Environmental Review Tribunal

Case Nos.: 10-121/10-122

Erickson v. Director, Ministry of the Environment

In the matter of appeals by Katie Brenda Erickson and Chatham-Kent Wind Action Inc. filed on November 29, 2010 for a Hearing before the Environmental Review Tribunal pursuant to section 142.1 of the *Environmental Protection Act*, R.S.O. 1990, c. E.19, as amended with respect to a Renewable Energy Approval issued by the Director, Ministry of the Environment, on November 10, 2010 to Kent Breeze Corp. and MacLeod Windmill Project Inc. (Kent Breeze Wind Farms) c/o Suncor Energy Services Inc. under section 47.5 of the *Environmental Protection Act*, regarding the construction, installation, operation, use and retiring of eight wind turbine generators located at Part Lots 8-11, Concession 1 and Part Lots 4-6, Concession 1 & 2, in the Township of Camden, Municipality of Chatham-Kent, Ontario; and

In the matter of a Hearing held on February 1, 2, 9, 10, 11, 15, and 16; March 2, 4, 11, 22, 23, 25, 29, 30, and 31; and May 26, 2011 in the Council Chambers, Municipality of Chatham-Kent, Civic Centre, 315 King Street West, Chatham, Ontario and in Hearing Rooms 16-1 and 16-3, 16th Floor, 655 Bay Street, Toronto, Ontario.

Before: Jerry V. DeMarco, Panel Chair
Paul Muldoon, Vice-Chair

Appearances:

Eric Gillespie and Julia Croome	-	Counsel for the Appellants, Katie Brenda Erickson and Chatham-Kent Wind Action Inc.
Graham Andrews	-	Articling Student for the Appellants, Katie Brenda Erickson and Chatham-Kent Wind Action Inc.
Frederika Rotter and Andrea Huckins	-	Counsel for the Director, Ministry of the Environment
Anne Sabourin and Tanya Nayler	-	Articling Students for the Director, Ministry of the Environment

Albert Engel, Rodney Northey and Jay Headrick	-	Counsel for the Renewable Energy Approval Holder, Kent Breeze Corp. and MacLeod Windmill Project Inc. (Kent Breeze Wind Farms) c/o Suncor Energy Services Inc.

Dated this **18th** day of **July, 2011.**

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Reasons for Decision

Overview:

This case is a reminder that energy facilities can generate more than electricity; they can also generate conflict. Though this case involves appeals of Suncor's Kent Breeze Wind Farm Project, the Appellants' approach to this proceeding has largely been a test of whether turbines in Ontario will cause serious harm to human health. The Parties called experts from all over the world to speak to the issue of whether this Project, which was approved according to Ontario's Ministry of the Environment Noise Guidelines for Wind Farms and Ontario Regulation 359/09 made under the *Environmental Protection Act*, will seriously harm humans living nearby. It is clear that this case is a novel case that not only involves new legislation but also new scientific research.

For the reasons that follow, the Environmental Review Tribunal finds that the Appellants have failed to show that Suncor's Kent Breeze Project, as approved, will cause serious harm to human health. However, the evidence shows that there are some risks and uncertainties associated with wind turbines that merit further research. In that regard, the Tribunal hopes that future debate focuses on the most appropriate standards rather than "yes or no" arguments about whether turbines can cause harm.

According to the evidence in this Hearing, where an impressive array of leading experts from around the world testified on cutting edge areas of scientific inquiry, the Tribunal cannot find that the Kent Breeze Project operated according to the current Ontario standards "will cause serious harm to human health". That is the test in the statute, but the evidence presented in this Hearing is insufficient to meet it. What the Tribunal can state is that the need for more research came up several times during this Hearing. Time will tell as to what that research will ultimately demonstrate. The Tribunal is hopeful that, whatever the results, further research will help answer some of the concerns and uncertainties raised during this Hearing.

Background:

On November 10, 2010, Mansoor Mahmood, the Director, Ministry of the Environment ("MOE"), issued a Renewable Energy Approval ("REA") under section 47.5 of the *Environmental Protection Act* ("*EPA*") to Kent Breeze Corp. and MacLeod Windmill Project Inc. c/o Suncor Energy Services Inc. (the "Approval Holder" or "Suncor") to engage in a renewable energy project in respect of a Class 4 Wind facility known as Kent Breeze Wind Farms located in the Township of Camden, Municipality of Chatham-Kent, Ontario (the "Project" or "Kent Breeze Project"). The Project consists of the construction, installation, operation, use and retiring of eight wind turbine generators, each rated at 2.5 MW generating output capacity. On November 29, 2010, Chatham-Kent Wind Action Inc. and Katie Brenda Erickson (the "Appellants") filed Notices of Appeal with the Environmental Review Tribunal (the "Tribunal") under section 142.1

of the *EPA*. Further background to this proceeding is set out in the Tribunal's Orders dated January 14, February 25, and April 5, 2011.

The Hearing took place on February 1, 2, 9, 10, 11, 15, and 16; March 2, 4, 11, 22, 23, 25, 29, 30, and 31; and May 26, 2011 in Chatham and Toronto. This proceeding was originally intended to be completed in early April 2011, with a Tribunal Decision in May 2011, in accordance with section 145.2.1 (6) of the *EPA* and section 59 of Ontario Regulation 359/09 ("O.Reg. 359/09") made under the *EPA*, which require that the Tribunal dispose of a hearing on an appeal of a renewable energy approval six months (with limited exceptions) from the day that notice of the appeal is served on the Tribunal. However, the Parties jointly requested an adjournment due to personal matters affecting Counsel on the case, as discussed further in the Tribunal's April 5, 2011 Order. The effect of that adjournment under section 59(2)(1)(i) of O.Reg. 359/09 was that the Hearing was completed in late May 2011, with a Decision due by July 18, 2011 pursuant to section 59(1) of the regulation.

The majority of the Hearing was conducted in open session. However, pursuant to a request from the Appellants, which was consented to by the other Parties, portions of the evidence are subject to a limited confidentiality Order. That Order, issued by the Tribunal on February 25, 2011 (*Erickson v. Ontario (Ministry of the Environment)*, [2011] O.E.R.T.D. No. 7) ("*Erickson 2*"), reflects the compromise reached among the Parties whereby the Appellants' concerns about "prior publication" of some of the unpublished data on which they relied were addressed, while also allowing public access to the documents in question. Once the data are published or by February 25, 2012 (whichever is earlier), the limitations on access to the confidential documents will be removed and the confidential documents will then be transferred to the Tribunal's public record file. In the meantime, any person may view the confidential documents according to the protocol set out in the Tribunal's February 25, 2011 Order. As agreed by the Parties, the Tribunal will summarize the confidential information herein in a manner that does not reproduce the detailed numerical results, in order to respect the Appellants' concerns about prior publication. Nevertheless, the detailed numerical results have been fully considered by the Tribunal in reaching this Decision.

Structure of this Decision:

The Tribunal has adopted the following structure for this Decision. First, the Issues are identified. Second, a summary of the evidence is provided. Given that this is the first appeal of this nature, this summary will provide the reader with a sense of the breadth of evidence that was heard. Third, many of the distinct legal issues raised by the Parties are addressed. Fourth, the Tribunal's findings on the main issues regarding the factual and opinion evidence are provided. These factual findings then provide a basis for the Tribunal's overall conclusion on the main issue raised by the Appellants, namely whether the Kent Breeze Project, as approved, will cause serious harm to human health. As well, Relevant Legislation (Appendix A), the Tribunal's Practice Direction for Technical and Opinion Evidence (Appendix B), List of Acronyms

used in the Decision (Appendix C) and List of References cited in the Summary of Evidence (Appendix D) are appended.

Issues:

The main issue is whether engaging in the Project in accordance with the REA will cause serious harm to human health.

The specific sub-issues raised by the Appellants are:

(a) Will the project as approved cause serious harm to human health of non-participants?

(b) Will the project as approved cause serious harm to human health of participants?

(c) Will the project as approved cause serious harm to human health if the approval authority is unable to properly predict, measure or assess sound from the facilities including audible noise and/or low frequency noise and/or infrasound?

(d) Will the project as approved cause serious harm to human health because the approval does not comply with the approval authority's Statement of Environmental Values?

The 2008 MOE Noise Guidelines for Wind Farms ("MOE Noise Guidelines") define "participating receptor" as "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".

As well, a number of specific legal issues, many of which involved competing interpretations of parts of section 145.2.1 of the *EPA*, arose during the course of the Hearing. They are dealt with below under the heading "Legal Issues Relating to the Interpretation of the Statute".

Qualification of Expert Witnesses:

At the outset of the Hearing, the Parties recognized that issues relating to the qualification of expert witnesses would arise repeatedly across many different witnesses. The Parties, therefore, agreed to render the witness qualification exercise much more efficient by presenting their global or generic submissions on witness qualification at the beginning of the Hearing. Thus, as each witness came to the stand, the Parties could simply refer back to those initial submissions and supplement them with any additional submissions that were relevant to the specific witness in question. This approach proved to be quite workable and assisted the Parties in adhering to their schedule of witnesses. The Parties' submissions and the Tribunal's findings on this subject are set out later in this Decision.

Summary of the Evidence:

Appellants' Witnesses

Mr. Richard James' Evidence

Mr. James was qualified to provide opinion evidence as an acoustician. Mr. James reviewed the Hatch "Kent Breeze Corporation – Kent Breeze Wind Farm and MacLeod Windmill Project Noise Assessment Report" (May 14, 2010) ("Hatch Noise Assessment Report") and identified three main concerns regarding the potential for excessive noise exposure on adjoining properties. For the most part, these concerns related to the assumptions and methodology used by Hatch in constructing the computer model of sound propagation.

The first concern raised by Mr. James related to a deficiency in the tolerances for instrumentation error used in the Hatch model, which results in what he considers to be an underestimation of the sound levels that will be received on the properties adjacent to the wind turbines. He stated that although the Hatch model included the 0.9 dB tolerances for instrumentation error of the IEC 61400-11 test procedures, the model did not also include the plus or minus 3 dB tolerances for the ISO 9613-2 modeling procedure. Mr. James stated that had the model included this tolerance, the results of the Hatch report would be 3 dB higher than stated.

Mr. James stated that the modeling software that Hatch used for its sound models consisted of general purpose commercial packages used for modeling noise from industrial, road and railway noise sources. He stated that in order to account for the differences between these noise sources and noise from wind turbines, proper consideration must be given to the known tolerances and accuracy limits when using this type of software to model noise from industrial wind turbines. According to ISO 9613-2, the accuracy and limits of this method of modeling has a tolerance of plus or minus 3 dB for predictions. Mr. James stated that this 3 dB tolerance should be added to the values predicted by the model to more accurately reflect the potential noise exposure on the adjoining properties and to provide the "worst case scenario". He stated that with this 3 dB addition, 40 of the receiving properties near the wind project would experience noise at a level of 40 dBA or higher, which exceeds the sound levels permitted by the MOE Noise Guidelines.

Mr. James agreed that neither the MOE nor the ISO 9613-2 specifically requires the plus or minus 3 dBA to be added. However, he indicated that it is common procedure in modeling to identify the assumptions and provide an estimate of what the error tolerances would be. Mr. James testified that tolerances are present for instrument measurements and models and that it is common practice to disclose all tolerances. He stated that it is not something that needs to be stated in a standard because it is commonly accepted practice.

The second concern raised by Mr. James was that Hatch's predicted sound levels underestimate the sound levels that will be received on the properties adjacent to the wind

turbine utility under night-time stable atmospheric conditions. Mr. James noted that section 6.2.3 of the MOE's Noise Guidelines requires that a noise assessment "must use manufacturer's acoustic emission data adjusted for the average summer night-time wind speed profile." He stated that the sound power data used in Hatch's sound propagation models does not represent the noise produced by wind turbines during night-time operations with high wind shear and stable atmospheric conditions. He stated that the IEC 61400-11 test standard collects data under neutral atmospheric conditions that do not cause the louder type of impulsive noise emissions known as "thumping." Mr. James referenced a study by van den Berg, G.P., "Effects of the wind profile at night on wind turbine sound" (2004), 277:4-5 J. Sound Vib. 955 ("van den Berg 2004") which reported that wind speed at the hub height of a wind turbine at night is up to 2.6 times higher than expected and this causes a higher rotational speed of the turbines and a sound level increase of up to 15 dB compared to the same wind speed in daytime. The study concluded that noise predictions at night from tall wind turbines are underestimated when measurement data are used assuming a daytime wind profile.

Mr. James explained the difference between the types of wind turbine noise known as "swish" and "thump". Blade "swish" occurs when the turbine is operating in a neutral atmosphere and it produces 1-3 dBA sound power level. Mr. James stated that this "swish" is included as part of the wind turbine sound power ratings provided by the manufacturer. "Thumping", on the other hand typically occurs at night under stable atmospheric conditions where there is a high wind shear. The "thumping" results from increased sound power emissions from the turbine blades and can modulate by 5 to 10 dBA or more. He explained that this occurs because ground level wind speed typically calms after sunset whereas wind speed at the hub height of large turbines typically increases or stays the same at night, resulting in different wind velocities at the rotating blade's top and bottom height. Since the blade angle is calculated for the average wind speed at the hub, when the blade encounters the different wind velocity that does not match its angle of attack this results in a rhythmic swishing noise.

Mr. James stated that, from his experience taking measurements at 10 to 15 sites including three in Ontario, the night-time noise level is increased by at least 5 dBA. He stated that this increased noise is not accounted for in the manufacturer's test data. Therefore, he concluded that the values found in the Hatch report tables and contour map are underestimated by 5 dBA. He stated that if the model's sound power levels were corrected for this additional 5 dBA to represent night-time conditions, as well as the additional 3 dBA to take into account the model's tolerance, 114 properties would experience sound levels of 40 dBA or higher.

Mr. James explained that, although an increase of 8 dB may seem like a small amount, it actually represents a large increase in sound energy because every 3 dB represents a doubling of the sound energy.

Mr. James' third concern with the Hatch noise models related to the height limits assumed in the algorithms used by the modeling software. Mr. James stated that the formulas used in the ISO standard's algorithms assume a height of no more than 30 m above the receiving point.

Mr. James stated that because the hub height of the wind turbines is much higher (typically 80 m) than the limit used in the ISO standard, the formulas need to be adjusted. He stated that the Hatch report did not disclose this limitation or make any effort to account for the errors that may result from the noise source exceeding the source height limits. Mr. James explained that the height referred to in the ISO standard's height limit is the mean height of the source and receiver, and the mean height for Kent Breeze wind turbines would be somewhere around 40 m.

Mr. James stated that several studies have been conducted which show that wind turbine noise is experienced as more annoying than airport, truck traffic, or railroad noise at the same sound pressure level or less (Pedersen, E. and Persson Waye, K., "Perception and annoyance due to wind turbine noise: a dose-response relationship" (2004) 116:6 J. Acoust. Soc. Am. 3460 ("Pedersen 2004"); van den Berg, F., Pedersen, E., Bouma, J. and Bakker, R., "Project WINDFARM perception: Visual and acoustic impact of wind turbine farms on residents: Final Report" (2008) FP6-2005-Science and Society-20 Project no. 044628, University of Groningen and University of Gothenburg ("van den Berg et. al. 2008")). He stated that the dynamic modulations, both audible and inaudible, that are unique to wind turbine noise are more directly responsible than the absolute sound level for why people respond more negatively to wind turbine noise. Mr. James referred to studies by Pedersen (2004) and van den Berg et. al. (2008) which found that annoyance from wind turbine noise is experienced at sound levels that are 10 dB lower than the sound levels that would cause annoyance from other common noise sources.

Mr. James explained that the level of annoyance produced by wind turbine noise also increases substantially for low frequency sound once it exceeds a person's threshold of perception. He stated that low frequency sound is in the range below 200 Hz and sound below 20 Hz is called infrasound and is generally presumed not to be audible to most people. He stated, however, that for the most sensitive people this threshold drops approximately 6 to 12 dB. Mr. James explained that there is an existing presumption that only infra and low frequency sounds that reach the threshold of audibility pose any health risks. However, he referred to recent research which has shown that the vestibular system responds at levels of sound significantly lower than the thresholds of audibility. In particular, Mr. James referred to a case series study by Dr. Nina Pierpont which proposed a hypothesis that wind turbine infra and low frequency noise was related to medical pathologies. In addition, a paper by Alec Salt and T.E. Hullar, "Responses of the ear to low frequency sounds, infrasound and wind turbines" (2010) 268:(1-2) Hearing Res. 12 ("Salt 2010") reported that, although the threshold for hearing infrasound is 95 dBG, the outer hair cells of the cochlea respond to infrasound at levels around 60 dBG. His review found that noise levels generated by wind turbines were approximately 70 dBG, suggesting that wind turbines produce an unheard stimulation of the cochlea. Mr. James stated that, during the summer of 2009, he conducted a study of homes in Ontario where people had reported adverse health effects that they associated with the operation of nearby wind turbines. He stated that this study found that sound levels in the 1/3 octave bands below 20 Hz were often above 60 dB and in many cases greater than 70 dB.

Mr. James referred to the Heating, Ventilation and Air Conditioning ("HVAC") field where acoustical engineers have confirmed that "dynamically modulated, but inaudible, low frequency sound from poor HVAC designs or installations can cause a host of symptoms in workers in large open offices." He noted that considerable attention is now paid to the design of systems to avoid these problems and methods have been developed to assess building interiors for these low frequency problems.

Mr. James also reviewed the Chief Medical Officer of Health Report "The Potential Health Impact of Wind Turbines" May, 2010 ("CMOH Report"). He concluded that the report "does not represent a complete and unbiased review of information on how infra and low frequency sounds that are inaudible can affect the health of people exposed to the complex, modulated sounds emitted by wind turbines in the lowest frequency ranges." He stated that, when he reviewed the report, it did not include the concerns that he had raised in his witness statement and testimony and that these issues need to be considered. Mr. James emphasized that the basis for his comment was that the report was not complete and he explained that he used the term "unbiased" to mean that he did not understand how the weighing of the literature seemed to provide more weight to reports that supported the conclusion than to reports that did not.

Dr. Michael Nissenbaum's Evidence

Dr. Nissenbaum was qualified to give expert opinion in the areas of diagnostic imaging with knowledge of medical physics, internal medicine and primary care.

Dr. Nissenbaum submitted a study conducted by himself, Dr. Jeff Aramini and Dr. Christopher Hanning entitled "Adverse Health Effects Related to Industrial Wind Turbines (IWTs) – a Retrospective, Cross-sectional Epidemiological Study" (2011) unpublished (the "Nissenbaum Study" or the "Study") and gave evidence relating to this Study. Dr. Nissenbaum described the methodology of the Study as a stratified cross-sectional epidemiological study involving two sites: Mars Hill, Maine and Vinalhaven, Maine. He stated that between March and July, 2010, a standard questionnaire was given to all residents meeting participation inclusion criteria and living within 1.5 km of an industrial wind turbine ("IWT") and to a random sample of residents meeting the inclusion criteria living 3 to 7 km from an IWT. The protocol was reviewed and approved by IRB Services, Aurora, Ontario. The questionnaire was developed following a review of anecdotal reports and case studies and consideration of the results and the criticisms of a smaller pilot study conducted in Mars Hill by Dr. Nissenbaum. The questionnaire consisted of three validated questionnaires: the SF-36v2 ("SF-36") measuring mental and physical health, the Pittsburgh Sleep Quality Index ("PSQI") measuring the quality of sleep and the Epworth Sleepiness Scale ("ESS") measuring daytime sleepiness. The questionnaire also included routine headache functional inquiry questioning and a series of attitudinal questions relating specifically to the "before and after" experiences.

