Niagara Region

REPORT TO: **Co-Chairs and Members**
Public Health and Social Services Committee

SUBJECT: **Wind Turbines**

RECOMMENDATION

That this Committee recommend to Regional Council that this report be received for information.

EXECUTIVE SUMMARY

The benefits from the utilization of wind energy for electricity generation are well documented. Wind power has been identified by the United Nations and the World Health Organization as a clean, renewable energy source that has no impact on climate change and no known emissions, waste products, or harmful pollutants. It is reliable, assists in the reduction of greenhouse gasses, and is considered to be part of an overall solution to forecasted energy needs in Canada and the United States. The government of Ontario has promoted this form of energy as a major component of its strategy to close all coal-fired generating plants in the province by 2014. However, some claims have been made that those living in close proximity to the wind turbines, which are used to convert wind to energy, may be at risk of experiencing adverse health effects.

Wind power has been in use around the world for decades with very little human impact. The technology employed continues to be refined in response to public concerns. Existing Regional and proposed provincial setbacks between turbines and residences are conservative and consequently the potential, in Niagara, for adverse health effects is considered negligible. Nevertheless, Niagara Region Public Health has written to the Ministry of Health and Long-Term Care requesting the development of a provincial public health position on the issue.

FINANCIAL IMPLICATIONS

There are no financial implications at this time.

PURPOSE

This purpose of this report is to update the Public Health and Social Services Committee on the current science on perceived health effects resulting from living in close proximity to wind farms.

BACKGROUND

On May 19, 2009, the Public Health and Social Services Committee reviewed copies of correspondence from the Corporation of the County of Prince Edward and the Grey Bruce Health Unit requesting that federal and provincial agencies:

1. Dedicate resources to the necessary scientific research to consider the impact of
   a. low frequency noise and,
   b. electrical and electromagnetic disturbances in areas of industrial wind turbines with the intent to confirm/deny public health implications; and

2. Create authoritative regulations and guidelines for municipalities and wind energy developers for the locating of wind turbines.

Committee requested that staff provide a report summarizing the current public health position on wind turbines.

REPORT

Wind farms capture wind energy and convert it to electricity by means of wind turbines. The world-wide use of wind power reportedly doubled from 2005 to 2008. As of May 2009, it is estimated that approximately eighty countries are using wind power on a commercial basis, with the highest production rates being found in Denmark, Spain, Portugal, Germany, and the Republic of Ireland. New projects are under way in all parts of Canada. The Government of Ontario has identified wind power as a significant contributor to this province's future energy needs and expects to have enough wind capacity to power 250,000 homes by the end of this year. However, opponents of wind power cite a number of concerns related to health. Given the ubiquity of wind farms and the proposed expansion of wind power across the province, Niagara Region Public Health contacted the Ministry of Health and Long-Term Care (MOHLTC) on February 9, 2009, and requested that the Ministry develop a uniform and defensible public health position in response to these concerns. MOHLTC responded that this would be delegated to the newly formed Ontario Agency for Health Protection and Promotion. Since this agency is currently in the process of recruiting staff, the development of such a position is not expected until 2010 at the earliest. Consequently, NRPH staff has reviewed the available literature and this report details the current scientific state of knowledge.

The health concerns which have been raised can be grouped into four categories:

- Turbine blade and structural failure
- Icing issues in northern climates
- Sound emissions and noise concerns
- Shadow flicker

Turbine blade and structural failure:

According to the National Collaborating Centre for Environmental Health (NCCEH), 68,000 wind turbines have been installed world-wide in the last 25 years. To date, there is no recorded evidence of injury to the public caused by a wind turbine. The American Wind Energy Association states that current safety standards require wind turbines to be constructed so as to withstand wind strengths equivalent to hurricane forces. The NCCEH reports that 74 turbine failures have been recorded in Europe since 2000, resulting in whole blades being thrown up to 150 metres and blade pieces up to 500 metres. In recognition of the potential hazard, the Region's recently approved wind energy policies require setbacks of up to 1.25 times the height of the turbine from open municipal rights-of-way. Additional setbacks might also be imposed for noise mitigation as required by the Ministry of the Environment through a Certificate of Approval (Noise).

No injuries have been documented in Ontario because of a wind turbine failure.

Icing issues in northern climates:

Those expressing concerns over the establishment of wind turbines in their community cite a potential for injury from ice chunks thrown from the rotating turbine blades. In Southern Ontario, two types of icing may form on turbine blades. Glaze ice may form during liquid precipitation when temperatures are around 0°C. Significant formations can occur if temperatures are just below freezing. This kind of ice usually falls shortly after forming and typically falls straight down but can be adhesive if temperatures remain below zero Celsius. Rime ice results from cloud contact with cold surfaces at colder temperatures, usually at higher elevations. It is less adhesive than glaze ice and can be thrown by the rotating blades but usually breaks into smaller pieces. The NCCEH report that icefall from stationary turbines is estimated to be less than 50 metres, while ice from moving blades would primarily fall 15-100 metres from the turbine. European studies have identified a safe distance of 200-250 metres, while a U.S. study recommends 250-350 metres.

A report prepared by the Chatham-Kent Health Unit references computer modeling which was used to estimate the potential for residential, vehicle, and person ice strikes within a typical wind farm environment in Southern Ontario. Assuming setback distances of 300 meters for buildings, 200 for vehicles, and 300 for individuals on the ground, it was concluded that buildings might be struck once every 500,000 years, vehicles once every 260,000 years and individuals once every 137,500,000 years.

