms, Queen's Printer for Ontario, October 2008, page 5.

¹⁴ Ontario, Ministry of the Environment, Publication NPC-104 – Sound Level Adjustments.

Even though wind turbine noise demonstrates the amplitude modulation defined in NPC-104, arguments at Environmental Review Tribunals that the noise modelling produced wind project proponents should be adjusted to reflect the requirements of this testing standard have been rejected.

In New Zealand a different approach has been taken. Their standard, Acoustics – Wind Farm Noise, applies a penalty to measured or predicted wind turbine noise levels:

“5.4.2 Wind turbine sound levels with special audible characteristics (such as, tonality, impulsiveness, and amplitude modulation) shall be adjusted by arithmetically adding up to +6 dB to the measured level at a noise sensitive location [i.e. what Ontario terms a receptor]. This adjustment is a penalty to account for the adverse subjective response likely to be aroused by sounds containing such characteristics.”¹⁵

4.2 Lower Background Noise Levels

The second concern with application of the WHO guidelines is the low level of background noise in rural Ontario where the turbines are being installed. In South Australia, the Wind Farms Environmental Noise Guidelines indicate that noise from wind projects should not exceed 35 dBA “in localities which are primarily intended for rural living or in other areas exceed the background noise (LA90,10) by more than 5dBA. These guidelines require the adjustment of measured or predicted wind turbine noise for tonality by 5 dBA.¹⁶

The New Zealand standard for wind turbine noise is also based on the difference between the background noise and the noise generated by wind turbines. Normally the noise limit for wind turbines (including any adjustment for amplitude modulation discussed in Section 4.1 above) is the background noise plus 5dB up to a maximum of 40 dB. The standards allows for “High Amenity Areas” to be identified in quiet rural areas where the standard is capped at 35 dB.¹⁷

5.0 WHO Standard Tested by the Health Canada Study

Several questions in the Health Canada study specifically tested the applicability of the WHO Night Noise Guidelines to wind turbines. A number of questions explored participants’ perception of various types of outdoor noise sources:

PNS_Q30A - Thinking about the last 12 months, when you are at home, how much does noise from road traffic bother, disturb or annoy you?

PNS_Q30B - Thinking about the last 12 months, when you are at home, how much does noise from aircrafts bother, disturb or annoy you?

PNS_Q30C - Thinking about the last 12 months, when you are at home, how much does noise from railways or trains bother, disturb or annoy you?

PNS_Q105 - Thinking about the last 12 months, when you are at home, how much does noise from wind turbines bother, disturb or annoy you?¹⁸

¹⁵ New Zealand Standards Council, Standard 6808:2010, Acoustics - Wind Farm Noise, March 2010, page 23.

¹⁶ South Australia, Environmental Protection Authority, Wind Farms Environmental Noise Guidelines, July 2009, page 14.

¹⁷ New Zealand Standards Council, Standard 6808:2010, Acoustics - Wind Farm Noise, March 2010, page 22.

¹⁸ Health Canada, Questionnaire, Community Noise and Health Study, January 2014

For all four questions, participants were given the options of answering 1: Not at all, 2: Slightly, 3: Moderately, 4: Very, or 5: Extremely. Participants who refused to answer or did not know were also noted separately.

It is noted that these questions dealing with annoyance asked respondents to “think about” the last 12 months. This avoids the issues associated with the seasonal trends of wind turbine noise that may have affected questions on other health effects where the study indicated that there was no association with wind turbine noise. 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 question. It is reasonable to assume that period involved in the questions appropriately aligns the responses with the “yearly average” noise level estimates that are being used as the second variable in the association.

Results published by Health Canada indicate the following:

- 5.1 **High Levels of Annoyance Found in Ontario** – The Results Overview of the study indicated that 25% of Ontario respondents living close to wind turbines were very annoyed or extremely annoyed by wind turbine noise.¹⁹
- 5.2 **Wind Turbines are Different** – The Results Overview also specifically highlighted that annoyance with wind turbine noise is very different than with aircraft, rail or road traffic noise which are the subject of the WHO Night Time Noise Standard. Based on these findings, it is appropriate to conclude that the WHO guidelines for Night Time Noise are not an appropriate basis to regulate wind turbine noise.
- 5.3 **Higher Noise Levels Increase Annoyance** – The study showed that there is a 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.”*²⁰
- 5.4 **Annoyance Threshold is 35 dBA** – The Health Canada study was very specific in its findings advising that annoyance with wind turbine noise was found to begin at 35 dBA.²¹ This specific finding directly contradicts the assumptions of Ontario’s Dr. King report – 40 dBA is not an appropriate noise threshold to apply to wind turbines. Conversely the findings support the 35 dBA limits for wind turbine noise established in South Australia and New Zealand for rural areas.
- 5.5 **WHO recognizes high levels of annoyance as a serious health effect**– 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:

¹⁹ Results Overview, Health Canada’s Wind Turbine and Noise and Health Study, Fall 2014, pg. 11.

²⁰ Health Canada, Preliminary Research Findings, Wind Turbine Noise and Health Study, Summary of Results, November, 2014

²¹ Results Overview, Health Canada’s Wind Turbine and Noise and Health Study, Fall 2014, pg. 11.