Dr. Nissenbaum stated that the validated questionnaires are well known and accepted. He stated that the SF-36 has been used in over 4000 studies to evaluate over 200 diseases and

that for scores of greater than 5 on the PSQI, the questionnaire is 90% sensitive and specific for the detection of sleep disorders. He stated that these questionnaires are designed to be self-administered by a patient and do not require any special qualification on the part of the person administering the questionnaire or the participant. He stated that he hired nurse practitioners to assist with the administration of the questionnaires. Where participants were able to fill out the questionnaire on their own, they would do so with the nurse practitioner available to answer any questions. Where participants had difficulty reading or comprehending questions, the nurse practitioner would assist with answering the questions or would fill out the questionnaire by directly questioning the participant.

The Mars Hill site consisted of a linear arrangement of 28 GE 1.5MW turbines on a ridgeline, while the Vinalhaven site consisted of a cluster of 3 GE 1.5MW turbines on a flat treed landscape. Dr. Nissenbaum stated that the Study identified and tried to capture all of the people living within 1400 m of the IWTs to prevent against self-selection bias. The nurse practitioners contacted participants by going door to door at least three times to each house and then via phone. For the control group, a random sample of households in a similar socioeconomic area further away from IWTs at each site was chosen and households were approached door to door by the nurse practitioners until a similar number of participants were obtained. Dr. Nissenbaum said that he did not participate in the questioning of the participants or handle the data. The data was scanned by the nurse practitioners into electronic format and was then provided to Dr. Aramini for statistical analysis. Dr. Nissenbaum stated that data quality of the SF-36 responses was determined and found to exceed parameter norms for indicators such as completeness, response range, internal consistency and others. Statistical analysis of the data was performed by Dr. Aramini.

Dr. Nissenbaum stated that “this study is the first epidemiological study to evaluate and demonstrate marked and significant associations between individuals living within close proximity to industrial wind turbines and a number of adverse health effects including sleep quality, mental health, and somatic health.” He described somatic health as bodily health, complaints of which would include for example, itching, chest or abdominal pain, vertigo, or nausea. Dr. Nissenbaum stated that the study found that levels of sleep disruption and the daytime consequences of increased sleepiness were related to distance from the IWTs. He said that the SF-36 demonstrated that psychiatric complaints and mental health dysfunction diminished as one moved further away from the IWTs. Dr. Nissenbaum noted that the survey found that pre-wind turbine attitudes between people living close by and far away were remarkably similar but the change in attitudes after operation of the turbines showed a marked difference between the close and far groups, with those living in close proximity viewing the IWTs unfavourably and those living far showing little, if any, change in attitude. Dr. Nissenbaum stated that the SF-36 physical component score did not demonstrate a relationship between somatic health effects and distance to wind turbine. However, he stated that this test did not include specific questions that are related to the particular symptoms commonly associated with IWTs, including nausea, vertigo, and tinnitus. He stated that the supplemental questions which

specifically looked at these symptoms did, however, find significant differences in those physical symptoms between those who live close to and far away from IWTs.

Dr. Nissenbaum stated that this Study is significant because it is the first to use validated questionnaires and a control group in looking at the complaints of people who live close to wind turbines. He stated that although the Study is not infallible, it is internally consistent and the findings are significant and plausible with regards to axiomatic medical pathophysiology pathways. He stated that this Study does not allow a definitive determination of which setback distances are safe, but it does provide some conclusions as to which setback distances are unsafe.

Dr. Nissenbaum also reviewed the “Kent Breeze Turbine Setback Confirmation Report” (November 24, 2011) particularly with regard to the receptor locations and the sound contour map. He stated that the 2.5MW GE turbines to be used at Kent Breeze do not produce less noise than the turbines in his Study (though the Tribunal noted that his statements on this point will not be considered expert opinion). Dr. Nissenbaum stated that he calculated that about 101 of the 285 receptor sites lie closer than 1400 m to a turbine. He stated that of those 101, the proportion that lie downwind will likely experience noise levels similar to those experienced by the residents in Mars Hill and Vinalhaven, whose adverse health effects, he asserted, have been described in his Study. Dr. Nissenbaum stated that the preconstruction sound modeling used in Mars Hill and Vinalhaven was found to be inaccurate and it failed to predict the actual sound levels that were experienced. He stated that, in his opinion, once real world data is available and applicable, this should take precedence over modeled data and this is the practice followed in the medical profession with respect to medical devices and pharmaceuticals, for example. Dr. Nissenbaum concluded that in applying the results of his Study to the Kent Breeze Project, it is his opinion that there will be serious harm to the health of many of the hundreds of people who live at a minimum within 1400 m of the proposed turbines.

Dr. Nissenbaum stated that there was no attempt to blind the participants to the subject matter of the Study and that is a potential weakness of the Study, having regard to the title of the questionnaire that was used. However, he said, the design of the survey was intended to minimize those biases through the use of validated questionnaires. Dr. Nissenbaum described a validated questionnaire as one whose utility has been proven in studies and that has been accepted as a tool that can be used to evaluate disease conditions in studies where the questionnaire itself is not the subject of the inquiry. Dr. Nissenbaum explained that an additional part of the questionnaire relating to headaches was a standard headache functional inquiry that had been designed by a neurologist and was not designed for this particular Study. He explained that the “before and after” part of the questionnaire was developed by him in collaboration with colleagues.

Dr. Nissenbaum discussed a separate study he had conducted with 15 participants in Mars Hill, Maine, which, he stated, utilized a different questionnaire than the one used in the Study he was presenting in his evidence. He stated that some or all of the participants in the preliminary study

may have also been participants in the present Study. Dr. Nissenbaum stated that in the preliminary study, participants were asked about their quality of life, whether they considered moving away, and if so, why they have not moved away. He acknowledged that in the preliminary study, he reported that in Maine, the noise variance that was actually measured was 45 to 50 dBA.

Dr. Nissenbaum stated that it was the same nurse practitioner who administered the questionnaire in the 2009 preliminary study and the main Study. He stated that all nurse practitioners are trained to perform functional inquiries and that the questionnaire for the main Study was a functional inquiry. He stated that there is no specific training available for administering questionnaires in particular and that none is need to supervise or assist the participants to fill out the study survey. He stated that the validated questionnaires are constructed to have internal consistency and that no single question can be isolated from the others and analyzed on its own to give meaningful results.

Dr. Robert Thorne's Evidence

Dr. Thorne was qualified as an expert in environmental health with knowledge of acoustics and psychoacoustics.

Dr. Thorne prepared an assessment of the potential for serious harm to human health due to noise from the Kent Breeze Project. His assessment referenced material provided by IBI Group, Hatch and others and was based on his observations, measurements and findings from the noise and perceptions assessments that he has done in relation to 15 rural wind farms in New Zealand and Australia. Dr. Thorne said he conducted his assessment by considering the noise contours for the Kent Breeze facility predicted by Hatch and comparing these to his own predictions. Based on his predicted noise contours, Dr. Thorne assessed the potential number of residences affected within a particular noise affect area as determined by wind patterns and information provided by IBI Group.

In developing his predicted noise contours for the Kent Breeze facility, Dr. Thorne said he relied on information provided to him by IBI Group and Hatch, as well as annual wind resource data, and aerial and site photographs. Dr. Thorne prepared noise contour predictions for 40 dBA and 45 dBA, which he found corresponded to the noise contour predictions prepared by Hatch. However, Dr. Thorne stated that the standard used by himself and Hatch for the modeling of the contours (ISO 9613-2) has an uncertainty range of plus or minus 3 dBA. Dr. Thorne stated, therefore, that the 40 dBA contour "is not a fixed line as shown by Hatch but a large area encompassed between the 37 contour and midway between the 40 and 45 contours." He stated that when this additional 3 dBA uncertainty is accounted for, a large number of residences would fall within an area where the noise contours exceed the MOE's 40 dBA noise limit. In addition, Dr. Thorne stated that the ISO 9613-2 standard has an assumed limit of 5 m/s wind speed. However, he found that the Kent Breeze wind farm will have wind speeds of 6 to 7 m/s on an annual basis. He stated that this limitation can be compensated for, but he would expect

to see some discussion along those lines, and this was absent in the Hatch Noise Assessment Report. He, therefore, stated that the Hatch Noise Assessment Report was good as a “first cut”, but that it was not complete because it did not take into account the known uncertainties or the other limitations of the standard. He stated that the ISO 9613-2 standard talks about its limitations and uncertainties and that these must always be put into the calculation protocol.

He stated that the noise contours will vary over time and according to different weather conditions. He also stated that there are other uncertainties that must be taken into account. Dr. Thorne stated that based on literature reviews and his own experience, it is his opinion that the ISO 9613-2 standard is not designed to accommodate the highly complex sound emission and propagation characteristics of a wind farm. He stated that while the model is excellent for plant and ground based sources of sound, it is not able to calculate sound levels due to noise sources in phase or the effect of wake and turbulence heightened noise zones. He stated that in his analysis he found that “for a significant percentage of time, on an annual basis, the south-west breeze brings at least 3 turbines into line significantly affecting approximately 38 non-participating residences in the north-east quadrant adjacent to the wind farm. On a westerly, approximately 52 non-participating residence are affected. These residences are all within 2000 m of their respective nearest turbine.”

Based on his experience at other wind farms in New Zealand and Australia, Dr. Thorne described the wind turbine sound effect known as “rumble-thump,” which results from the turbines interacting with each other and from changes in wind direction. He stated that this type of noise is normally non-predictable on a daily or hourly basis and that it can create significant noise distress to residents living within 1200 to 2200 m from the nearest turbine in a row of turbines. In addition, Dr. Thorne stated that this noise can affect people both inside and outside their homes. He stated that at the Kent Breeze facility, the trees on site will not provide any significant noise mitigation because the turbines are 85m high. Further, relatively light roof construction and window glazing would also not provide significant noise reduction.

In his opinion, “serious harm to human health occurs when an individual is so beset by the noise in question that he or she suffers recurring sleep disturbance, anxiety and stress.” He stated that the marker for this sound level is 32 dBA outside the residence and above the individual’s threshold of hearing inside the home. He said that the perception of infrasound is also a marker for adverse health effects. He concluded that based on his prior experience at other wind farms, he expects that between 5% and 10% of exposed households within 1500 to 2000 m of wind turbines (or 32 dBA) will have their health seriously harmed by noise causing sleep disturbance, anxiety and stress. Thus, he indicated, this means that for the Kent Breeze wind farm, five to nine non-participating households will be exposed to serious harm due to noise. He stated that he does not normally discuss effects at distances less than 1500 m because he sees it as a given that if you are within 1000 m, the bulk of people will be adversely affected and that in his experience these people are generally participating or have signed agreements with the wind farms.

Dr. Daniel Shepherd's Evidence

Dr. Shepherd was qualified as an expert psycho-acoustician with knowledge of human health and quality of life.

In preparing his report, Dr. Shepherd reviewed the Kent Breeze Project Description Report, the Hatch Noise Assessment Report, relevant data reported in the peer-reviewed literature, and experimental and epidemiological data collected as part of his own research practice. Dr. Shepherd explained that the recognition of a new disease, disorder or threat to health typically follows a characteristic process, which begins with individual complaints.

Second, case studies begin to appear in the literature and exploratory research is undertaken to obtain better descriptions of the symptoms. Third, intensive research is undertaken to examine the distribution and prevalence of the symptoms and ultimately to determine causal explanations for the symptoms. Dr. Shepherd stated that the literature regarding the health effects of wind turbines is caught somewhere between the first and second stages. He stated that case studies have already emerged in the literature, such as the peer-reviewed group of case studies by Harry, A., "Wind Turbines, Noise and Health" (2007) ("Harry 2007") and Pierpont, N., *Wind Turbine Syndrome: A Report on a Natural Experiment*, (Santa Fe, New Mexico: K Selected Publications, 2009) ("Pierpont 2009"). In addition, descriptive research has been published in Europe by Pedersen E., and Persson Waye, K., "Wind turbine noise, annoyance and self-reported health and well-being in different living conditions" (2007) 64:7 Occup. Environ. Med. 480 ("Pedersen and Persson Waye, 2007") and van den Berg et. al. 2008 describing a correlation between wind turbine noise and annoyance and sleep disturbance.

Therefore, he concluded that the possibility of detrimental health effects due to wind turbine noise must be taken with utmost seriousness. Dr. Shepherd stated that currently, there is not a single credible research paper in the peer reviewed literature stating that chronic wind turbine noise is harmless to health, and rather, there is an emerging body of evidence that under certain circumstances wind turbine noise can have substantial physiological and psychological impacts on individuals.

Dr. Shepherd stated that no acoustic standard exists to sufficiently define what is and is not a serious health effect. He stated that he adopts the definition of health proposed by the World Health Organization ("WHO"): "health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." In his opinion, severe insults to well-being and quality of life, as well as increased morbidity or mortality constitute serious health effects. Dr. Shepherd characterized annoyance as a primary health effect and stated that in its medical usage, annoyance is defined as a mental state capable of degrading health. Annoyance has been found to be correlated to lowered sleep quality and negative emotions (Pedersen 2007) and symptoms of stress, including headache, tiredness, tension and irritability (Pedersen, E., van den Berg, F., Bakker, R., and Bouma, J., "Response to noise from modern wind farms in The Netherlands (2009) 126 J. Acoust. Soc. Am. 634 ("Pedersen et. al. 2009")). He also stated

that annoyance is really another name for stress, so if someone is highly annoyed, that is indicative that they are highly stressed and that is why chronic annoyance can lead to stress-related disease.

Dr. Shepherd stated that the literature to date demonstrates that for equivalent noise levels, people judge wind turbine noise to be of greater annoyance by about 10 dB than aircraft, road traffic, or railway noise. He stated that this is likely due to the unique modulating sound produced by wind turbines. He stated that this corresponds with his own research where he observed that modulating sounds tend to be highly annoying. He stated that standards which are based on road and aircraft noise should, therefore, be adjusted by 10 dB to account for the added annoyance caused by wind turbine noise.

He stated that noise standards are traditionally developed using a dose-response curve that plots noise annoyance as a function of noise level. The standard is set by defining an acceptable level of annoyance and then determining the corresponding level of noise. However, Dr. Shepherd stated that noise level is actually a very poor predictor of the human response to noise because annoyance reactions tend to vary substantially and do not appear to be correlated with noise level. He explained that both the physical nature of sound and psychological characteristics of the listener combine to produce noise annoyance. The bulk of the annoyance response is likely to depend more on individual traits and contextual factors such as age, attitude to the noise source, personality, mental functioning, time of day and noise sensitivity than on acoustical characteristics of the noise. He stated that noise level only accounts for between 15 to 20% of the variation in annoyance response across individuals, and he, therefore, recommended that noise level should be given a 15 to 20% weighting in the decision as to whether a proposed wind project should go ahead. In his opinion, the most weight should be placed on the potential amenity threats and the impact on vulnerable groups in the area, such as the elderly, children and noise sensitive individuals.

Dr. Shepherd referred to the WHO's "Night Noise Guidelines for Europe" (2009) ("WHO Night Noise Guidelines") and noted that these guidelines indicate that health begins to be degraded between 30 and 40 dB and that 30 dB is the level that can be considered "safe" while 40 dB and above can be considered "unsafe." He explained, however, that these values were developed based on aviation and road noise annoyance data. In addition, the WHO used a value of 21 dB for sound attenuation from outside a building to inside, instead of the 10 to 15 dB which is typically used. Further, he noted that although the guidelines recognize the existence of vulnerable groups and individual differences in noise sensitivity, the noise levels are based on aggregate data which do not distinguish between vulnerable and non-vulnerable groups. Dr. Shepherd concluded that based on the limitations of the WHO Night Noise Guidelines as applied to wind turbine noise, the lower guideline of 30 dB would protect residents from adverse health effects and levels greater than this will increase the proportion of residents experiencing noise-induced health effects to unreasonable levels. Supporting this conclusion, Dr. Shepherd referenced the van den Berg et. al. 2008 study which found that, at 30 to 35 dBA, 10% of

respondents were rather or very annoyed at wind turbine sound, 20%, at 35 to 40 dBA and 25%, at 40 to 43 dBA. This study also found that road noise does not adequately mask turbine noise and reduce annoyance. Dr. Shepherd stated that it appears that the proponent of the Kent Breeze Project has not sufficiently assessed the health impacts of turbines in the region by considering the prevalence of vulnerable groups or traits or factors that predict amenity values.

Dr. Shepherd described his experience with wind farms in New Zealand and how there are many examples where the actual noise levels measured once the turbines are in operation are higher than the predicted noise levels. He described how higher noise levels than predicted have been observed in the Manawatu region, the Makara Valley and the Te Rere Hau project. Based on this experience in New Zealand, Dr. Shepherd cautioned against relying solely on models, which are heavily constrained by assumption, when trying to determine the effect of wind turbine noise on residents.

Dr. Shepherd stated that the peer-reviewed literature demonstrates that people who live in rural areas have greater expectations of peace and quiet than do those living in suburban, urban or industrial areas, and consequently, exposure to noise produces a greater negative reaction in rural areas. He noted that Pedersen and Persson Waye 2007 found that those living in rural areas are more likely to be annoyed than those in suburban areas. Dr. Shepherd classified the Kent Breeze area as rural / semi-rural and concluded that it is more likely than not that noise from the proposed wind farm will degrade amenity for a large proportion of residents and that this will result in strong annoyance reactions to wind turbine noise. Dr. Shepherd stated that since annoyance is a primary health effect, he predicts serious adverse health effects for some individuals in the Kent Breeze area arising from their response to amenity loss.

Dr. Shepherd stated that noise sensitivity is considered to be a stable personality trait that is relatively invariant across noise levels and is a strong predictor of noise annoyance and correlated with sleep quality. He stated that noise sensitive individuals are more likely to pay attention to sound and evaluate it negatively and they have stronger emotional reactions to noise and greater difficulty habituating. He said that international studies and his own research estimate the prevalence of severe noise sensitivity to be between 10 to 15% of the population. He noted that noise sensitive individuals may try to avoid noisy areas and choose to live in quieter areas. His research in New Zealand showed that there is a higher proportion of noise sensitive individuals in rural areas than urban and suburban areas. Based on this research, Dr. Shepherd predicts that at least 10 to 15% of the residents exposed to noise from the Kent Breeze wind farm will suffer adverse health effects of sufficient severity to justify medical intervention.

Dr. Shepherd explained that noise interferes with sleep in several ways. It may be sufficiently loud or annoying to prevent the onset of sleep or return to sleep following an awakening, or it may arouse or awaken the sleeper during sleep. He noted that there is a proportional relationship between arousals and doziness, fatigue, headaches and poor memory and concentration. Dr. Shepherd stated that audible wind turbine noise has the potential to cause

arousals, sleep fragmentation and sleep deprivation. He noted that the effect of wind turbines on sleep is not yet sufficiently quantified. However, he said, chronic sleep disturbance appears to be the most common complaint of those living near wind turbines. He referenced a number of studies which demonstrate the relationship between wind turbine noise and sleep disturbance. From his own research in the Makara Valley, New Zealand, Dr. Shepherd found that satisfaction with sleep is significantly less in turbine areas than in non-turbine areas.

He stated that noise sensitive people take longer to fall asleep and their sleep quality is more likely to be compromised by noise than that of non-sensitive individuals. It is Dr. Shepherd's opinion that at 40 dB, the probability of sleep disturbance for noise sensitive individuals is high (approximately 40%) and that noise sensitive individuals living near the Kent Breeze wind turbines will more likely than not suffer disrupted sleep and an associated decline in health. Dr. Shepherd stated that the WHO reports that noise-induced annoyance and sleep disturbance can, when chronic, compromise positive well-being and quality of life.

Dr. Shepherd stated that the noise contours predicted in the Hatch report are averages (dB Leq) which do not represent the peak noise levels that are more likely to disturb sleep. He noted that it appears that the reports prepared for the Kent Breeze Project do not include estimates of maximum noise levels, which would be more meaningful in relation to predicting sleep disturbance.