Sound emissions and noise concerns:

Sound is carried through air in compression waves of measurable frequency and amplitude. Sound can be tonal, predominating at a few frequencies, or it can contain a random mix of a broad range of frequencies and lack any tonal quality (white noise). Sound that is unwanted is called noise. While noise is measured in decibels (dB), environmental noise is adjusted to include the sensitivity of the human ear and is measured in dB (A). Wind turbines produce noise from two specific sources: the aerodynamic effect generated by the rotor blades as they rotate in the wind; and mechanical operations which generate the motor noise from within the turbine unit itself. Mechanical noise is controlled in newer wind turbines so that it is a fraction of the aerodynamic noise. Mechanical noise from the turbine or gearbox should only be heard above aerodynamic noise when these components are not functioning properly. The sound wind turbines emit can be characterized as audible or as infrasound, that which is inaudible to the human ear. The health impact of the noise created by wind turbines has been studied and debated for decades with no definitive evidence supporting harm to the human ear.

The audible sound created by a wind turbine, measured at 350 metres, is approximately 35-45 dB (A). By comparison, rural night-time background noise ranges from 20-40 dB (A), urban residential background noise is 58-62 dB (A), and a jet airplane at 250 metres is 105 dB (A). Wind on its own, as it interacts with the environment, produces levels up to 35 dB (A). The Ministry of the Environment (MOE) requires a Certificate of Approval (Noise) for wind farms in Ontario and has published technical guidelines for the preparation of a Noise Assessment Report that includes details of the wind turbine design and operation, and location of the wind turbine(s) within the specific site and surrounding area, as well as a summary of compliance with the applicable sound level limits. If appropriate, the Noise Assessment Report must also include similar details of the Transformer Substation used for transforming the power from the wind turbine units.

MOE is currently developing regulations under the Green Energy Act which will include a requirement for minimum setbacks of 550 metres between wind turbines and any residence. This setback will increase depending on the number of turbines and decibel noise of each turbine. For example, a turbine with a sound power level of 106 decibels will have to meet a setback of 950 metres from the nearest receptor, while a facility with eight turbines with a sound power level of 105 decibels will be required to meet a setback of 1,000 metres. All wind turbines with a sound power level greater than 107 decibels, regardless of the number, would require a noise study, as would projects involving more than 26 turbines within 1.5 km of any receptor.

Infrasound or Infrasonic waves are long wavelength low frequency acoustic waves that are below the frequency range of human hearing. Opponents of wind farms cite this as the source of headaches, nausea, and discomfort reported by some people living in close proximity to wind turbines. It has been determined that wind turbines installed in the 1980s were "downwind" models. This means the wind would pass around the turbine tower before reaching the blades, thus generating a low frequency, repetitive "whooshing" or

thumping. Newer turbines have upwind rotor blades, thereby minimizing low frequency infrasound. Staff in the Chatham-Kent Health Unit undertook a review of studies conducted around the world and concluded that these indicate that infrasound generated by wind turbines is not known to be harmful to human health.

Nevertheless, proposed MOE regulations will stipulate that as a condition of approval for wind turbine projects, proponents will be required to monitor and address any perceptible infrasound (vibration) or low frequency noise as a condition of the Renewable Energy Approval.

Shadow flicker:

The rotating wind turbine blades can cast moving shadows that cause a flickering effect similar to that which might be experienced if one is driving down a tree-lined road when the sun is low in the sky. This can be annoying and opponents of wind farms have expressed concerns that it could trigger epileptic seizures in individuals who suffer from photosensitivity.

Most importantly, there is no evidence to suggest that shadow flicker from wind turbines can trigger epileptic seizures. Frequency (number of times/second something happens) is measured in Hertz (Hz). Shadow flicker generated by wind turbines has a frequency of 0.5 to 1.25 Hz, well below the 5 to 30 Hz which the American Epilepsy Foundation states may trigger epileptic seizures.

While standards for shadow flicker caused by wind turbines could not be identified in any jurisdictions, a review of best practices from the available research, and usage history in Europe and the United States, conducted by the Chatham-Kent Public Health Unit in 2008, concluded that shadow flicker would not be a health concern when setbacks are enforced. As noted, proposed MOE regulations will require a minimum setback of 550 metres between wind turbines and any residence.

Furthermore, wind energy experts assert that shadowing can be eliminated or significantly reduced by proper siting of the turbines. By using computer modeling, it is possible to identify precisely where shadowing could occur by entering such data as the prevailing wind direction and the angle of the sun in the sky throughout the course of the year. This information is then overlaid on a site-specific map showing, schools, residences, and other structures in the area. If the model indicates potential shadowing, then modifications can be implemented to mitigate the impact.

Approval process:

Currently, any applicant wishing to establish a wind farm in the Region of Niagara must demonstrate compliance with the policies of the Region's Official Plan. Other approvals from the local municipality, including official plan and zoning by-law amendments, and site plan approvals, may also be necessary. Upon approval of the proposed Regulations under the Green Energy Act, an applicant would be required to submit a Renewable Energy Approval application form to the MOE and satisfy a number of requirements

including public notice and consultation, municipal consultation, and compliance with minimum setbacks.

It should also be noted that Integrated Community Planning staff will be bringing a report forward to discuss how the proposed Regulations may have implications on the Region's policies and initiatives relating to wind energy.

Given the priority that many jurisdictions, including the province of Ontario, are placing on the expansion of clean and renewable sources of energy, the continuing establishment of wind farms appears inevitable. Opponents have raised concerns on a number of fronts and relatively little scientific evidence exists to refute or to lend credence to claims of adverse health impacts. Nevertheless, the Region's recently approved wind energy policies, the proposed regulations under the Green Energy Act, and the technological improvements implemented in recent years provide a large measure of comfort that the potential for adverse health effects resulting from properly designed and operated wind farms is negligible.

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