*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.*²²

5.6 High Annoyance Linked to Participant Health Issues – The summary report goes further in confirming the WHO assessment that high annoyance is an adverse health effect 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:

1. *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.*
2. *WTN annoyance was found to be statistically related to measured hair cortisol, systolic and diastolic blood pressure.*²³

On this basis, the high levels of annoyance identified in the Health Canada study qualify as a serious health risk that should require immediate action by provincial and federal health authorities. These findings suggest that the Ontario guidelines for audible turbine noise and their related 550 metre setbacks from occupied residences, can no longer be considered safe as 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.

6.0 Corresponding Increase in Setbacks

The Health Canada study findings that a lower sound threshold is required to protect nearby residents from adverse health effects linked to wind turbine noise in turn necessitates a corresponding increase in setbacks from wind turbines.

As part of their study, Health Canada had wind turbine noise levels estimated for 1,232 participants in the study based on their distance from the nearest wind turbine. These data have been released as part of a Freedom of Information request and provide an independent basis to evaluate the setbacks from wind turbines that will be required to protect nearby residents from noises above the 35 dBA level identified in the Health Canada study.

The data is summarized by distance range in Table 1. For each distance group, the number of observations in the Health Canada study is indicated along with the average dBA level that the participants in that group are exposed. The estimates of wind turbine noise were subject to a statistical error rates of +/-5%. These values are also provided for each data range.

This table indicates that setbacks of at least 1,150 metres from the nearest residence are required to protect residents from health effects of wind turbines. To provide full protection against 35 dBA noise levels, setbacks of 1,300 metres should be used to allow for the statistical error in the wind turbine noise modeling.

²² http://www.euro.who.int/__data/assets/pdf_file/0008/136466/e94888.pdf

²³ Health Canada, Preliminary Research Findings, Wind Turbine Noise and Health Study, Annoyance and Health, November, 2014

Figure 1
Turbine Noise Levels by Distance

Distance Range (in Metres)	Sites in Range	Average Predicted Noise Levels		
		Predicted	+1 St Dev	-1 St Dev
250 to 299	3	45.7	48.0	43.4
300 to 399	8	44.2	46.4	42.0
400 to 449	8	42.8	44.9	40.6
450 to 499	21	41.9	44.0	39.8
500 to 549	30	41.1	43.1	39.0
550 to 599	66	40.1	42.1	38.1
600 to 649	74	39.7	41.6	37.7
650 to 699	86	39.5	41.5	37.5
700 to 749	89	38.9	40.8	36.9
750 to 799	56	38.9	40.8	36.9
800 to 849	65	37.8	39.6	35.9
850 to 899	43	37.1	38.9	35.2
900 to 949	47	36.6	38.4	34.7
950 to 999	58	36.4	38.2	34.6
1000 to 1049	50	36.3	38.1	34.4
1050 to 1099	30	35.5	37.3	33.8
1100 to 1149	29	35.2	36.9	33.4
1150 to 1199	33	34.8	36.5	33.1
1200 to 1249	31	34.3	36.0	32.5
1250 to 1299	20	34.4	36.1	32.7
1300 to 1349	39	33.1	34.7	31.4
1350 to 1399	35	32.5	34.1	30.9
1400 to 1449	39	31.7	33.3	30.1
1450 to 1499	25	32.3	33.9	30.7
1500 to 1599	42	31.2	32.8	29.7
1600 to 1699	35	31.0	32.5	29.4
1700 to 1799	32	30.5	32.0	29.0
1800 to 1999	23	30.0	31.5	28.5
2000 to 3999	53	26.5	27.8	25.1
4000 to 9999	62	11.0	11.5	10.4
	1232			

Source: Derived from noise estimates for each participant in the Health Canada study that was provided to Health Canada by MG Acoustics. Data was obtained from Health Canada through an Access to Information request.

It also should be noted that noise modeling prepared for Health Canada raises questions about whether the current setback of 550 metres is providing protection even against the current level of 40 dBA as currently required in Ontario. If the error in the estimate for the 40 dBA level is considered, the setbacks for the Ontario standard of 40 dBA should be set at 800 metres.

These results are not surprising for people who are living with wind turbines. Residents living at much greater than 550 metres from a wind turbine are filing complaints about excessive wind turbine noise. The Health Canada study and related noise estimates only provide confirmation that these existing complaints are valid.

7.0 Recommendations

The findings from the Health Canada study show that the standards that form the basis of the Ontario wind turbine regulations are not sufficient to protect human health. The study indicates that the sound power threshold needs to be lowered to 35 dB which in turns means that the setback needs to be increased to 1,300 metres. These standards are not without precedent as both New Zealand and South Australia are using this standard in rural areas.

To protect the health of Canadians, the federal Health Minister should be immediately issuing an interim advisory indicating requiring wind companies to respect the 35 dB threshold in both new turbine siting and the operation of existing turbines.

At the same time, the Ontario Ministry of Environment and Climate Change should be updated regulations and guidelines related to the siting of wind turbines to incorporate the findings of the Health Canada study.

The Ministry of the Energy should be instructing the Ontario Power Authority to defer the issuance of the RFP planning for early February 2015 until after the findings of the Health Canada study are reflected in new regulations and guidelines.

The Ministry of the Environment and Climate Change should also be providing the Health Canada findings to Environmental Review Tribunal panels with instructions to consider them in their evaluation of proposals currently under appeal.

The Environmental Review Tribunal should also consider the Health Canada findings when confirming that the projects will not cause harm as required under the Environmental Protection Act, Section 145.2.1 (5).