Dr. Shepherd described some of his own research in the Makara Valley in New Zealand, a rural setting where wind turbines have been operating for the past year. The study used a non-equivalent control group post-test-only design and measured Health-Related Quality of Life ("HRQOL") from residents living in the Makara Valley and those in a matched comparison area. The study used a WHO tool to measure HRQOL and asked questions on amenity, noise annoyance, and noise sensitivity, while masking the intent of the study with a neighbourhood satisfaction survey. He said that the research has not been published yet, but it has been submitted to a peer-reviewed journal for consideration and details were recently presented at a New Zealand acoustics conference. Dr. Shepherd stated that the results of the study found that the Makara Valley sample reported lower physical, environmental and overall HRQOL and were less satisfied with their sleep than those in control areas. There were no statistical differences between the two areas in social or psychological HRQOL. From the findings in the Makara Valley that exposure to wind turbines is linked to degraded HRQOL, Dr. Shepherd predicted that, given the similarities between the projects, the Kent Breeze turbines would likewise degrade the HRQOL of nearby residents and serious health effects will occur.

Dr. Shepherd concluded that it is his opinion that it is more likely than not that the Kent Breeze wind farm will compromise the well-being of many residents and that over a longer period of time exposed individuals with noise sensitivity will develop stress-related disease. He stated that, despite his opinion that the standard should not be based solely on noise level, if this is the sole criterion to be relied on, then he is satisfied that a level of 30 dB will avoid serious health effects to individuals in the immediate vicinity.

Dr. Shepherd recommended that a 30 dBA limit would be more appropriate because the WHO derived their Night Noise Guidelines based on traffic and air noise, not turbine noise which is constantly judged to be more annoying. In addition, the Guidelines assume a 21 dB attenuation from inside to outside. He stated that his recommendation of 30 dB is 5 dB lower than that which is recognized to cause harm in the draft New Zealand wind turbine noise standard. He stated that he took 5 dB off this recommendation because the New Zealand standard uses mean noise levels rather than peak levels, and in relation to sleep, 35 dB noise is high enough to disrupt sleep and sleep onset.

Dr. Shepherd testified that, in light of the WHO definition of health, sleep deprivation and annoyance are in themselves serious health impacts that, if experienced chronically, can result in harmful health degradation. He noted that chronic and severe annoyance and sleep deprivation have been reported in the peer-reviewed literature by Pedersen (Pedersen 2004; Pedersen and Persson Waye 2007) and van den Berg et. al. 2008. He stated that his own paper outlining the impacts of turbine noise on quality of life has been submitted to the peer-reviewed journal “Noise and Health” and has been accepted. He noted that quality of life is an operationalization of well-being, which is a component of the WHO definition of health.

Dr. Jeff Aramini’s Evidence

Dr. Aramini was qualified to give opinion evidence as an epidemiologist with knowledge of public health, statistics and statistical analysis.

Dr. Aramini gave evidence relating to a study by Wind Vigilance for Ontario Communities (Windvoice), “A Self-reporting Survey: Adverse Health Effects, Industrial Wind Turbines (IWT) and The Need for Vigilance Monitoring” (January, 2011) unpublished (the “Windvoice Survey”), in which he was involved. He explained that the Windvoice Survey was a self-reporting survey conducted in the spring of 2009 to document changes in health outcomes of people living near industrial wind turbines. Participants were notified of the study through a Health Survey Contact Flyer that was distributed to residents living near existing wind projects in the following areas of Ontario: Melancthon, Shelburne, Goderich, Ripley, Kincardine, and Port Burwell.

In addition, he said, the study was advertised at community meetings and on the internet and a toll free phone number was provided for people to phone in and request the survey. Dr. Aramini noted that this methodology follows the approach that Health Canada uses for post-market drug surveillance. The questionnaire that was used in the study was reproduced from Harry 2007. Completed questionnaires were returned via mail and the responses were entered into a database which was then provided to Dr. Aramini. In performing the statistical analysis of the data, Dr. Aramini said he primarily conducted descriptive analysis, as well as some statistical modeling. The study included 109 participants. However, Dr. Aramini said, only the data for 96 participants was analyzed because seven were excluded as they did not report having altered health or quality of life, four were excluded because they were under 18 years of age, and two were excluded because they were 5 km or more away from an IWT. The mean age of

participants was 52 years old, ranging from 20 to 80 years and there were an almost equal number of males and females.

Dr. Aramini stated that his analysis found that there was no association between how far the participant lived from a turbine and stress, anxiety, and depression. He explained that this is expected since the participants were self-selecting to participate in the survey, presumably because they were experiencing these symptoms. However, Dr. Aramini stated that for disturbed sleep, excessive tiredness and headaches there was a dose-response relationship with how far the participants lived from the turbines. Dr. Aramini suggested that, if there truly was no effect of distance from the wind turbine on these health effects, then you would expect to see results more like those for stress and anxiety, and you would not expect to see what appears to be a dose response within the self-selecting group. He stated that based on the limited modeling that he did for this project, a log-linear type curve fit better than a linear curve and this fits with the characteristics of noise and how it propagates.

Dr. Aramini explained that while case series studies do not carry as much causal weight as the more controlled-type studies, they are still important and the vast majority of diseases and conditions are recognized through these types of studies. He noted that it is important not to over-interpret a case series study.

Dr. Aramini also performed the statistical analysis for the Nissenbaum Study. Dr. Aramini explained that this Study was a stratified cross-sectional study, where the outcome and exposure are measured on the same people. In this Study, the dependent variable was distance to the wind turbine and the independent variable was the various health outcomes. He explained that the SF-36 questionnaire comes with QualityMetric Health Outcome Scoring Software to calculate the mental health and physical scores as well as other indicators, such as the internal consistency and completeness. Dr. Aramini stated that for the SF-36 data, the indicators of the quality of the data all exceeded the minimum value, and therefore, he had confidence that the data were reliable. Dr. Aramini used SAS 9.22 software to perform descriptive and multivariate analyses. He explained that the sample size was 79 participants, 39 lived within 1400 m of a wind turbine and 41 lived further than 3300 m from the nearest wind turbine. The mean ages of participants ranged from 50 to 65 across the groups and there were roughly equal numbers of male and female participants. The parameters of age, gender, and household clustering were controlled for in the statistical analysis.

Dr. Aramini stated that he found a statistically significant association between sleep quality and distance to the nearest wind turbine. When controlled for gender, age, household clustering and site (Vinalhaven versus Mars Hill) he said that the results show that the closer you are to the IWT the higher the PSQI and the ESS score. Dr. Aramini explained that for these data a log liner type slope fit better than a straight linear curve and he stated that the curves for both the PSQI and ESS were found to be statistically significant. He noted that although the PSQI and ESS involved different approaches to look at sleep quality, the results showed a very similar dose response curve for both. Dr. Aramini stated that for the mental component score measured

by the SF-36 there was also a statistically significant difference between the close and far groups from the IWTs. He explained that, for this scale, a mental health score of 50 is considered average and anything below that is considered below average. The curve of these results shows that the closer the resident to an IWT, the poorer the mental health score following a log linear curve. In addition, the results of the "before and after" questions relating to irritability, anger, anxiety and stress also showed significant differences between the close and far groups in the change from before and after the installation of the IWTs. For attitude and quality of life, which were assessed through the "before and after" questions, he found that people reported that they had positive, favourable attitudes towards the wind projects regardless of their distance away and then after the turbines went into operation, the close group reported a negative attitude that was significantly different from the change in attitude experienced by the far away group. Dr. Aramini explained that the log linear shape of the curves was informative because it accords with how sound decays and thus provides additional weight or confidence in the findings.

Dr. Aramini explained that in order for something to bias the result, the factor needs to be associated with both the outcome and the exposure of interest. He stated that reporting bias and selection bias are potential biases that were looked at in the Nissenbaum Study. He explained that reporting bias would occur if individuals living closer to the IWTs were more or less likely to report adverse health outcomes than those living far away and selection bias would occur if those living close to IWTs are more or less likely to participate in the study. Dr. Aramini stated that because the participants in this Study were not blinded, there is potential for information bias. He explained, however, that the validated questionnaires were used to attempt to minimize this type of bias. He stated that there would be a greater possibility of bias with the "before and after" questions. However, he noted that the associations of health outcome with distance were strong across all of the questions, including the validated questionnaire scores, so this provides an indication that reporting bias likely did not have a large influence on the results. Dr. Aramini stated that there was actually some blinding in the Study, as the participants generally performed very poorly in perceiving how far away they were located from the turbines. He stated that it is difficult to conceive of how you would obtain the dose response curves that were generated if the answers were purely driven by bias, particularly since the participants did not know how far they actually were from the turbines. Dr. Aramini stated that the relationships were observed across both of the sites without any statistical difference between the two, which allowed the data to be pooled.

Dr. Aramini explained that there are five basic parameters that are typically used to judge causal relationships. The first is time sequence and this requires that, in order for the factor of interest (ie.: wind turbine noise) to cause a health effect, it must precede the onset of the health effect. He stated that the results of the "before and after" questions and the questions asking whether their symptoms improve when the participants are away from their residences confirmed that the operation of the turbines preceded the health effects. He said that the results showed that the majority of measured parameters (sleep quality, mental health, somatic health and attitude)

significantly worsened among those living within a closer distance post operation of the IWTs compared to those living further away from IWTs. In addition, temporary improvements in sleep and headaches were reported when participants were away from their residences.

He stated that the second parameter is strength of association. This is different than statistical significance because it describes the degree to which phenomena occur in close association. The stronger the association, the more likely it is to be causal. Dr. Aramini found that the associations between distance to IWTs and health outcomes were both statistically significant and clinically relevant for the majority of health outcomes assessed.

The third parameter is specificity of association which describes the precision with which the occurrence of one variable will predict the occurrence of another. Dr. Aramini stated that it is difficult to use specificity of association to evaluate the causal relationship between IWTs and health because distance to IWTs appears to be associated with a number of health outcomes, which individually are not specific. However, he stated that if you look at the collection of health outcomes as a whole, this group may actually represent a relatively unique health outcome.

The fourth parameter, he stated, is consistency and replication, which looks for the replication of results in many studies or analyses to demonstrate causation. Dr. Aramini stated that because this is the first controlled study investigating the association between IWTs and health, the criteria of consistency cannot be used to evaluate causation. However, he noted that the Nissenbaum Study found a similar result across the two different sites and also that similar adverse health effects among people living near IWTs have been documented in a number of other case-series studies and surveys. He acknowledged that case series studies do not carry as much causal weight, but they do add value to the consistency criterion.

Dr. Aramini stated that the last parameter relates to the coherence of the explanation for the causal association and whether it is plausible, physiologically and biologically, that noise could cause the observed health outcomes. However, he did not discuss this parameter as it is outside his expertise.

Dr. Aramini explained that a P-value represents the probability of getting the observed result just by random chance. He stated that it is generally accepted that a significant P-value is anything under 0.05. However, he stated, it is really a very arbitrary cut off to say that a 5% chance of seeing that difference is significant but a 6% chance is not. He explained that, even though some of the P-values for the various health outcomes in the Windvoice Survey were greater than 0.05, they were still informative in drawing conclusions about a possible trend. Dr. Aramini noted that the Windvoice Survey was not designed to test causation, but rather to identify individuals who perceived their symptoms to be due to wind turbines. Dr. Aramini explained that the seven individuals who did not report altered health were excluded because they did not add any value to the analysis, which was aimed at quantifying those who had altered health and quality of life and looking at the descriptive parameters within those individuals only.

Dr. Aramini stated that he was retained for this Hearing to discuss the Nissenbaum Study and the application of appropriate epidemiological principles.

Dr. Aramini stated that the Nissenbaum Study presented the average effect over adults controlled for age. Dr. Aramini explained how he assessed the Vinalhaven data for selection bias, given that about half of the people identified as living within the closer distance of the wind turbines did not participate. He stated that the results of the Mars Hill site, where there was a high proportion of participation, were compared to the results of the Vinalhaven site and he found that the associations were similar across the two sites, which indicated that there was no strong selection bias which could explain the results.

Dr. Aramini explained that the Bonferroni correction can be used to correct for the phenomenon that, if you perform enough statistical tests or comparisons, significant results will be generated by random chance. He stated that he did not apply a Bonferroni correction to his analysis and that, in his opinion, it was not necessary or appropriate because he was looking at outcomes that are measuring different things (eg. mental health, sleep, etc.). Further, he suspected that even if he had done so, many of the results would still be statistically significant. He also explained that the Bonferroni correction attempts to guard against Type I errors (i.e., showing an effect when there is none). He noted that adjusting for Type I errors can lead to more Type II errors (i.e., not showing an effect when there is one).

Dr. Aramini explained that the Bonferroni correction looks at the number of tests; the fewer the tests, the easier it is to meet a statistically significant value. He said that is why many think it is inappropriate to use. In response to the suggestion that he did not use the Bonferroni correction, thus leaving himself open to more Type I errors, Dr. Aramini answered that if one looks at all the results, including the magnitude, the directions, and the trends, many of the results are suggesting an effect some way or another, regardless of the Bonferroni correction. He said that there is a way to actually calculate how likely it would be to get so many tests going in one direction and not the other. He said that you can try to do “statistical magic” that way too, to actually show it is highly significant; it is highly unlikely to get several outcomes going in all the same direction. However, he said that that is just more “statistical camouflage” with respect to what truly is being demonstrated.

Dr. Aramini testified that he reviewed the witness statements, documents and critiques submitted by Drs. Mundt, Ollson, Baines and Speechly. He indicated that some of the comments deal with formatting and how the information was presented. While those were useful, he stated that he focused on comments relating to the substantive epidemiological parts of the Nissenbaum Study. He then discussed issues relating to P-values, various graphs, such as the PSQI and Mental Component Score (“MCS”) graphs, produced in the Nissenbaum Study and the criticism that he did not present any of the R-squareds.

Dr. Aramini said that he created three new charts with regression analysis curves but with a line for each site, leaving in the interaction term. He explained that together with the P-values, he looks at the shape and the slope and makes an assessment whether it is reasonable to include

that interaction term. He concluded that with all three, the trends are all in the same direction and the slope of the curves is close.

With respect to the suggestion of reviewers that potential bias affected the Nissenbaum Study, Dr. Aramini commented that, while there is no “statistical magic” that can remove bias and produce valid results, it is possible to consider the potential influences of bias and determine their effect on the results.

Dr. Aramini then discussed issues dealing with criticisms that there may be various types of bias in the Study, such as selection bias, reporting bias, recall bias and fatigue. Dr. Aramini summarized his comments on bias by saying that it is impossible to rule out all potential sources of bias, but one can make assessments to help determine how likely it is that bias influenced the results.

He also responded to the criticism that the “before” parameters with respect to attitude and stress for the near and far are quite a bit different and that, as a result, the groups cannot be compared on any of the other scales, ie., ESS, PSQI and MCS.

Dr. Aramini addressed the reviewers’ comments that the Nissenbaum Study did not provide information about what would be considered normal and abnormal scores for the health outcomes measured by the validated questionnaires. Dr. Aramini responded to the criticism that the Study results cannot be interpreted in relation to other sites without the background rate of abnormal/normal. He wished to address how the Study results can be applied, together with other studies, to help make decisions in other circumstances.

Dr. Aramini stated that regression analysis is commonly used by epidemiologists to investigate the relationship between a risk factor (here, the nearest wind turbine) and a health outcome (here, MCS scores). He said that epidemiologists use techniques such as regression analysis because it is difficult to appreciate and impossible to accurately measure these relationships when looking at the raw data. This is because simple summary statistics (including scatter plots) do not account for other potential factors that one is less interested in, in this case, age, gender, site and the effect of household clustering. He said that statistical tests and resulting P-values are then used to assess how unlikely it would be to find the relationship if in fact it does not exist in the study population.

Dr. Aramini responded to Dr. Mundt’s assertion that the regression modeling approach taken and the results presented “not only fails to represent the source data – the ultimate goal of statistical model – but it is misleading”. He said that this is disturbing to him as a public health epidemiologist. He said that he has analyzed hundreds, if not thousands, of health datasets over the past 15 years. He said that with the exception of adjusting for household clustering, which added a higher degree of sophistication to the modeling exercise, the regression analysis methods used in the Nissenbaum Study are standard techniques used to investigate risk factors and health outcomes.

Dr. Aramini stated that the Nissenbaum Study looked at the association of various health outcomes and distance from people's residences with respect to the nearest wind turbine. He said that the results do not prove but do support a causal link between living close to a wind turbine and a number of health outcomes. He concludes that the primary exposure examined was distance, so the results show that there is something happening that is related to distance. The Study does not look at mechanisms of causation (sound, visual impact).

Dr. Aramini disagreed with the suggestion that, as a member of the Society for Wind Vigilance ("SWV"), he is looking for certain study outcomes and used statistical methods that will enhance the results looked for. He said that he was looking to help identify what is truly going on. He said that in epidemiological studies, he uses his best experience and education to apply valid approaches to try to analyze the data.

Dr. Aramini confirmed that the current manuscript of the Nissenbaum Study is not in final form; final formatting has to be performed and he said that much of what came out of the review and criticism in this Hearing will make it a better manuscript.

In reply evidence, Dr. Aramini presented a model which applied the results of the Nissenbaum Study to predict potential health impacts of the Kent Breeze Project on residents living near the Project.

Dr. Jeffrey Wilson's Evidence

Dr. Jeffrey Wilson gave opinion evidence in this proceeding as an expert in epidemiology, with knowledge of public health, statistics and statistical analysis.

Dr. Wilson said he conducted an independent epidemiologic methodology review of the Nissenbaum Study resulting in his report dated January 20, 2011 (the "Wilson Report"). Dr. Wilson testified that his professional opinion, as set out in his report, is that the authors of the Nissenbaum Study provide strong evidence of a causal relationship between wind turbines and various health effects which are outlined in the Study.

Dr. Wilson explained that the potential biases in any study are an important consideration. With respect to the Study, the areas of potential bias are: 1) selection bias (selection of study participants); 2) information or reporting bias (ways in which participants could respond inappropriately or in an exaggerated or untrue way); and 3) compliance bias (participants enrol in a study in a biased manner resulting in an apparent health effect that does not exist). Dr. Wilson testified that it did not appear plausible to him that any of these possible biases would be adequate to fully explain the Study results.

He explained that for selection bias to be present, the people conducting the investigation would have had to select participants in a biased manner by, for example, selecting people at the sites distant from the IWT who had a low level of health effects. However, Dr. Wilson testified, this would require the investigators to make their selections without knowing the participants' general state of health. The selection would have to occur in a stepwise manner as the

distance from the wind turbine decreased in order to create the linear effect in the Study. This would have to occur for multiple health outcomes and at the two sites represented in the Study. Dr. Wilson concluded that it was not plausible to expect that the purposeful or inadvertent selection of people could result in the pattern of data in the Nissenbaum Study.

Dr. Wilson explained that for compliance bias to exist, people would have to enter the study voluntarily in a biased manner, namely to self-select in a graded manner, the closer they got to the wind turbine, in order to create the consistent effect in the Nissenbaum Study. This would have to occur for multiple outcomes and for two sites. He concluded that the data did not support the presence of such a bias.

Dr. Wilson explained that it was always possible that reporting bias might be present with respect to an individual, namely exaggeration or lying about responses. However, he concluded that it was not plausible that enough people might have done it in a systematic manner so as to result in the pattern of data in the Nissenbaum Study. He indicated that there would have to be misrepresentation of answers in an organized fashion that resulted in the dose response curves in the Study. The participants would also have had to understand the nature of the questionnaires to get a consistent dose response. The Study also involved multiple outcomes at two sites. He indicated that the questionnaires are designed to detect misinformation and inconsistencies. He explained that when the internal check of the data in the Study was done by computer, the results exceeded the norms for this type of study.

Dr. Wilson testified that he finds it implausible that those levels of bias could exist at a level to explain the health effects reported. He stated that the health effects demonstrated by the Nissenbaum Study are very strong compared to most epidemiological studies. He explained that a doubling of the health effect as a result of exposure is considered substantive evidence for an effect, all other things being equal. He said that in the Study, effects are reported from two up to 10 times as a result of exposure. He indicated that the results argue against a bias which would have to be acting at a very profound level – stronger than normally seen with actual real risk factors in studies.

Dr. Wilson stated that determination of a causal relationship is fundamental to epidemiology. There are a variety of criteria for causation, of which five are outlined in the Nissenbaum Study. He explained that he has used and taught that scheme but over the years has developed his own practical approach to determining causation.

He stated that he first examines whether the study in question is well-designed. With respect to the Nissenbaum Study, he stated, his conclusion was yes, based on his critical evaluation. He indicated that there are some methodological flaws, but they have a minor impact and are not significant. He indicated that all epidemiological studies have some flaws.

Second, he examines whether there is an association between the risk factor and the outcomes. Association is demonstrated by a statistical association, which is interpreted by looking at P-values. He stated that a convention is that if the P-value for an association is less than .05, that

is considered a statistically significant result. Depending on the sample size and so on, a higher P-value might be accepted, for example, .06 or .07. He concluded that the tables and P-values in the Nissenbaum Study demonstrate lots of associations at less than .05, therefore not necessitating an expansion of the significance of criteria.

The third criterion is whether the statistical association is strong. He indicated that the Nissenbaum Study shows ranges of effects from two up to 10 times resulting from exposure. He testified that these are very strong effects, as effects of doubling resulting from exposure to a risk factor are generally considered to be strong effects.

Finally, he examines whether there are any other biases that might be missing from the analysis. In this case, Dr. Wilson stated, the biases can be discounted as he previously indicated.

Dr. Wilson indicated that he looked at the other criteria identified in the Nissenbaum Study, one of which is time sequence. Dr. Wilson noted that the time sequence criterion is satisfied as health effects reported in the Study followed exposure; namely that the effects worsened after exposure for a period of time.

Dr. Wilson explained that the criterion of specificity dictates that if it can be demonstrated that one exposure (in this case wind turbines) causes one health outcome, that is presumed to be stronger evidence of a causal relationship. But, he explained, that thinking comes from 19th Century work on establishing causation of things like anthrax bacteria causing septicaemia in people. He said that they were studying simple situations. He further explained that most environmental exposures today have multiple health outcomes, so that this criterion is not relevant.

Fourth, he stated, he examined the criterion of consistency of replication which speaks to whether the effect is seen under more than one circumstance. This Study, he testified, could be viewed as two independent studies occurring at two different sites. He referred to the analysis by Dr. Aramini indicating there was no interaction by site, meaning the effects were identical by site and as a result, he pooled the data. Dr. Wilson stated that the data were replicated in two sites by virtue of the Nissenbaum Study. He added that further information on consistency of the effect comes from the case reports mentioned. Although case reports do not provide as strong information as this controlled study or other epidemiologic studies, any trained epidemiologist with experience would include them as part of an assessment of the effect and would view them as evidence of a consistent effect.

Finally, he stated, with respect to the criterion of coherent explanation, in addition to evidence from the epidemiologic study, it is helpful to have an understanding of the underlying biology of the system, namely the impacts of sound from wind turbines on people, which he stated, was outside his area of expertise. However, Dr. Wilson stated that with respect to the data in the Nissenbaum Study, the logarithmic-shaped curve of dose response suggests or parallels

exponential decay in sound intensity that would come from a point source, which would be consistent with the underlying biology.

He explained that another criterion for causation is the dose response. He indicated that the dose response provides additional evidence for causation because most sources of bias do not tend to produce that kind of a dose response. Rather, they produce a yes/no kind of response.

Dr. Wilson concluded that the analysis in the Nissenbaum Study takes into account all of the necessary parameters and passes the criteria, providing strong evidence of a causal relationship between wind turbines and adverse health effects.

Dr. Wilson stated that the sample size was adequate to show the associations presented in the Nissenbaum Study. He discussed the implications of how the Study was titled and the use of non-standardized questions in the questionnaire. Dr. Wilson explained that the words "relationship" and "association" are essentially synonymous, but when the word "causal" is added, the meaning is altered. Association is simply a statistical observation of two things happening at once, while causal associations are when A causes B. Dr. Wilson also testified on issues relating to the sampling method used in the Nissenbaum Study.

Dr. Wilson described the objective of the Nissenbaum Study as being to investigate the association between adverse health effects and proximity of residence to an IWT. Dr. Wilson explained that the Study provides evidence of a causal relationship, but the precise nature of the relationship, in terms of its strength in different contexts, different populations, different situations, would come from additional study. Dr. Wilson also discussed whether the data in the Study can be extrapolated to Ontario.

Dr. Wilson stated that he looked at the questionnaires but did not evaluate them. He also discussed the implications of a preliminary study being undertaken with some of the same people that were sampled. He discussed the use of the Bonferroni correction, which, he stated, helps avoid Type I errors, but at the same time, is likely to cause Type II errors. He also addressed the issue of providing median scores without giving means.

Dr. Wilson stated that it would be an editorial decision as to whether to: 1) include in the manuscript the time over which the questionnaires were completed, the number of questions asked and answers; 2) include text with the tables; and 3) provide normal ranges for the tests administered together with the results.

Dr. Wilson discussed whether confounding variables could be another source of potential bias. He also discussed the practice of using a nurse practitioner to ask the questions of those being surveyed.

Dr. Wilson said that there are multiple approaches for evaluation of epidemiological studies, all of which address fundamentally the same issues. He explained that there is no one single "checklist" that is correct; all of the criteria for validity and causation have to be evaluated in context and all are ultimately open to debate in most situations.

He also testified on cross-sectional study designs, exposure variables and study evaluations.

Dr. Christopher Hanning's Evidence

Dr. Hanning was qualified to give evidence as a medical doctor with experience in sleep medicine and sleep physiology. He authored a January 2011 report titled "Wind turbine noise, sleep and health."

Dr. Hanning explained that he found the source materials for his report, which was a literature review, by searching the Web of Science database for articles and other publications, searching their reference lists but also searching the internet more generally. With respect to the Kent Breeze Project, he indicated that he looked at the Hatch Report, other relevant sections of the application, as well as the MOE Noise Guidelines and O.Reg. 359/09.

Dr. Hanning stated that his initial conclusion from reviewing the literature was that there was good evidence that IWTs do create sufficient noise to disturb sleep and impair health. He referred to section 511 of the draft New Zealand standard on wind farm noise, which also appears in the actual standard. It states that limits for wind farm noise are required to provide protection against sleep disturbance and maintain reasonable residential amenity.

Dr. Hanning concluded that in the United Kingdom and Ontario, the guidelines are set too high, such that turbines can be sited too close to human residence to prevent this harm and serious harm does occur. Dr. Hanning explained that it is now well recognized that sleep is not a state of inertia but a state in which the brain is to a degree disconnected from the real world but is actually processing sounds and deciding whether they merit awakening.

He indicated that noise can interfere with sleeping in a number of ways. It may be sufficiently annoying or audible so that it prevents the onset of sleep or if it is present when a person awakens, it may prevent a return to sleep. Dr. Hanning explained that sleep is not a continuum but a cycle and people commonly wake between cycles although they may not be aware of it.

Dr. Hanning testified that there is a very large body of literature showing that if sleep is inadequate because it is too short or of an inadequate quality, the long-term risks can be obesity, the risk of diabetes, high blood pressure, heart disease, stroke, cancer and impaired immunity. People who are sleep deprived are more susceptible to cold viruses. The short-term risks are fatigue and sleepiness, which pose a risk of traffic accidents. He indicated that being sleepy can also impair the ability to hold down a job, do mental tasks and remember things. He stated that it is very important for a child to have adequate sleep. He also testified that a study that used the SF-36 Questionnaire as well as others, compared people with diabetes, epilepsy and arthritis to people who were sleepy and found that the overall effect on the quality of life was much the same. He stated that sleepiness is not a trivial matter and patients who have sleepiness induced have been put to serious harm.

Dr. Hanning explained that humans have two types of sleep. Slow wave sleep tends to occur the first half of the night. Rapid eye movement or dreaming sleep tends to occur mostly in the

latter half of the night. Both are important. Dr. Hanning testified that slow wave sleep, during which the brain is relatively inactive, consists of stages one to four. Stage two is the first level of true sleep and stage four is a deep sleep, which would occur 20 to 30 minutes after first falling asleep.

Dr. Hanning testified that the character of noise can be important. He said that, where some sounds such as music are very soothing and are recommended to help induce sleep, it appears that the sort of thumping noise made by wind turbines is particularly annoying and intrusive. Dr. Hanning explained that moving from wakefulness into sleep and vice versa is not an instantaneous event but a process. When one moves from wakefulness into sleep, the transfer of information from short-term memory to long-term memory stops and is the last to be restored on awakening. One remembers an awakening only if it is longer than 20 or 30 seconds. As a result, he said, if one relies on recalled awakenings as the outcome measure of an effect, say of noise, one will underestimate the effect because of the failure to recall all of the brief awakenings.

Dr. Hanning indicated that some noises do not cause an actual awakening but an arousal, which is a brief increase in the frequency and decrease in the amplitude of the brain waves or electroencephalogram ("EEG"). Arousal is moving from a deeper level of sleep to a lighter level of sleep and usually lasts a few seconds. Wakefulness is not reached, so there is no recall of it, but the result is to disrupt the sleep and reduce its efficiency in restoring the normal daily functions. Dr. Hanning stated that people may have several hundred arousals per night of which they are unaware and have very fragmented sleep but be aware only of its symptoms which are sleepiness, fatigue, headaches, poor memory and poor concentration. He stated that people vary in their susceptibility to arousals; a recent paper by Dang-Vu et. al., "Spontaneous brain rhythms predict sleep stability in the face of noise" (2010) 20:R Current Biology 626 ("Dang-Vu 2010") shows that this has to do with the number of spindles, a particular EEG phenomenon. The fewer the spindles, the less robust sleep seems to be. Spindles decrease with age.

Dr. Hanning explained that arousal arouses the autonomic nervous system, which controls internal functioning, blood pressure and heart rate, and results in a small blip or increase in blood pressure and heart rate. If there are enough blips, high blood pressure can result, which, he said, has been very well recorded for aircraft and traffic noise exposure. Dr. Hanning discussed a study from 2005 that suggests that arousals could be caused by sounds as low as 32 dBA and awakenings, by events at 42 dBA. He added that the more recent evidence in Dang-Vu 2010 suggests that, in susceptible individuals, much lower sound levels (30 dBA or less) may cause arousals.

Dr. Hanning explained that it is well established that arousals are caused by aircraft, railway and traffic noise, as shown in Basner's work (Basner, M. et. al., "Aircraft noise: Effects on macro- and microstructure of sleep" (2008) 9:4 Sleep Medicine 382 and Basner, M., "Nocturnal aircraft noise exposure increases objectively assessed daytime sleepiness" (2008) 17:supp. 1 Journal

of Sleep Research 512), resulting in daytime sleepiness. He said that other work stated that freight trains are more likely to cause arousals than passenger trains, because they are longer, so the sound goes on for longer, move more slowly and tend to produce more low frequency noise. Some, he stated, equate wind turbine noise with the sound of a passing train that never passes, which may be why wind turbine noise seems to be particularly likely to cause sleep disruption. He stated that he did not know the source of the quote about a passing train that never passes, nor did he know what level of noise would be emitted.

Dr. Hanning referred to a 2009 study from de Kluizenaar (de Kluizenaar, Y. et. al., "Long-term road traffic noise exposure is associated with an increase in morning tiredness" 126 J. Acoust. Soc. Am. 626) linking exposure to traffic noise and the risk of awakening in the morning feeling not rested. Although that was a non-specific question, the increase in effect started at 35 dB at an L night value. Dr. Hanning stated that this confirms that excessive noise does disturb sleep, impairs its restorative properties, leading to daytime sleepiness, which in his view, constitute serious harm.

Dr. Hanning indicated that there is a proportion of the population, about 15%, that is more sensitive. He explained that the trait does not seem to be dyscratic, is at least partly heritable and is stable or present through life.

With respect to the testimony of Dr. Thorne and Dr. Shepherd, Dr. Hanning indicated that he was in general accord with their recommendations about external noise levels and setback distances. He stated that they recommended lower levels regarding external noise than he has at 35 dB because he conducted a review of the published evidence, rather than actual experience and live research they relied on; thus he deferred to them.

Dr. Hanning commented on the recommendations of the WHO Night Noise Guidelines and explained that the WHO initial recommendation was 30 dB of L night outside, which, he indicated, is not really a night average but was suggested to protect the public, including the most vulnerable group such as children, the chronically ill and the elderly, from the adverse health effects of noise. Subsequent reports, he added, introduced the concepts of dose response and the lowest adverse effect level. The lowest observed adverse effect level would depend on the population studied; if the population were particularly insensitive, there would be a high level, if it were sensitive, a low level. Similarly, if the adverse effect is an insensitive one, there would be a high level. Dr. Hanning explained that his reading of the WHO Night Noise Guidelines is that they developed their lowest adverse effect level predominantly on the longer term cardiovascular effects, namely blood pressure, heart rate and stroke outcomes, rather than on the short term effects of sleep disturbance, fatigue and sleepiness, which is what led them to suggest in the later report an L night outside level of 40 dB. Dr. Hanning agreed with Dr. Shepherd that the conclusions in the WHO report differ from the actual discussion in it. He noted that in the range of 35 to 40 dB there were still a number of effects, including awakening, self-reported sleep disturbances and arousals, that were characterized as a modest effect, which he does not think is correct. He was of the opinion that they chose the wrong effects and

played down the short-term effects of sleep loss, which he considers are serious harm. Dr. Hanning suggests that the WHO set the 40 dB level on the basis of traffic noise, with some rail and aircraft noise data, but did not consider wind turbines.

Dr. Hanning concluded from the literature review that external sound levels in excess of 35 dBA or setbacks of less than 1.5 km were likely to lead to unacceptable sleep disturbance with serious harm. He stated that at the Kent Breeze site, there were approximately 49 dwellings subject to external turbine noise levels in excess of 35 dB and 76 occupied dwellings within 1.5 km, which would all be at risk of sleep disturbance and serious harm to their health. His overall conclusion is that, if operational, Kent Breeze Wind Farm will cause unacceptable levels of sleep disturbance to local residents with consequent effects on their health. In his view, based on the effects of sleep disturbance, this constitutes serious harm.

With respect to the Nissenbaum Study, Dr. Hanning indicated that he was surprised at the extent of the increase in ESS and PSQI scores, both very well established tools in clinical sleep medicine and sleep medicine research, in those living within 1400 m of the wind turbines compared to those living further away, particularly as these scores look at sleep quality and sleepiness over a period of time. Rather than being a point measure, it is an average response over a matter of days. He stated that because noise from turbines varies from day to day and night to night, depending on wind strength and direction, the effect on a subject will not be the same every night. Further, he stated, the subjects would differ in sensitivity. The degree of difference in the scores, he opined, appears to be absolutely genuine and significant.

Dr. Hanning stated that he neither recommended nor endorsed the two scoring methods as test instruments in the Nissenbaum Study. With respect to whether there is a normal or average score expected on these two survey methods, he said that it depends on the population surveyed. He stated that a general population survey for both would yield mean values of about 4.5. With the PSQI, a surveyed population with no sleep complaints would result in a score of around 3. With the ESS, the mean score is about 4 or 4.5. With a population of insomniacs, the score would be from 0 to 2.

Dr. Hanning stated that the ESS for the distant group in the Nissenbaum Study is slightly higher than the population mean. Two conclusions are possible: Either that group is also subject to the effects of wind turbine noise or they happened to be slightly sleepier than the population average. He indicated that the mean score for the group in the 350 m to 1400 m group showed a significant difference. They are sleepier by a couple of points, but because these are mean scores, this is clinically significant.

He stated that the PSQI values were greater than the population mean for the distant group, being greater than the threshold value for poor quality sleep. Again, either this group has poor quality sleep for some reason for they are also being affected by the wind turbines. He stated that the difference between this group and the closer group is significant, both clinically and statistically.

With respect to the modeling relating to the PSQI scores of the Nissenbaum Study, Dr. Hanning stated that it shows a clear relationship between distance of the turbines and the sleep quality and sleepiness scores. If this were a drug and not a wind turbine, and the manufacturers stated that the drug does not cause sleepiness, he indicated that he would say they were wrong. He asserted that there is a clear dose response relationship causing levels of sleepiness and reductions in sleep quality causing harm. He said that the end result would be that the drug would be withdrawn or the dose to be administered would be reduced.

With respect to the ESS modeling from the Nissenbaum Study, Dr. Hanning indicated that his comments are the same. The PSQI is an overall measure of effect on sleep disturbance while the ESS is a measure of the outcome or effects of the disrupted sleep. He said that they are both going in the same direction and magnitude, showing a firm link between the two and causation.

Dr. Hanning explained that it would be very rare for raw data to be submitted for peer review. Generally, it is the manuscript that is submitted and if the peer reviewer needed to look at the raw data, they could request it. He said that the main focus in a peer review is the methodology, including how the data was collected. Dr. Hanning indicated that if he were peer reviewing a study such as the Nissenbaum Study, he might well ask to see the questionnaire to inform his review.

Dr. Hanning stated that he was in entire agreement with Dr. Aramini's conclusions. In his view, the adverse health effects, the sleep disturbance, the sleepiness and the other symptoms recorded in the survey are due to IWT noise. Dr. Hanning noted that the dose response and the clear relationship between noise and sleep disturbance and its consequences, convinced him of the causation.

When asked why he had changed his opinion between November, when an earlier version of his report was released, and January, when he produced the report relating to this proceeding, Dr. Hanning referred to the Nissenbaum Study and Dr. Shepherd's work. Although the Study does not measure noise, he explained that Dr. Shepherd's work references noise which shows health effects at 35 dB. He stated that in November 2010, his opinion was that 35 dB avoids disturbance to sleep, while 40 dB avoids risks to health such as high blood pressure, which is a health consequence of a sleep disorder. He indicated that his statements were made using the information available.

He explained that his January 2011 report referred to serious harm while the earlier report did not, because he was aware that "serious harm" was the issue in this proceeding, while the November 2010 report was a general one. He also said that he removed the words "potential risk to health" and referred to "risk to health and serious harm" in the later report because of new science known to him (the Nissenbaum Study and Dr. Shepherd's work). He also indicated that he suspected that his reference on page 3 of his January 2011 report to an external noise level of 45 dB should have been 40 dB.

With respect to the conclusions in the WHO Night Noise Guidelines that "…even in the worst cases, the effects seemed modest", Dr. Hanning indicated that he agreed with it but that the conclusions were informed by studies on traffic, aircraft and railway noise. He further stated that there is good evidence, in his view, that wind farm noise is more annoying and has a greater effect than do those sources. With respect to his expertise to opine on "annoyance", Dr. Hanning explained that annoyance does influence people's ability to sleep. If you are annoyed and your level of consciousness is aroused, then you will have difficulty in initiating sleep; he added that this is within his area of expertise. He stated that he is able to opine on the reference to annoyance in a third party study with respect to its consequences on sleep and stress.

Dr. Hanning interpreted the statement in the WHO Night Noise Guidelines respecting a variable L night outside 40 dB as being equivalent to the lowest observed adverse effect level for night noise, which is consistent with what his November 2010 report said, to be addressing blood pressure changes (long-term changes). However, he agreed that the document did not refer to "long-term". He added that, in his understanding, the interim target L night 55 dB was introduced because the traffic noise, on which the document was predominantly based, was expensive to reduce and the interim target was meant to allow European Union member states time to achieve the interim target first, and ultimately, the guideline.

Dr. Hanning added that he agrees with Dr. Shepherd's and Dr. Thorne's comments that because of the characteristics of wind turbine noise, they would want to reduce the WHO Night Noise Guidelines by up to 10 dB and thus, they were advocating external noise levels of 30 to 32.

He pointed to the Nissenbaum Study as evidence that wind turbine sound is the main cause of sleep deprivation in those exposed to it. Although the Study does not measure noise, he indicated that the only clear and obvious mechanism is the sound the wind turbines produce. He stated that studies have not been done in sufficient detail to determine what proportion of those who are exposed to sounds are affected. He indicated that there are studies using instruments like the SF-36 which demonstrate that sleepiness has as much impact on health as epilepsy and arthritis, although he did not quote them.

Dr. Hanning stated that there is no doubt that wind turbine noise causes awakenings because there are a multitude of reports that show that people do awaken and recall it. He stated that he has interviewed those who awoke from wind turbine noise, but that more study is needed to measure arousals and awakenings in a lab such that one could distinguish between those that are natural and those that are produced by extraneous noise. He indicated that, if the noise went on beyond awakening those awakened, would be aware that it was the noise that had awakened them.

Dr. Hanning indicated that he has studied patients with sleep disturbances, primarily sleep apnea and that it is not uncommon for a patient with severe sleep apnea to have 60 to 70 arousals per hour of sleep. He said that studies of people sleeping in rooms with wind turbine

noise will need to be done, but they would be extremely expensive. He stated that there is a strong relationship between the presence of arousals and development of high blood pressure. He also indicated that in a study done by Martin (Martin, S.E. et. al., "The effect of nonvisible sleep fragmentation on daytime function" (1997) 155:5 American Journal of Respiratory and Critical Care Medicine 1596), noise levels were used to induce arousals and the same effects of sleepiness and changes in blood pressure. He said he thought noise levels were more than 30 dB in order to ensure arousal, but that it did not mean that the subjects would not have aroused with lower levels of noise. However, he indicated that there is individual susceptibility to arousal.

With respect to his reference in the January 2011 report to a study (Quibai, C.Y.H. and Shi, H., "An Investigation on the physiological and psychological effects of infrasound on persons" *The Effects of Low Frequency Noise and Vibration on People* (Ed: C. Hansen, Multi-science Publishing Co. Ltd, 2007)) of increased blood pressure effects from short-term exposure to infrasound, Dr. Hanning agreed that the noise was at a single frequency and fairly high value. He stated that he was not extrapolating those results, but observing that in that situation, infrasound caused an increase in blood pressure.

Dr. Hanning indicated that at present there are no laboratory-based studies measuring EEG (brain waves), which demonstrate that wind turbine noise produces arousals. However, when looking at the clinical effects as in the Nissenbaum Study, he said the logical cause for that is the production of arousals. He stated that there may be some other mechanism whereby the wind turbine noise is disturbing sleep, but arousals is the logical one to look at because it has been shown for other noise sources (road, rail, aircraft).

Dr. Hanning indicated that questionnaire studies are usually less robust and more open to criticism than studies which measure objective things like blood pressure. Nevertheless, questionnaire studies can be very strong in their indications.

He stated that serious harm is guaranteed for some people at night-time levels of 40 dB, not all people. With respect to attenuation of sound of 10 to 15 dB and bedroom sound levels being 25 to 30, within the WHO Night Noise Guidelines, Dr. Hanning stated that current evidence shows that arousals are generated by lower levels of noise as noted by Dr. Shepherd, who made relevant measurements. Dr. Hanning was aware that most urban dwellers sleep with sound levels of 25 to 30 dB from appliances, fans, air conditioners but indicated that some may be suffering serious harm from sleeping at these noise levels.

Dr. Hanning indicated that "wind turbine syndrome" is not a recognized and classified disease, but is a phrase that Dr. Pierpont coined. His view is that he is not convinced that there is such a distinct syndrome but is open for his mind to be changed if further evidence appears.

With respect to annoyance, Dr. Hanning agreed that Pedersen stated that economic factors can mitigate the psychological upset that results from stress, but that this is not unique to wind

turbines. Dr. Hanning stated that it has been noted in a number of areas that, if you have a financial interest in whatever is causing annoyance and stress, the effects are reduced.

Dr. Hanning stated that his only contribution to the Pierpont study (Pierpont 2009) was to review a print publication of the manuscript that became the book and provide comments at her request. He stated that he believed she incorporated some of his comments in the manuscript. He indicated that she acknowledges a number of people who reviewed the manuscript, but that books are not normally subject to peer review in the way that articles are. Dr. Hanning agreed that the Pierpont study is uncontrolled and involves unverified accounts of non-specific symptoms in 38 people from 10 families interviewed by telephone and that the selection criteria and methods of interview could lead to a biased outcome. He added that they are case studies and are useful evidence, but nothing more than that. He indicated that what she did was support subsequent investigators regarding the types of symptoms that should be investigated in more controlled studies. He stated that, to the best of his knowledge, she did not physically examine the subjects. He indicated that the major thing she has claimed is that the symptoms in a subject were present when they were in proximity to wind turbines, went away when they were absent from them, and returned when they came back. This relationship gives strong credence to the notion that the symptoms described were related to wind turbine noise. He stated that he thought the National Health Service ("NHS") Knowledge Service conclusions that no firm conclusion could be drawn from Dr. Pierpont's study were fair.

With respect to Dr. Hanning's criticism of the design of the study leading to the United Kingdom Department of Trade and Industry Report ("The Measurement of Low Frequency Noise at Three UK Wind Farms" (2006) W/45/00656/00/00 Hayes McKenzie Partnership), he indicated that he has qualifications and experience in designing research studies through his career in academic medicine (e.g., involvement in the design of many trials, associate editor of a respected medical journal, and review of a very large number of papers, all of which contained different trial designs). However, he indicated that he has never designed or been involved in a study of low frequency noise or wind turbine noise. He added that, if he were asked to design a study of health effects from external stimulants, he would be in a position to do that because his expertise is in health and in sleep medicine, in particular. However, with respect to measurement of the low frequency noise in order to relate it to the health effect, he would have deferred to an acoustician with experience in low frequency noise. Dr. Hanning indicated that the study is cited as part of the evidence examined by the MOE when it made a decision about noise levels and the setback distance.

Dr. Hanning confirmed that 40 dBA outside is acceptable as a maximum but must be fully justified (e.g., the subject has a financial interest or has the power to turn the turbines off or control the noise).

Dr. Hanning explained that he was not involved in the pilot study conducted by Dr. Nissenbaum and that the noise statistics in the Nissenbaum Study were provided to him by Dr. Nissenbaum. He stated that the Study design was largely in existence because it was modeled on the pilot

study. He said that he identified from the pilot data that sleep disturbance was the main symptom. He said that he was involved in selecting the PSQI and ESS as two appropriate and validated questionnaires to use in evaluating sleepiness. He stated that he also contributed to the interpretation of the results and drafting of the results respecting sleep.

Dr. Hanning conceded that he was not an expert on amplitude modulation, noise characteristics and modeling.

With respect to his literature review of the American and Canadian Wind Energy Associations' Report "Wind Turbine Sound and Health Effects; An Expert Panel Review" (2009) (the "AWEA/CanWEA Report"), he found that its conclusions were open to considerable doubt, which opinion, he said, was shared by the NHS Knowledge Service. He indicated that one of the criticisms is that there was no epidemiologist involved in it. He agreed that it was a literature review, but a partial review. He agreed that he contributed to the SWV's review of that review (Society for Wind Vigilance, "An Analysis of the American/Canadian Wind Energy Association sponsored: Wind Turbine Sound and Health Effects: An Expert Panel Review" (2009) ("Society for Wind Vigilance Review")). The SWV's review of the Australian National Health and Medical Research Council report (Australian Government National Health and Medical Research Council "Wind Turbines and Health: A rapid review of the evidence" (2010) ("NHMRC Report")). He explained that the latter report claimed to use only peer-reviewed literature, but did not do so. He conceded that he had not included the work of Rideout or the McMaster analysis (not referenced by witness) that indicate that there are a lack of serious health effects from wind turbines, but indicated that this was not deliberate and that he may have missed some papers that may be relevant.

With respect to whether he was aware of any peer-reviewed research that proves that wind turbines do significantly affect sleep at the distances and noise levels that are approved of by Ontario, Dr. Hanning replied that the peer-reviewed Pedersen studies focus principally on annoyance but do discuss sleep disturbances at noise levels which would be permitted by the Ontario regulations. Annoyance as a condition resulting in stress was the primary outcome measure. He added that Pedersen said that there is a strong relationship between reporting high levels of noise and sleep disturbance. However, he stated, Dr. Shepherd indicated some subjects did not report annoyance with the wind turbines but nevertheless were not sleeping and obviously had disturbance to their sleep.

Dr. Hanning agreed that people could mitigate noise from outside by using ear plugs for an unavoidable noise. However, he added, the noise situation in Chatham-Kent is avoidable. Ear plugs themselves could cause impaction of wax in the external ear and could be uncomfortable. He agreed that the Ontario standards are not 45 dBA, but 40.

Dr. Arline Bronzaft's Evidence

Dr. Bronzaft was qualified to give expert opinion evidence in the areas of environmental psychology with knowledge of noise and its effects on humans.

Dr. Bronzaft's evidence was focused on the AWEA/CanWEA Report, which reviewed the existing literature on the effects of noise on mental and physical health. Dr. Bronzaft stated that the Report ignores the large body of studies on the effects of noise on performance and behaviour that have been conducted over the past 20 years. In addition, the Report's summary of annoyance as a "subjective response" that varies amongst people, misses the accepted concept that annoyance varies on a normal distribution scale, meaning that there are noise sources that would be annoying to people of reasonable sensitivities. She took issue with the fact that the Report largely dismissed annoyance as a serious effect.

Dr. Bronzaft explained that annoyance includes being bothered by noise but it can also mean that noise is intruding upon one's activities. She explained that continuous exposure to noise goes beyond annoyance, and the stress caused by these annoying sounds can result in physiological disorders. She stated that it is well documented in the literature that annoyance leads to stress and stress can adversely affect bodily functions. She stated that when people exposed to noise cannot abate the noise, they experience "learned helplessness", which can exacerbate the stress beyond the stress of the actual noise problem. Dr. Bronzaft stated that by dismissing annoyance as a potential health threat, the Report ignores the known effects of noise on mental health. Dr. Bronzaft also stated that the expert panel incorrectly dismissed the influence of visual factors and attitudes, which can heighten a person's annoyance level.

Dr. Bronzaft was concerned with the panel's conclusion that low frequency sound and infrasound from wind turbines do not present a risk to human health. She stated that despite the lack of scientific studies specifically relating to low frequency sound from wind turbines, the literature on the impacts of low frequency sound from other sources is applicable. She noted that the psychological effects of low frequency noise on workers have been studied for years (work of Alves-Pereira and Castelo Branco). She acknowledged that vibroacoustic disease ("VAD") is not yet accepted as a pathological entity, however the WHO has concluded that low frequency noise can disturb rest and sleep and that more research is needed.

Dr. Bronzaft stated that in her opinion, the AWEA/CanWEA panel should have presented a fuller discussion on the adverse effects of noise on sleep. She stated that the panel did not refer to the abundant studies in this area which document that night-time noises disrupt sleep stages, increase awakenings and affect heart rate.

Dr. Bronzaft also stated that the Report appears to be biased in its selection of only those studies which suggest a weak association between noise and health problems. She stated that there is a growing body of literature that indicates a link between noise and health, which was not referenced in the Report. According to the WHO's definition, health refers to not only the absence of symptoms but a state of complete physical, mental and social well-being. She stated that the Report does not include a discussion of quality of life or the fact that noise can disrupt this. Dr. Bronzaft endorsed the view of the former U.S. Surgeon General, Dr. William H. Stewart, that in protecting health, absolute proof often comes too late and waiting for this proof prolongs suffering unnecessarily. However, she said, the panel's Report demanded absolute proof and

ignored the growing body of work that strongly warns about protecting health when siting wind farms.

Dr. Bronzaft also reviewed the Witness Statement of Rick James and his report that the Hatch Noise Assessment had underestimated the sound levels by up to 8 dBA. Dr. Bronzaft noted that the literature indicates that 3 dB produces a recognizable difference in sound levels by individuals responding to the sounds, and therefore a 3 dB underestimation is significant. In support of this conclusion, she referred to the New York City Noise Code (Local Law 113 of 2005) ("Noise Code") which recognizes 3 dB differences from ambient level in determining the issuance of violations. In her opinion, these underestimations of dBA levels indicate that too little attention has been paid to the potential impacts of the sound levels on humans. She also noted that the Noise Code includes measurements on the C scale for low frequency noise when determining violations.

Dr. Bronzaft acknowledged that the Noise Code restricts sound levels from bars or restaurants within a nearby residence to 42 dB or 7 dB above the ambient sound level as measured on the street 15 feet or more from the source. For noise created by air conditioners and other types of circulation devices, she agreed the Noise Code restricts sound levels to 42 dB measured 3 feet from the noise source of an open window or nearby residence. She also acknowledged that the Noise Code is a step in the right direction towards protecting public health, safety and welfare.

Dr. Bronzaft stated that it would now be deemed unscientific to reach the conclusion of the AWEA/CanWEA panel that sound from wind turbines does not pose a risk of any adverse health effect in humans, given the growing body of research linking health effects to noise in general and wind turbine noise specifically. In her opinion, "it would be more scientific to state that based on the existing evidence it would be wiser to refrain from exposing individuals to wind turbine noise when there appears to be evidence that exposure to wind turbine noise is affecting the health of individuals living in nearby homes."

Dr. Carl Phillips' Evidence

Dr. Phillips was qualified to give opinion evidence in the area of public health with knowledge of epidemiology and related health sciences and scientific epistemology and methodology.

Dr. Phillips' opinion is that there is ample scientific evidence that wind turbines sited near residences cause serious health problems for some people living in those residences. Specifically in regards to the Kent Breeze Project, it is Dr. Phillips' opinion that based on the available evidence, it is more likely than not that the proposed facilities will cause serious harm in the exposed population.

Dr. Phillips stated that there is substantial epidemiologic evidence of health effects on residents from nearby wind turbines. He stated that the greatest part of this evidence is in the form of adverse event reports, or case studies. He noted the Windvoice Survey, Pierpont 2009 and Harry 2007 as examples. He stated that adverse event reporting is often the foundation of

identifying new health risks and it provides useful information in a number of ways. First, he stated the health problems (sleep disorders, mood disorders, headache, fatigue) are similar across reports and they are plausibly related to each other and the exposure. Second, the number of adverse reports indicates that the problems are not restricted to a few rare, highly-susceptible individuals. Third, some of the case studies provide some case-crossover study data, which is one of the most effective methods for assessing the transitory effect of a transitory exposure. He stated that many of the reports describe the onset of symptoms beginning shortly after the activation of the turbines, and some residents reported temporary improvements in their symptoms when they were not exposed to the turbine noise. However, he noted that this cross-over type data has not been collected in a formal way that provides the optimal amount of information, as data concerning timing and crossing back is absent.

Dr. Phillips admitted that he could not comment on what sound levels were experienced at the locations where these adverse event reports had occurred. He also stated that the adverse event reports, which constitute the bulk of the available evidence, do not make it possible to make scientific calculations about what portion of the population is susceptible to any particular outcome, nor what characteristics about them make them susceptible.

Dr. Phillips noted that there exists a small collection of systematic studies that provides further evidence of health effects. He noted the studies by Pedersen (Pedersen 2004; Pedersen and Persson Waye 2007; Pedersen et. al. 2009; and Pedersen, E., van den Berg, F., Bakker, R., and Bouma, J., “Can road traffic mask sound from wind turbines? Response to wind turbine sound at different levels of road traffic sound” (2010) 38:5 Energy Policy 2520 (“Pedersen et. al. 2010”)), Phipps (Phipps, R., “In the Matter of Moturimu Wind Farm Application” Evidence to the Joint Commissioners, Palmerston North (March, 2007) (“Phipps 2007”)) and the Nissenbaum Study as examples. He further noted that residents have taken actions such as moving away or retrofitting their homes to reduce noise, which are costly and would not be taken by people who were suffering only minor problems. He stated that the real estate data indicating economic revealed preference can also be used to infer health information and to quantify the effects.

Dr. Phillips further stated that the existing evidence is particularly convincing and it stands up well to criticisms and concerns regarding its validity. He stated that the existing data as a whole is more compelling than its individual parts since there are different types of data, collected in different ways but still showing similar results. He also noted that this exposure-disease combination is relatively easy to study, as opposed to other slow-developing diseases caused by environmental pollution. In this case, the turbine noise can be observed and the symptoms develop in a way that a proximate explanation is available. Dr. Phillips stated that often health claims are disputed by providing other explanations for the residents’ symptoms, such as claims that residents are distressed because they just do not like the wind turbines, or their symptoms have developed because of the stress in their attempts to oppose the developments. However, he noted that these alternative explanations tend to agree that the installation of the turbines is the event that caused the problem. He also stated that an individual’s assessment of the cause

of his symptoms, while typically used to discredit health claims, actually has substantial value, even for a more subtle exposure. In response to attempts to dismiss the entire body of evidence regarding health effects from wind turbines, Dr. Phillips noted that a large portion of all knowledge is based on data that does not come from studies conducted according to the preferred approaches. He stated that the objective is to reach the best conclusion possible and that just because a particular study or finding is not conclusive, it can still contribute to the emerging body of knowledge. He stated that the affirmative evidence presents a compelling case that there are substantial health effects from exposure to wind turbines.

Dr. Phillips stated that, although the reported health effects are subjective and therefore more difficult to measure, many important diseases are diagnosed and largely defined based entirely on subjective experience. In addition, not all of the effects are subjective, as inability to sleep and reduced productivity due to loss of concentration can be objectively measured. He stated that it is not unusual to observe heterogeneous effects where some people report severe symptoms from their exposure to the turbines while others have no significant problems and that this type of effect is observed in most exposure-disease combinations.

Dr. Phillips stated that the health effects that have been reported are serious and have important implications for public health. He acknowledged that most of the reported health effects of wind turbines are psychologically mediated. However, he stated that these types of health problems can have much greater effect on quality of life than physical damage. Further, he stated that almost all accepted definitions of health include psychological health as part of the consideration. He noted that there is no accepted definition of which problems are health problems and the boundary between health problems or disease and other problems is ambiguous. He stated that many of the problems that are reported with wind turbine exposure, including headaches and sleep disorders, are in fact considered to be health problems.

Dr. Phillips stated that there is a plausible causal pathway to explain the health effects observed in relation to wind turbine exposure. He stated that it is clear that the physical effects of noise and light flicker do reach local residents and that these effects can cause health problems under some circumstances. He stated that even though it is not known which is the dominant pathway, there are several plausible pathways, including the vestibular system, the sensory system and secondary effects due to stress reactions. Further, he noted that there are many studies to support the plausibility of these pathways.

Dr. Phillips also reviewed the CMOH Report. He concluded that the Report ignores most of the available evidence and gives the reader a biased picture of what exists by overlooking many of the adverse event reports of health problems, which in fact constitute the majority of the useful evidence about the effects of wind turbines. Dr. Phillips stated that the Report indicates that no conclusions can be drawn from the reported cases. He said that this is correct in the technical sense, in that no amount of evidence can ever conclusively prove a phenomenon. Nonetheless, he said, the evidence that we have is tremendously useful. Dr. Phillips stated that the Report's reliance on peer-reviewed literature only is not appropriate for a phenomenon that has only

recently been recognized, as much of the available information exists outside of journals. Dr. Phillips stated that the Report therefore excludes most of the available evidence and then relies on the conclusions of the existing reports without actually providing an analysis of why those reports are correct or why their analyses are useful.

Dr. Phillips noted that the Report relies on the setback distances set out in O. Reg. 359/09 as being informative in an assessment of health effects. However, he noted that this conclusion is not based on any analysis of the evidence, but rather follows a fallacious line of reasoning that because the rule exists, it is informative.

Dr. Phillips explained that he was concerned with the main conclusions of the Report because they are asserted but are not supported by any analysis of the evidence. He stated that the Report does not attempt to analyze or explain the contrary evidence and arguments, but simply denies that they exist. In his opinion, the Report, therefore, does not constitute a proper summary or analysis of the evidence.

Dr. Phillips acknowledged that some of the published adverse event reports were referenced in the Report. However, his critique was that much of this literature was referenced in a way that seemed like a “for further reading list” and that the evidence from these reports was not incorporated into the Report’s analysis. He stated that in his opinion, the Report is misleading about the existing evidence. Although it lists various references, much of the evidence from these references is ignored in the text of the Report and consequently, a reader of the Report would be unaware of the huge body of quite compelling evidence that is available. He stated that all of the material listed in the reference section may have been considered by the authors, but it was not reported.

Dr. Phillips stated that, although it is difficult to quantify the risk, in his opinion it is more likely than not that there will be persons in the area of the Kent Breeze Wind Farm who will suffer serious health problems. In making this assessment, he noted that there are about 70 occupied homes within approximately 1400 m of a turbine (the same distance studied in the Nissenbaum Study) and estimated that an average of 5 people will live in each over the lifetime of the project for a total of 350 exposed people. He stated that the probability of any given individual suffering serious health problems would have to be 0.002 (or 1 person out of every 500) before it was less likely than not. He stated that this probability is far less than any of the estimates of risk in the available evidence, which are at least in the few percent range. He stated that even if you only look at the 100 closest people, the risk would have to be less than one percent to make it less likely rather than more likely that someone would suffer a serious health problem.

Dr. Phillips explained that in calculating this probability he used a binomial distribution. He stated that the question of whether something is more likely than not is a matter of whether the probability of that thing happening is 0.5 or greater. In terms of his actual calculation he explained that for 350 people and a probability of 0.002 that an individual will suffer health problems, the chance of having zero people experience health effects is just under 50%.

Dr. Phillips stated that Dr. Mundt is incorrect in asserting that Dr. Phillips has not conducted a systematic or critical review of the epidemiological literature. He stated that Dr. Mundt is incorrect in his suggestion that adverse event reports and case-crossover studies are not accepted scientific evidence for epidemiology-based policy decision making. Dr. Phillips stated that it is always possible to make a best possible scientific estimate of something based on the available evidence. He stated that there is no bright line that distinguishes between “we know absolutely nothing” and “we have sufficient and sound evidence.” He stated that studies of the health effects of wind turbines are a case where the evidence is unusual, which is the opposite of standard but does not make it wrong or useless. He stated that the type of evidence that is available is much more compelling than the types of evidence that epidemiologists usually have to rely on. He stated that most epidemiological evidence about environmental or behavioural exposures relies on people giving an answer to a survey. He stated that evidence of people leaving their homes is of value in making epidemiologic analyses because it indicates that these people have little doubt about the cause of their health problems and they are experiencing problems of great enough magnitude that they are willing to endure large financial losses over enduring the health problems. Dr. Phillips stated that his report is a scientific analysis of the type of evidence that is available and why it is useful. He noted that the type of evidence that is available is exactly what health policy makers use to make many decisions about emerging risks and the types of studies that have been done so far are among the most compelling study types in epidemiology.

In reply to Dr. Ollson, Dr. Phillips stated that he has reviewed hundreds of adverse event reports, which provide empirical evidence of serious health effects. He stated that he has reviewed adverse event reports from well over 200 people, which formed the basis for his assessment. He is also aware of the reports by Pedersen and colleagues and Drs. Thorne and Shepherd and over 100 other reports that have not been captured in any collection or data summary. He stated that, therefore, he is quite confident that the total number of individual adverse event reports is in the thousands. Dr. Phillips stated that just because the adverse event reports that he has cited have shortcomings, this does not mean that they have no value, as Dr. Ollson suggests. Dr. Phillips stated that his binomial distribution calculation was based on example calculations and hypothesized inputs. He stated that this is a useful, common and well-accepted approach in policy decision analysis. He stated that the point of his analysis is to show what the proper calculation is and then show what inputs into the calculation would make the result fall on a particular side of the “more likely than not” standard. He stated that his analysis shows that the evidence supported numbers that are well into the “more likely than not” range. He noted that Dr. Ollson did not propose any different input numbers which would lead to a different conclusion.

Dr. Phillips disagreed with Dr. Speechly that epidemiological studies always assume that the null hypothesis is true and stated that in most cases, the reason that a study is being done is because there is a belief that there is an association. Dr. Phillips agreed that good evidence comes from trying to make the case that something is not true and failing. He stated that this

test actually applies in this case because the best that the consultants working for the wind developers have come up with to explain the reported symptoms are “some unsupported hypotheses that people are bringing on the effects themselves and that we should ignore most of the evidence.” Dr. Phillips stated that because we know incidence times and have crossover data, the evidence is a lot stronger, even though sleep disorders are non-specific, subjective, common symptoms as Dr. Speechly suggests. Dr. Phillips stated that Dr. Speechly’s hypothesis that the symptoms are caused by a fear reaction is possible, but there is no evidence to support it. Further, without evidence that it is possible to “fix” perceptions so as to eliminate the health effects, it would make no practical difference whether this fear response was the mechanism, as the cause and effect would remain the same. He stated that even if this hypothesis were true, it would only justify a different policy analysis if we were willing to say “since we believe your health problems are partially caused by your own fear, we are just going to let you suffer.”

Dr. Robert McMurtry’s Evidence

Dr. McMurtry was qualified to give opinion evidence as a physician and surgeon with experience in delivery of health care, health care policies and health policy.

Dr. McMurtry stated that he has spent an extensive amount of time researching the issue of adverse health effects and wind turbines and has met with and conducted in person interviews with more than 40 people in Ontario who live near IWTs and are experiencing adverse health effects. Dr. McMurtry concluded that people living near IWTs in Ontario and other parts of the world are experiencing serious adverse health effects, which include sleep disturbance, annoyance, stress or psychological distress, inner ear symptoms, headaches, excessive tiredness and loss of quality of life.

He noted that these adverse health effects initially appeared or substantially worsened following the operation of IWTs and they subside when the individual is away from the IWTs. He stated that although the precise patho-physiological mechanism is not known, the adverse health effects are more likely than not caused by exposure to one or all of infrasound, low frequency noise, audible noise, visual impact and/or shadow flicker produced by IWTs. As well, the tonality, pulsating nature of the noise and lack of night-time abatement are contributing factors. He stated that these adverse health effects are occurring at setback distances and modeled sound pressure levels which some residents living near the Kent Breeze Wind Farms will be exposed to. He concluded that, in his opinion, the Kent Breeze Wind Farms as approved will more likely than not cause serious harm to human health to many people in the surrounding area.

Dr. McMurtry noted that the WHO’s definition of health includes complete physical, mental and social well-being and is not restricted to the absence of disease or infirmity. He further noted that, according to the WHO Guidelines for Community Noise (1999), “an adverse effect of noise is defined as a change in the morphology and physiology of an organism that results in impairment of functional capacity, or an impairment of capacity to compensate for additional

stress, or increases the susceptibility of an organism to the harmful effects of other environmental influences." He noted that the WHO has recognized noise as a serious health hazard. He stated that peer reviewed scientific research confirms that noise-induced annoyance, stress and sleep disturbance are serious adverse health effects.

Dr. McMurtry noted that annoyance is a medically recognized adverse health effect which is associated with stress, psychological distress, sleep disturbance, and physiological distress. He explained that annoyance, when sustained or recurrent, leads to stress and the cascade of health issues that result from stress. He said that the physiological reactions that result from stress can increase the risk of developing high blood pressure, compromise cardiac output, raise blood glucose levels and blood viscosity which lead to effects on blood clotting factors. Following this pathway leads to manifest disorders such as hypertension, arteriosclerosis, or ischemic heart disease. He stated that noise can cause serious stress related adverse health effects, resulting in serious harm to human health. He explained that stress and sleep deprivation are well known risk factors for increased morbidity, including significant chronic disease such as cardiovascular problems like hypertension and ischemic heart disease. Dr. McMurtry also stated that sleep disturbance is a serious adverse health effect related to IWTs. He indicated that adverse health effects caused by sleep disturbance include poor performance at work, fatigue, memory difficulties, concentration problems, mood disorders, cardiovascular, respiratory, renal, gastrointestinal and musculoskeletal disorders, obesity and impaired immune system function. He stated that impact to mental health is also a serious adverse health effect related to IWTs. He concluded that the adverse health effects related to chronic exposure to IWTs are serious. Dr. McMurtry clarified that adverse health effects present a risk for serious harm, but they are not the same as serious harm.

Dr. McMurtry noted that there is an emerging body of international scientific research, literature and reports which document the adverse health effects experienced by people exposed to IWTs. He noted that these adverse effects have been reported in France, Japan, Denmark, the United Kingdom (Harry 2007), New Zealand (Phipps 2007), Australia, the United States (Pierpont 2009 and the Nissenbaum Study) and Ontario (the Windvoice Survey). Dr. McMurtry also referred to complaints of adverse health effects reported by residents living near Suncor's Ripley Wind Farm in Ontario, which were presented to the Standing Committee on General Government with respect to the *Green Energy and Green Economy Act*, *2009*. Dr. McMurtry referred to the studies conducted by Pedersen et. al. 2009, which showed that the portion of people who were rather annoyed or very annoyed by wind turbine noise while indoors was 8% for 35 to 40 dBA and 16% for 40 to 45 dBA and when outdoors the result was 18% for both sound level intervals. In Pedersen 2004, the proportions for outdoors were 28% at 37.4 to 40 dBA and 44% at 40 dBA and greater. He stated that this research shows a dose response with a clear and significant trend that begins at 30 dBA. He also referred to Pedersen 2004 which found that people perceive wind turbine noise as more annoying than aircraft, road traffic, or railway noise at the same sound pressure levels. This research found that annoyance for these other sources starts at levels at least 10 dBA higher than it does for wind turbine noise.

Dr. McMurtry acknowledged that Pedersen et. al. 2009 conducted the same comparison of the percentage of people very annoyed for wind turbine versus other noise sources and the results were not the same as those found in Pedersen 2004. He stated that the results of the 2009 study show lower percentages of people very annoyed at particular sound levels. However, he noted that these results still showed the same effect that wind noise is perceived as more annoying than other noise sources. He stated that although there is variance in the numbers among the studies, the risk of adverse health effects is consistent.

Dr. McMurtry also referred to a report prepared for the MOE by Howe Gastmeier Chapnik Limited (HGC Engineering) "Low Frequency Noise and Infrasound Associated with Wind Turbine Generator Systems: A Literature Review" (2010) ("HGC Report 2010") which stated that "audible sound from wind turbines, at the levels experienced at typical receptor distances in Ontario, is nonetheless expected to result in a non-trivial percentage of persons being highly annoyed." The Report further stated that "annoyance associated with sound from wind turbines can be expected to contribute to stress related health impacts in some persons."

Dr. McMurtry also reviewed the AWEA/CanWEA Report. Dr. McMurtry noted that the findings of this panel should be approached with caution as experience has consistently demonstrated that reliance on industry sponsored expertise is inappropriate when assessing health risks associated with the industry's product. Dr. McMurtry stated that the Society for Wind Vigilance Review concluded that the Report was not authoritative or convincing, that it was biased in its use of references, and its conclusions were not supported by its contents. He stated that the review of the Report by the NHS Knowledge Service of the United Kingdom NHS concluded that the link between psychological distress and physical symptoms was not explored by the Report and that necessary expertise was lacking on the panel. Dr. McMurtry stated that, nonetheless, the Report does acknowledge that wind turbine noise may cause annoyance, stress and sleep disturbance resulting in adverse physiological and psychological symptoms.

Dr. McMurtry also reviewed the Chatham-Kent Public Health Unit Report "The Health Impact of Wind Turbines: A Review of the Current White, Grey, and Published Literature" (2008) ("Health Unit Report"). Dr. McMurtry stated that the review was heavily weighted towards wind industry sources and inappropriately selective in the aspects of the literature that it highlighted. He stated that the review provides an incomplete risk assessment related to human health and it is an inadequate public health document.

Dr. McMurtry also reviewed the CMOH Report. He stated that the Report acknowledges the symptoms that some people living near wind turbines are experiencing and that some people might find wind turbine noise annoying. He stated that the symptoms that are acknowledged in this Report, including sleep disturbance, dizziness, headaches, and annoyance, are all considered to be adverse health effects. Dr. McMurtry stated that the Report's conclusion that there is no scientific evidence demonstrating a direct causal link between wind turbine noise and adverse health effects ignores the possibility of indirect adverse health effects from noise. He

also stated that the main conclusion that the sound level at residential setbacks is not sufficient to cause direct adverse health effects is not supported by the literature that the study reviewed.

He stated that the proper process that should be undertaken to study adverse health effects from IWTs is for the government to do a Request For Proposals through an organization such as the Canadian Institute of Health Research in order to collect the best available evidence by an accredited, neutral third party group.

Dr. McMurtry explained that his evaluations of the Windvoice Survey participants were interviews about functional disturbances and the criteria of the Case Definition presented in his witness statement. He stated that he provided advice on the design and the process of collecting data and maintaining confidentiality for the Windvoice Survey, but it was conducted independently. In addition, he did an initial analysis of the material presented from the Study and he presented the preliminary results of the Survey to the Standing Committee for Bill 150.

Dr. McMurtry referenced a number of WHO documents which indicate that annoyance is an adverse health effect. The WHO Guidelines for Community Noise list the health significance of noise pollution according to the specific effects, including annoyance and classify moderate and serious annoyance as Critical Health Effects. The WHO Night Noise Guidelines list the direct and indirect pathways for noise effects on human health, including annoyance. Dr. McMurtry was asked whether there is any peer reviewed scientific or medical literature that has come to the conclusion that annoyance caused by wind turbines equates to serious harm to human health. He responded that there are peer reviewed studies reporting on annoyance specifically from wind turbine noise (the Pedersen et. al. studies) and there is also peer reviewed research regarding the serious health impacts of noise induced annoyance.

Dr. McMurtry stated that Dr. Mundt's and Dr.Ollson's criticism with respect to the lack of support for his conclusions regarding the risk of adverse health effects is unfounded, as his conclusions are supported by the extensive references provided in his witness statement. In response to Dr. Ollson's concerns regarding the apparent lack of information about the people that Dr. McMurtry has interviewed who are experiencing adverse health effects, Dr. McMurtry stated that all of the individuals whom he has interviewed participated in the Windvoice Survey and it is known that almost all live within 1.5 km of a wind turbine. In response to Dr. Ollson's statements about the consideration of wind turbine noise in the development of the WHO Night Noise Guidelines, Dr. McMurtry referred to the experts called by both the Appellants and the Respondents who agreed that the WHO Guidelines were not developed with consideration of wind turbine noise. Dr. McMurtry responded to Dr. Ollson's comments regarding limitations on the interpretation of Pedersen's findings on annoyance as applied to adverse health effects by noting that the WHO has determined that annoyance itself is an adverse health effect.

Mr. William Palmer's (Presenter) Evidence

In his presentation, Mr. Palmer focused on the issues of ice shedding, ice throw and blade detachment. He believes that serious harm to human health in the form of physical injury is

possible for the people living in the Kent Breeze area because of these issues. Mr. Palmer stated that there are three basic steps in risk assessment: 1) determining the possible consequential failures that can happen that can hurt people; 2) conducting a deterministic risk assessment to determine what barriers can be put in place to protect people; and 3) conducting a probabilistic risk assessment to determine whether there is some high level event that can cause something to happen that ends up in an accident which you might not have originally imagined.

In Mr. Palmer's assessment, he looked at accidents which put wind turbine blades on the ground and therefore might cause an injury. He stated that potential failures producing this outcome include blade failure and turbine collapse. Mr. Palmer listed 35 such incidents that occurred world wide over the two year period of January 2008 to 2010. Specifically in Ontario, Mr. Palmer referred to two such incidents which involved GE turbines. He stated that in April 2007, a wind turbine in Port Burwell was struck by lightning resulting in blade failure and causing pieces of the blade to fall to the ground. The second event occurred at the Prince Wind Farm in January 2008 where two thirds of the blade broke off and landed on the ground away from the tower. Mr. Palmer stated that turbine tower collapse has not occurred in Ontario and that it is not a frequent event, but such incidents have occurred in the US and Japan.

Mr. Palmer stated that he could not say whether any of the 35 accidents that he listed resulted in injury to a person. However, he said, he is aware that 38 people have been killed as a result of turbine related incidents. In addition, he stated that to the best of his knowledge no one was injured in the two blade failures that occurred in Ontario. He stated that he was not present at the time of any of the accidents listed and that he became aware of the accidents through other sources, including television news and the newspaper. Mr. Palmer listed the details of the 38 deaths that had occurred from wind turbine related incidents which he obtained from the Caithness Wind Farm information website. He stated that of those 38 deaths, three people were killed in factories making parts for wind turbines, 14 people were killed on site in maintenance accidents (including six falls, one electrical event, one tower collapse, one crane accident, one struck by a vehicle, four unspecified), 11 people were killed on site in site construction accidents, five people were killed in aircraft accidents (surveying and collisions), one person was killed in a boating accident doing surveying for offshore turbines, and four citizens were killed (one climbing a tower, two road accidents, one carbon monoxide poisoning).

In his January 17, 2011 submissions, Mr. Palmer indicated that one of the problems in determining the actual risk of wind turbine failure is that failure events are not widely reported or communicated by the wind turbine industry and there is no publicly available database of wind turbine failures. He stated that the first thorough investigation of wind turbine failures was conducted in the Netherlands in 2004 (Braam, H. and Raemakers, L.W.M.M., "Guidelines on the Environmental Risk of Wind Turbines in The Netherlands" prepared for The Netherlands Agency for Energy and the Environment, 2004), and from this a handbook with procedures for the risk assessment of wind turbines was produced. He said that the 2004 Dutch study identified the

expected and recommended risks in events per year for different scenarios. He stated that the study documented blade failures with a maximum throw distance of 150 m for an entire blade and 500 m for a blade fragment.

Based on the two blade failures in Ontario, Mr. Palmer calculated that the failure rate is about 1,600x10-6 or 1600 in a million operating years. In comparison, he stated that the nuclear industry considers a failure rate of 1 in 10-5 years or 10 in 10-6 years to be very serious. He stated that the world failure rate for wind turbines is about 220x10-6, which is eight times less than his calculation for Ontario's failure rate. Mr. Palmer calculated the world failure rate based on the number of reported blade failures worldwide (which he noted is probably less than the actual number due to lack of reporting) and the number of turbine years in operation worldwide from the World Wind Energy Association, "World Wind Energy Report 2008" (February, 2009). Mr. Palmer referred to a report by the U.S. Department of Energy in 2002 (Kelly, N. and Smith, B., "Evaluation of wind shear patterns at Midwest wind energy facilities" NREL/CP-500-32492 National Renewable Energy Laboratories, US Department of Energy (May, 2002)) which predicted that new, taller wind turbines might be subject to a new failure rate because of the difference in wind speeds across the large rotor.

Mr. Palmer explained that for the mechanical load analysis he used a wind shear coefficient of 0.42 instead of the yearly average wind shear of 0.34 that was used by GE in performing the analysis. He stated that 0.42 is the night-time wind shear obtained from the Hatch Noise Assessment Report and that using this maximum wind shear is more meaningful than using the average wind shear. He stated that he has never performed a mechanical load analysis for a wind turbine for a developer or manufacturer.

Mr. Palmer explained that ice shed refers to the situation where ice falls off a stopped turbine, whereas ice throw results when the turbine is moving. In regards to this issue, Mr. Palmer relied on data collected and reported by Garrad Hassan from the Tacke TW-600 wind turbine, installed at the Bruce Information Centre in 1995. He explained that this turbine is smaller than those proposed for Kent Breeze; it has a hub height of 50 m and a rotor diameter of 42 m. Mr. Palmer stated that over its first five years of operation there were 13 cases of ice shedding/ice throw reported. He stated that icing events were reported where many ice pieces, the largest of which was 12 inches x 12 inches x 2 inches, were found up to 100 m away from the tower, and another where 1000 pieces totalling about 1 tonne of ice were found up to 100 m from the turbine. Mr. Palmer calculated that if ice, the size of the largest piece found near the Tacke turbine, fell from a turbine at the Kent Breeze wind farm, it would be equivalent to dropping an 18 kg concrete block from an eight storey window.

Mr. Palmer acknowledged that he is not aware of any statistics from Ontario of persons being hit by ice shed or throw from a wind turbine. He also stated that he cannot point to any specific cases of injury from ice throw anywhere else in the world.

Mr. Palmer stated that according to the General Electric report "Ice Shedding and Ice Throw – Risk and Management" (April, 2006) ("GE Ice Report") the equation for predicting ice throw is

1.5 x hub height + rotor diameter. For the Tacke turbine, he stated that this would give a predicted ice throw of 138 m, and he noted that ice throw was in fact observed at similar distances (100 m). Using the known ice throw from the Tacke turbine and extrapolating this to the bigger GE xl turbines being installed at Kent Breeze at the same wind speed, he stated that the projected ice shed for Kent Breeze would be 190 m. Mr. Palmer stated that the GL Garrad Hassan, "Ice Throw Risk Assessment for the Proposed Kent Breeze Wind Power Project" (February, 2011) ("GLGH Risk Assessment") predicted a maximum ice throw distance of 240 m, but he is not certain what assumptions this was made under. Further, he does not believe that this prediction is accurate because one of the papers referenced in the GLGH predicted a maximum of 240 m for smaller turbines with a basic wind speed, and since the Kent Breeze turbines are bigger and have higher wind speeds, the distance predicted should be further. Also, the predicted ice throw using the GE equation for predicting ice throw with the GE xl 2.5MW turbine specifications was 278 m. Mr. Palmer noted however, that the property lot line setbacks approved by the MOE are 87 m and the road and railway setbacks are 150 m, both of which fall within the 190 m distance that he projected from the known Tacke turbine ice throw distance and the distance predicted in the GLGH Risk Assessment. He stated that as a professional engineer, this gives him cause for concern.

However, Mr. Palmer indicated that he had received information from Suncor that six blocks of land had been added to the project and therefore the 85 m property lot line setbacks had increased.

Mr. Palmer also stated that the GLGH Risk Assessment estimate that the weight of ice that will come off the turbine will be 150 kg was inaccurate. He stated that according to the reports from the Tacke turbine, which has a smaller, shorter blade, it was found that up to 910 kg of ice was shed. Mr. Palmer stated, that extrapolating these results from the Tacke turbine to the longer, wider blades of the Kent Breeze turbines, it can be expected that about 4000 kg of ice could be shed in a particular incident. Mr. Palmer stated that according to Environment Canada data, in the area where Kent Breeze wind farm is located 9 to12 days of icing per year can be expected. He compared this to the data for the area where the Tacke turbine is located for which seven to nine days of icing per year can be expected.

Mr. Palmer stated that the GLGH Risk Assessment relies on shutdown capability. However, he stated that the GE documentation (GE Ice Report) indicated that the shutdown technology is not highly reliable. He stated that GE acknowledged that, if ice forms symmetrically on the blade, the vibration detector may not shut the turbine down. Mr. Palmer also stated that in conducting a risk assessment one needs to assume a person present, and the GLGH Risk Assessment did not do this.

Mr. Palmer expressed concern with the GL Garrad Hassan, "Recommendations for Risk Assessments of Ice Throw and Blade Failure in Ontario" (May, 2007) ("GLGH 2007 Report") because he stated that in the individual risk assessment the calculation was done assuming the ice falls on one square meter of area. However, he stated that ice throw/fall is actually

distributed over a wide area. He stated that the GLGH Report reduces the risk by a factor of 1 in 275000 (the area between points 50 m and 300 m from the tower) and he claimed that a factor of 1 in 2.5-5 should have been used to account for the wide distribution of ice. Mr. Palmer also claimed that the GLGH 2007 Report suffers from many of the same problems identified in the GLGH Risk Assessment.

According to Mr. Palmer's calculations, he found that five of the Kent Breeze turbines would have risk of ice and/or blade throw at nearby roads, for four turbines there would be risk to the railroad, and for the neighbouring properties all eight turbines would present a risk of blade throw and seven turbines would present a risk of ice throw. He stated that for the one participating property there is no protection from these risks for the family or any employee that comes on their property because of the agreements they sign. Mr. Palmer indicated that the distances on which he based these calculations were obtained from Suncor's final design and operations report and that these were the values that were used and approved by the MOE in issuing the approval. Mr. Palmer stated that after he performed these calculations, he was provided with new information from Suncor that they have added six additional lots around the Project that increase some of the lot line setbacks. However, he stated that this new information does not change his results regarding the risk to road, railroad or neighbours, with the exception that the setback for one of the turbines (Kent #3) is now greater than 500 m to road and rail and may be as much as 500 m away from the nearest non-participating neighbour, and thus it would no longer pose a risk from ice throw and blade failure.

Mr. Palmer also presented evidence based on actual experiences in Ontario, which he stated shows that the sound levels at homes surrounding the Kent Breeze Project will exceed the predicted levels half of the time. Mr. Palmer referred to data collected by an acoustical firm for a home which was having issues with noise from a turbine. He stated that the predictions that had been made for this project were that for a wind speed of 6 m/s, the turbine will create no more than 36.6 dBA of noise. However, he stated that the data shows that 50% of the time the measured sound level was greater than 37 dBA and 25% of the time was more than 3 dBA greater than what was predicted. Mr. Palmer stated that the data shows a weak correlation between the ground level wind speed and the sound level of the noise and instead shows a strong correlation between the wind turbine output, as measured by the Independent Electricity System Operator, and the sound level. In terms of the Kent Breeze Project, Mr. Palmer stated that there are 37 receptors and 13 vacant lots where the predicted sound level is greater than 37 dBA. Applying the results from the other data, Mr. Palmer predicted that these receptors will experience noise levels of greater than 40 dBA at least 25% of the time.

Mr. Palmer stated that he has taken over 250 noise samples over 12 months at various locations in Ontario with different makes of turbines, including Vesta, GE, Siemens, and Enercon, though not including the GE xl 2.5 MW turbines that will be installed at Kent Breeze. He compared sound levels at various frequencies at houses located 5 km away from the nearest turbine with sound levels at houses that were approved by the MOE to meet the 40 dBA

standard. Measurements were taken when the turbines were at low power (approximately 0%), moderate power (25%) and high power (88%) and for each case, the measurements were taken within two hours of each other so the wind and weather conditions were the same at all of the homes. Mr. Palmer found that for low frequency octaves, the sound levels were about 20 dB higher at the MOE approved homes than the further away homes and that at 0% power and wind speeds of 1 m/s the sound levels at the approved homes were the same as the sound levels at the far homes in the high power case when the wind speed was 8 m/s. He also found that when the wind speed increased from 1 m/s to 8 m/s, the sound levels at low frequency octaves up to 125 Hz at the approved homes increased to 50 dBA.

He stated that this data was collected from the Enbridge Wind Farm which has 110 Vestas V82 turbines. He stated that the Certificate of Approval for this project was issued in July 2007 and operations commenced in April 2008. He stated that this project was not subject to the MOE Noise Guidelines, but that the earlier noise guidelines used the same ramped effect of increasing noise allowances as wind speeds increase. He also stated that this project was not subject to O.Reg. 359/09. He explained that his samples were taken at homes which were located 450 m, 550 m, and 617 m from the nearest turbine, as well as the one home which was 5000 m away from the nearest turbine. He stated that the noise measurements were taken outside the homes and that he tried to take the measurements in locations that would avoid any vegetation noise. He stated that the specific details of his acoustic measurements can be found in his January 17, 2011 submissions. He stated that he used a LM81AM device to measure the wind speed, which he then confirmed by looking at a 7 m mounted wind speed indicator at one of the sites and also by looking at the wind speeds reported by Environment Canada's 10 m readings from the Wiarton and Goderich sites, which bracket the sites where he was taking the measurements. He stated that for the 25% moderate power case, the wind speeds at the three closest sites were 1 to 1.3 m/s, 2 to 2.3 m/s and 1.2 m/s.

Director's Witnesses:

Dr. Gloria Rachamin's Evidence

Dr. Rachamin was qualified to give opinion evidence as an expert human toxicologist and pharmacologist with expertise and extensive experience in assessing potential health risks of chemicals and physical agents and in developing standards, guidelines and policies for the protection of human health.

Dr. Rachamin is a toxicologist in the Public Health Division of the Ontario Ministry of Health and Long Term Care. She was involved in researching and drafting the CMOH Report released in May 2010. Dr. Rachamin explained that the role of the CMOH is to safeguard the health of Ontarians and provide public health advice to the health sector, the Ministry of Health and Long Term Care, the Ministry of Health Promotion, other ministries and the Ontario government. The CMOH provides oversight and takes appropriate steps to promote and protect the health of

Ontarians. The CMOH is appointed by Order in Council, and the current CMOH is Dr. Arlene King.

Dr. Rachamin explained that the CMOH Report was prepared in response to public health concerns about the potential health impact of wind turbines. She stated that Dr. King made a commitment to a Legislative Standing Committee to review all the existing scientific evidence on wind turbines respecting health impact in consultation with the Ontario Agency for Public Health Promotion and Protection and the local Medical Officers of Health. Dr. Rachamin was recruited to be involved in reviewing the scientific evidence and she wrote the final report. She stated that the review was conducted by a technical working group of medical experts composed of Ministry staff, the Associate CMOH Dr. David Williams, Dr. Ray Copes from the Ontario Health Protection and Promotion Agency and the local Medical Officers of Health from Brant County Health, Haldimand-Norfolk Health Unit, Chatham-Kent Public Health Unit, Grey Bruce Health Unit, and Peterborough Health Unit. Dr. Rachamin stated that the group discussed the health concerns, both those in the literature and any issues they had observed at the local level, their review of the scientific evidence, their interpretations, findings and conclusions. She stated that the final report is a consensus report that is a reflection of their collaborative work.

Dr. Rachamin explained that the Report is not an original research study, but a synopsis of the existing scientific evidence followed by the working group's conclusions on this evidence. She stated that they conducted a very comprehensive literature search on any papers or reports on the impact of wind turbines on health. She stated that they searched all scientific bibliographic databases and "grey literature" which includes reports that are published on websites, papers published by commercial publishers, and reports from government agencies such as the WHO. They also performed a structured internet search and studied materials from individuals and organizations who had expressed concerns about health impacts. She stated that the literature search was completed in early 2010, but they continued to monitor for new information up to the date that the report was published. Dr. Rachamin stated that over the four month period that it took to produce the report, she probably spent more than five weeks on reviewing the literature for the report.

Dr. Rachamin stated that the question which the review addressed was a very broad one: "are there any health impacts of wind turbines?" She stated that noise was the factor that people were most concerned about, so the report focused on the potential health impact of noise. In addition, they looked at how noise is assessed in Ontario and the consultation process that took place in the development of the regulations regarding set back distances.

In reviewing the literature, Dr. Rachamin stated that they applied rigorous scientific criteria, which gave higher weight to scientific papers that were published in peer-reviewed scientific journals and reports that were produced by a credible, world recognized public health agency or the WHO. She stated that they looked at the quality of the data in the documents they reviewed for things like sample size, study design, exposure data, whether noise was measured or modeled and confounding exposures. She stated that they looked at whether any causal link

between noise exposure and health impact has been established using the criteria of strength of association, consistency of findings, biological plausibility and temporal relationship. She referred to the chapter that she wrote which details the methodology on how health based exposure limits are developed and the standard scientific methodologies for evaluating scientific data.

Dr. Rachamin stated that the Report concludes that although people who live near wind turbines may report symptoms such as dizziness, headaches and sleep disturbance, the available scientific evidence does not demonstrate a direct causal link between exposure to noise from wind turbines and adverse health effects. Further, she stated that the noise levels from wind turbines are not sufficient to cause any hearing impairment or any other direct adverse effects. However, she said, they recognize that some people do find wind turbine noise annoying. She explained that a direct causal link refers to a cause/effect relationship and means that if one is exposed to noise, that noise acts directly on the ear to produce hearing impairment, for example.

Dr. Rachamin explained that the complete list of papers and reports that was reviewed is found in Appendix 1 of the Report and that the studies discussed in the Overview are the main studies that, in the working group's judgement, provided the best scientific evidence and this includes four cross-sectional studies and one case study series (Pierpont 2009).

Dr. Rachamin stated that she reviewed the WHO 1999 Noise Guidelines even though only the fact sheet which is based on these Guidelines is referenced in Appendix 1. She stated that it is an error that the reference to the full Guidelines was omitted.

Dr. Rachamin discussed Dr. Pierpont's case study series (Pierpont 2009), which studied 10 families with total of 38 people living near wind turbines in Canada, the United Kingdom, Ireland, Italy and the United States. She noted that the study was published on Dr. Pierpont's website and then privately in a book, but has not been subjected to a rigorous scientific review and published in a scientific journal. She explained that the study described a "wind turbine syndrome" in which people reported symptoms such as dizziness, headaches, and sleep disturbance and Dr. Pierpont suggests that these symptoms are related to low frequency noise from the wind turbines. However, Dr. Rachamin stated, there were no measurements of noise level done in the studies and no attempt to correlate the distance from the wind turbine to the symptoms reported. The methodological limitations raised in the study include the fact that the symptoms were reported via telephone interview, so Dr. Pierpont had not seen the patients or confirmed their medical history; the small number of cases studied; the lack of a control group, and; potential selection bias, as the families studied were those who felt they had the most pronounced symptoms.

Dr. Rachamin referred to section 2.2 of the CMOH Report and discussed aspects of noise including sound level and frequency, low frequency noise, infrasound and the generation of sound from wind turbines. She stated that the impact of sound on health is directly related to its pressure level and sound levels greater than 75 dB could result in hearing impairment. She

stated that the requirements for wind turbine setbacks in Ontario limit noise at the nearest residence to 40 dB and that this level is consistent with a limit of 40 dB that the WHO Night Noise Guidelines recommend for the protection of public health from community noise. The CMOH Report notes that according to the WHO, the 40 dB guideline is below the level at which effects on sleep and health occur, but above the level at which complaints may occur.

Dr. Rachamin stated that from a health perspective 40 dB is the level that she understands will protect health and that any levels higher than this would have to be reviewed in the context of the particular scenario. She stated that sound level exposures of 43 dB, for example, may not have a terrible adverse health impact but she would need to see the exact data in order to make such a determination. She stated that based on the evidence she currently has, she would not be able to support exposures of 43 dB today, but she would prefer to see the data of the particular situation to provide a better answer. She stated that based on the WHO recommendation, she may not be able to support a guideline of 45 or 50 dB, but she would have to review the context.

Dr. Rachamin discussed the four studies conducted by Pedersen et. al. in Sweden and the Netherlands (Pedersen et. al., 2009; Pedersen 2004; Pedersen and Persson Waye 2007; and E. Pedersen and K. Persson Waye, “Wind turbines: low level noise sources interfering with restoration?” (2008) 3 Environ. Res. Lett. 15002 (“Pedersen 2008”)). She stated that these studies found a relationship between modeled sound levels and self-reported perception of sound and annoyance, such that the association between sound pressure level and sound perception was stronger than that with annoyance. Further, they found that the sound was annoying only to a small percentage of those exposed; approximately 4 to 10% were very annoyed at sound levels between 35 and 45 dBA. She stated that these studies found that annoyance was strongly correlated with individual perceptions of wind turbines and that negative attitude, including aversion to the visual impact of the turbines, was associated with increased annoyance, while positive attitude, including direct economic benefit from the turbines, was associated with decreased annoyance. She noted that these studies also found that wind turbine noise was perceived as more annoying than transportation or industrial noise at comparable levels. In addition, people in rural areas were much more sensitive to noise than people in urban areas because they were used to a lower level of background noise. She stated that these studies did not find significant adverse health effects.

The CMOH Report concluded that there is no scientific evidence to indicate that low frequency sound generated from wind turbines causes adverse health effects. Dr. Rachamin stated that low frequency sound can produce annoyance in people. However, she said, the sound levels have to be over 90 dB in order to produce any significant adverse health effects, such as severe ear pain. She stated that the studies measuring infrasound and low frequency sound from wind turbines found that sound levels did not exceed 50 to 70 dB, well below the level where known health effects occur. The Report stated that a small increase in sound level at low frequency can result in a large increase in perceived loudness, and this may be difficult to ignore even at

relatively low sound pressures. Dr. Rachamin also stated that sensitivity to annoyance caused by low frequency sound could be greater than that caused by audible sounds.

The CMOH Report noted the work of Alves-Pereira and Castelo Branco (Alves-Pereira, M. and Castelo Branco, N.A.A., "Infrasound and low frequency noise dose responses: contributions", "Public health and noise exposure: the importance of low frequency noise", "The scientific arguments against vibroacoustic disease" in Proceedings of the Inter-Noise Congress, Istanbul (Aug. 28-31, 2007) and "In-home wind turbine noise is conductive to vibroacoustic disease" in Proceedings of the 2nd International Meeting on Wind Turbine Noise, Lyon (Sep. 20-21, 2007) ("Alves-Pereira and Castelo Branco papers")) which proposed that excessive long-term exposure to vibration from high levels of low frequency sound and infrasound can cause whole body system pathology, which they named VAD. The Report stated that this finding has not been recognized by the international medical and scientific community. Further, there is no evidence to support the claim that people living near wind turbines will develop VAD from exposure to low frequency sound.

The CMOH Report referenced the Health Unit Report 2008 and Rideout, K., Copes, R., and Bos, C., "Wind turbines and health" (2010) Vancouver: National Collaborating Centre for Environmental Health ("Rideout et. al. 2010") for its findings on other potential health hazards of wind turbines. The Report concluded that wind turbines are not considered a significant source of electromagnetic field exposure. The Report explained that shadow flicker occurs when the blades of a turbine rotate in sunny conditions, casting moving shadows on the ground and concluded that about 3% of people with epilepsy are photosensitive to flicker frequencies between 5 to 30Hz but that most industrial turbines rotate at a speed below these flicker frequencies. The Report also concluded that ice throw from turbines may pose a significant hazard, ice shed presents a potential risk to service personnel, and that ice fragments have been reported within 100 m of the wind turbine. It notes that turbines can be stopped during icy conditions to minimize risk. In terms of structural hazards, the Report stated that the maximum reported throw distance for turbine blade failure is 150 m for an entire blade and 500 m for a blade fragment. It noted that reported risks of blade failure range from one in 2400 to 20000 turbines per year and that injuries and fatalities have been reported, mostly relating to construction and maintenance activities.

Dr. Rachamin discussed the CMOH Report's main conclusions. The Report concluded that while some people living near wind turbines report symptoms such as dizziness, headaches and sleep disturbance, the scientific evidence available to date does not demonstrate a direct causal link between wind turbine noise and adverse health effects. Further, the sound level from wind turbines at residential setbacks is not sufficient to cause hearing impairment or other direct adverse health effects, although some people may find it annoying. Low frequency sound and infrasound from wind turbines are well below the sound pressure levels at which known health effects occur and there is no scientific evidence to date that vibration from low frequency wind turbine noise causes adverse health effects.

Dr. Rachamin denied the claims that the Report was selective in the literature it reported. She stated that the authors looked at everything available and applied a rigorous scientific method to select the studies that were better designed, and this is what they presented in the Report. She stated that there are other anecdotal reports that exist. However, she said, they were not relied upon because they were not a complete study that attempted to study the exposure to noise in relation to health outcome. She stated that the authors of the CMOH Report did not ignore case reports, and they, in fact, included the work of Dr. Pierpont (Pierpont 2009), which they felt was the best available in terms of case reports. She stated that the authors gave more weight to studies that were published in peer-reviewed scientific journals, such as the Pedersen et. al. studies. She explained that they reviewed the anecdotal reports and what they saw in these reports did not lead them to believe that there is any direct causal link to health impacts.

Dr. Rachamin stated that the authors of the CMOH Report did not consider annoyance to be a significant adverse health effect. However, she acknowledged that in some cases annoyance could produce significant health effects. She also noted that annoyance may not have been triggered only by noise but also by visual impacts and attitude towards the wind turbines. Dr. Rachamin stated that in her opinion “serious harm to human health” would be something of a serious functional impairment, a physiological impairment or tissue damage and likely not to be reversible. She stated that they have not come across any such effect in the literature that is due to wind turbine noise.

Dr. Rachamin stated that of the documents reviewed, the Pedersen et. al. studies was peer reviewed. She stated that the CMOH Report has not been independently peer-reviewed or published. When questioned about whether the Tribunal should apply her criteria of giving more weight to studies that are peer-reviewed and published in scientific journals in considering her Report, Dr. Rachamin noted that her Report is a literature review and not original research and that the purpose of the review determines what criteria are applied. However, she stated, it would be better to subject it to peer review.

Dr. Rachamin stated that the Report relied on the WHO Night Noise Guidelines’ recommendation that sound levels of 40 dB are below the level at which effects on sleep and health occur. She acknowledged that these Guidelines were produced based on community noise sources such as traffic, rail, and aircraft and not wind turbine noise. She also stated that she relied on the review by Rideout et. al. 2010 for her findings regarding electromagnetic fields, shadow flicker, and ice throw and shed. However, she acknowledged that they did not rely on the findings in Rideout et. al. 2010 which indicated that annoyance and sleep disruption are common when noise from wind turbines is at sound levels of 30 to 45 dBA. She disagreed that her reliance on some parts of this report but not others was being selective in presenting the evidence. She noted that Dr. Copes, who was one of the authors of Rideout et. al. 2010, was part of the group that produced the CMOH Report and that this Report was produced on consensus. However, she acknowledged that she has heard that there were issues in the media

afterwards relating to objections from two members of the group, Dr. Copes and Dr. Lynn, about the contents of the Report, but she maintained that the Report was based on consensus.

Dr. Syed Mansoor Mahmood's Evidence

The Director, Mansoor Mahmood, testified as to the process he followed in approving the REA, as a Director under section 47.5 of the *EPA.* He explained that he has been a practising professional engineer for 23 years, with a Ph.D. in chemical environmental engineering and has been employed by the MOE since January 2004. He currently is the supervisor of the Waste Water Approvals Unit as well as the acting manager for the Renewable Energy Approvals Unit ("REAU"). He testified that the REAU was created in September 2009 to review applications for renewable energy projects and comprises ten permanent staff members. They include five professional engineers dedicated to the team, three of whom are noise engineers, one of whom is a waste engineer and one of whom is an air engineer. The Director indicated that the team also includes three senior program co-ordinators of the approval process and two senior project evaluators who screen incoming applications for compliance with the regulatory requirements.

The Director explained that his prime responsibility as manager is to ensure that any application for a REA is complete, that all requirements have been fulfilled and that the review by the project evaluators and senior review engineers has been done in accordance with the legislation and regulations. He stated that his responsibilities also include ensuring that the unit is properly staffed and that internal and external stakeholder interactions are properly done. He added that he has conducted over 210 meetings with project proponents himself with respect to application requirements.

The Director explained that with the introduction and coming into force of the *Green Energy and Green Economy Act, 2009*, the province decided to "change the approvals process, and to make it comply with" the MOE's Statement of Environmental Values ("SEV"). He said that it is now a multi-media streamlined approval approach, consolidating municipal planning, environmental assessment and the previous Certificate of Approval process requirements and taking into consideration the precautionary approach and cumulative effects.

The Director explained that the REA requirements include five reports, and consultation with the public and Aboriginal communities (a minimum of two public consultation sessions). A project description report prepared by the proponent identifies the Aboriginal communities that should be consulted. The proponent must obtain clearance from the Ministry of Natural Resources ("MNR") with respect to a natural heritage assessment, including bird and bat monitoring, woodlots, wetlands and water resources under the MNR's purview. Finally, the Director explained, the proponent must also engage with the Ministry of Tourism and Culture ("MTC") and complete stage 1, stage 2 and, sometimes, stage 3 archaeological assessments. This entire process must occur before an application is submitted to the MOE.

Based on estimates and the 41 applications received, the Director indicated that an application can take anywhere from eight months to eighteen months of review and preparation. Of the 41

applications, three have been approved and 23 have been returned. The Director indicated that the screening process is rigorous; if an application lacks any of the required studies or consultations, the application is returned.

The Director explained that a Noise Engineering Assessment Report is required as part of the approval review process. For the Kent Breeze Project, John Kowalewski, senior review noise engineer, wrote the Report, which the Director indicated he reviewed before the approval was given.

The Director testified that the preliminary screening of the Kent Breeze Project application took two to three months to complete. The Decision Document (Nov. 2010), created for the REA process, defines the background of the project, which, in this case, is comprised of eight wind turbines, 2.5 MW each, with a total project nameplate capacity of 20 MW. The application was submitted on June 9, 2010 and had some shortfalls which the proponent rectified. The Decision Document sets out a summary of the five required reports.

The Director testified that the first and most important report is the Project Description Report, which identifies the nature of the project, its nameplate capacity, location, and associated facilities, and is submitted even before an application is filed as it identifies the Aboriginal communities to be consulted. The Director testified that in the Kent Breeze Project, MOE staff was satisfied that the Project Description Report met all the requirements in Table 1 of O.Reg. 359/09.

The Director explained that the Consultation Report summarizes the consultations conducted with Aboriginal communities, municipalities and the public to demonstrate that the proponent has met the requirements in Table 1 of the regulation. The Director testified that the applicant on the Kent Breeze Project changed the project from ten turbines to eight designed to be more efficient and less noisy. The MOE required the applicant to advise the public of the change by advertising the revised project requirements in the local newspaper.

The Director indicated that a Decommissioning Plan Report is required for a REA, outlining for the MOE's review how the site will be restored to its nascent state at the end of the life cycle of the project. He stated that the MOE was satisfied with the information provided.

He stated that the Design and Operation Report, the last of the five required reports, provides the maps, diagrams, site plans, environmental effects, monitoring plan and performance objectives for the project.

The Director explained that once the reports are completed, the proponent is also required to conduct additional technical review and studies, such as a water bodies assessment to study whether there are any significant water features 120 m off the project area, which the proponent completed in this case as required by Table 1 of the regulation. He added that conditions in the approval ensure that storm water management occurs so that sediment and erosion do not affect natural water features during and after construction.

The Director testified that the issue of whether the site might have to be de-watered during construction was addressed in a hydrogeological assessment conducted by the proponent, indicating that this was not the case. The Director stated that in accordance with the precautionary approach, the REA includes a condition putting the onus on the proponent to obtain a permit if during construction dewatering activities of more than 50000 litres per day of water are necessary.

The Director stated that besides completing the Hatch Noise Assessment Report and obtaining clearance certificates from the MNR and MTC, the proponent also conducted a First Nations Consultation to the satisfaction of the Director and per the requirements of Table 1 of the regulation. The Director pointed out that one of the First Nations members was on the site during the stage 2 archaeological field work, indicating the extensiveness of the First Nations consultation.

The Director testified that municipal consultation is also an essential part of the REA process. During the consultation, certain concerns were identified by the municipality. The Director stated that the MOE used the precautionary approach in contacting the municipality before completing the application review to ensure that the municipality's concerns were met; the Director of Public Works at the municipality confirmed this.

The Director testified that once screening of an application is completed, it is posted on the Environmental Registry for a minimum period of 30 days for comment. With respect to this Project, he testified, the MOE received five comments; two were in opposition to wind energy in general; one supported the green energy project; and two raised concerns about the Project, including night lighting and setback distances.

The Director stated that the MOE ensured that the proponent was aware that Transport Canada is the agency that deals with approvals of lighting and indicated that Kent Breeze was in touch with that agency. The Director indicated that the MNR was satisfied with the bird and bat assessment and included a condition in the REA to take into account any concerns raised by public comment.

The Director addressed the portion of the Decision Document relating to consideration of the SEV and testified that for the Kent Breeze Project, as for every approval issued, the SEV was reviewed and upheld. For example, principles of environmental management were examined; the Director indicated that the applicant employed the ecosystem approach in considering land, water, air and discharge to the environment. The Director testified that pollution prevention and reduction opportunities were upheld; principles of strategic management were taken into account, as well social and economic considerations. The Director also pointed out that the assessment of the Site indicated that, depending on the configuration of the facility, the land can remain in farm operation, indicating the quality of the design.

The Director explained the Conditions of the REA, one of which set performance limits (Condition 9) respecting noise levels at different wind speeds. The Director testified that this is

a standard requirement in approvals of class 4 wind turbines and represents the limits the MOE has set to be implemented across the Province. The Director stated that Condition 10 is an example of ensuring that the SEV, precautionary approach, sustainable development, planning and management are upheld; Condition 10.1 requires the proponent to submit reports verifying that the locations comply with the regulation. The Director explained that for the Kent Breeze Project, he received two information packages from Kent Breeze, one on November 24, 2010 identifying seven turbine locations, which was approved on November 25, 2010 and a final confirmation on January 10, 2011 of eight turbine locations, which was approved that day.

The Director testified that Condition 11 requires that within six months of completion of construction, the proponent submit a written report verifying that it complies with minimum setback distances, in accordance with the regulation. This would include setback requirements for the noise receptors, property setback requirements which are equivalent to the hub height and public road setback requirements, which is the blade length plus 10 m, totalling around 60 m. The Director indicated that the Noise Assessment Report identifies the closest point of reception for the Project to be a rural residence about 580 m from the wind turbine.

The Director explained that Conditions 12 and 13 require that the proponent employ the best management practices for storm water management and sediment and erosion control during and after construction. Within six months of completing construction, the proponent must provide the MOE district manager with a written description of post construction storm water management conditions, ensuring that any sediment or eroded construction material from the site is contained and does not migrate to any of the water features. The Director described the dewatering condition mentioned above.

The Director indicated that the condition respecting monitoring of birds and bats takes into account the concerns expressed during the Environmental Registry comment period and requires the proponent to implement the environmental effects monitoring plan, continue to consult with the MNR and, if there is a potential for the mortality threshold to exceed the standards, to engage in mitigation measures.

Conditions 18, 19 and 20, the Director explained, deal with traffic management, which was raised during the comment period. The proponent is required to develop a traffic management plan and obtain road users' and municipal agreements on that within three months. If unable to do so, the proponent has to so advise the MOE.

The Director explained that Condition 25 requires the proponent to maintain records of the operational logs and record complaints of adverse effects caused by construction, installation or operation of the Project or the equipment. The Director stated that this complies with the precautionary approach in the SEV, and that the log maintenance complies with transparency requirements.

The Director testified that Condition 26 outlines what information must be recorded about complaints. Condition 27 requires that the proponent maintain records for a minimum of five

years from creation and make them available to the MOE for inspection. Condition 28 requires that the MOE be notified of each complaint within two business days of receipt; the written record must be provided within five business days of receipt.

With respect to the MOE's future activities respecting REA applications, the Director testified that the MOE requested two studies to be done in January 2010; the first is the HGC Report 2010 that has just been completed and is being reviewed by the MOE; the second, on the measurement of wind turbine noise for development of a standard protocol for use by the MOE as well as external stakeholders. The Director also testified that the Province has provided funding to the Ontario Council of Universities and appointed a research chair, Dr. Siva Sivoththaman from the University of Waterloo, to establish a team to research renewable energy technologies and assess potential health impacts of those technologies, and publish a mandate in June 2011.

The Director explained that he has approved over 1500 projects since 2007. As a professional engineer, he stated, he is bound by a code of ethics and has never signed off on anything that he feels would cause harm or have any adverse effects. He testified that he always ensures the MOE's legislation, regulations, guidelines and policies have been appropriately followed before an approval is given. He stated that in his opinion, the project completed all the requirements of O.Reg. 359/09, which is a very prescriptive regulation. He added that the proponent has on some occasions gone above and beyond the requirements. He stated that just the screening of the Project took two to three months time, indicating the extensive review of the application. He stated that in his opinion, the approval given to the Project was correct.

In comparison to other approvals, the Director stated that REA approvals are comprehensive, rigorous, consolidated and multi-media, involving what would otherwise have been two or three approvals; one under section 53 of the *Ontario Water Resources Act* for storm management, one for noise approval under the *EPA* and, if any waste were generated, an approval under Part V of the *EPA*. He also stated that the process takes into account all environmental and socio-economic aspects, as well as involving the mandate of the MNR and MTC.

The Director agreed that on issues of human health, he relied on the opinions of others, such as the CMOH, who have the necessary qualifications to comment on that, in order to reach his conclusions regarding the approval. The Director stated that there was nothing else in the Decision Document regarding human health in terms of the decision-making process on the approval.

The Director stated that he was familiar with the name Barbara Ashbee and recalled a meeting that took place with Doris Dumais, his director, and Ms. Ashbee at the MOE offices on June 22, 2010 with respect to concerns about health impacts of wind turbines but did not recall the specific details of that discussion.

The Director stated that Suncor's application was not a rush project nor that it was a priority, but testified that it met all the requirements of the REA and all the studies and reports were

completed. He did state that the project had accelerated timelines because of certain project concerns, but assured the Tribunal that the review was thorough.

The Director identified an email chain staring September 24, 2010 as being from Kristina Rudzki, a senior project evaluator in the REAU, who screens projects for completeness and accuracy when they are received. He indicated that she was the project evaluator for the Kent Breeze Project. With respect to a comment in the email from Ms. Rudzki to John Kowalewski, project engineer on the file, that there was a priority rush on this file to complete the review mid-October and asking that he complete his review of the noise assessment by September 17, the Director responded that it was not a project that was rushed by the MOE but the proponent had some contractual obligations and requested that the review be done in an expeditious manner. Since this was one of the first projects and there was no backlog or workload in the unit at the time, there was no need to rush the project and it was done in "its due course of time"; the resources were available to complete the review in a short period of time. The Director explained that there were two other applications at the time, being small Class 2 applications.

Mr. John Kowalewski's Evidence

Mr. Kowalewski was qualified as a mechanical engineer with specific experience and expertise in environmental noise issues and in the application and development of noise guidelines. Mr. Kowalewski has been a Senior Noise Engineer in the MOE since 2001 and is currently working in the REAU of the Environmental Assessment Branch of the MOE. He has been working in engineering and acoustics since 1972.

He testified that he reviews projects submitted for approval by the MOE. For the last three years, he has dealt mainly with wind power projects, having been involved with 45. He testified that he has been involved in the Certificate of Approval process for 30 or 35 wind projects. He has been involved in close to 300 other projects. Mr. Kowalewski stated that he was one of a number of people involved in the design and development of the MOE Noise Guidelines and in the creation of noise setbacks for wind farms. He stated that he has published on the topic of acoustics, has been a member of the Canadian Acoustical Association since 1986 and is a past member of the Institute of Noise Control Engineering.

Mr. Kowalewski explained that a complete noise assessment report is a key element in a REA application. The report includes drawings, tables and calculations and contains a description of the location of the project, the equipment being proposed (wind turbines and any power transformers), and the noise receptors within a prescribed distance, which is 1500 m from any proposed wind turbine, as well as detailed calculations for predicting the noise that would be expected at all of the noise receptors. He stated that the critical group of receptors are those with land properties not associated with the project, including properties with existing dwellings, vacant lot properties with a municipal building permit for a receptor and vacant lots with municipal zoning permitting a potential receptor. He testified that the noise prediction

calculations must demonstrate that the project would be in compliance with the sound level limits prescribed by the MOE.

Mr. Kowalewski testified that once that information is submitted and found to be complete, the project is reviewed to determine whether the proposal would comply with the sound level limits, in which case he recommends approval of the project to the Director. He said that under O.Reg. 359/09, the proponent must submit the information discussed earlier; in addition, a noise report must address the requirements in the MOE Noise Guidelines.

He indicated that the MOE Noise Guidelines were developed in consultation with various stakeholders through meetings and focus groups. The aim was to upgrade the previous guidelines issued in 2004 and clarify requirements for proponents. He indicated that a focus group session in October 2007 involved leading acousticians in the Province as well as interested groups and individuals, the objective being to review a report commissioned by the MOE on regulations and guidelines in other jurisdictions. He indicated that in June 2008, the revised noise guideline was again reviewed in a stakeholder's workshop, following which the new guidelines were posted for comment and issued in October 2008.

Mr. Kowalewski explained that the 2008 guidelines clarified the earlier 2004 guidelines by maintaining the same sound level limits but explaining how wind shear was taken into consideration and changing the distance of noise receptors to be considered in review of a proposal from 1000 m from the closest wind turbine, to 1500 m. There was also clarification of parameters chosen for calculations, such as ground attenuation, or the reflection of wind turbine sound off the ground which, when combined with the direct sound, reduces the sound. He testified that the MOE chose to specify these values in a conservative way, resulting in an overestimation of the noise levels and a greater setback.

Mr. Kowalewski testified that the MOE requires that the principle of predictable worst case be applied in the design or assessment of noise assessments. This means that certain assumptions are made about expected noise impact under certain conditions where the difference of noise from the industry as compared to background noise would be the greatest or the worst case. He explained that this would typically occur at night when the background noise is usually the lowest.

He stated that, in some localities and predominantly during summer months, the atmospheric conditions occasionally present relatively high wind shear for part of the night-time hours. Some portion of this time will include sufficient wind speeds at hub height for driving the wind turbines to generate electricity and noise. Therefore, to account for these special atmospheric and operating conditions, a conservative approach is taken, requiring an adjustment to the specified noise emissions of the wind turbines, typically for the wind speed categories below 8 m/s (MOE Noise Guidelines section 6.2.3). Thus the resulting noise assessment would compare the maximum total noise level from all wind turbines operating against the most restrictive sound level limit (i.e., 40 dBA). He indicated that the MOE has historically used the one-hour increment of time for making this evaluation.

He stated that the evaluation is made using the standard value for quantifying the noise emissions from a wind turbine, and wind patterns that exist in a particular area, to determine whether wind shear conditions exist that are significant to this project. He explained that wind shear is the rate at which the wind velocity varies with height. There are different atmospheric stability conditions which would vary that rate. High wind shear conditions mean that the rate of change between the ground level and high level wind shear, i.e. at the height of a wind turbine, is very high. A numerical factor is applied to that to perform calculations. He explained that if the wind shear is fairly high on occasion in a particular project, the daytime noise emissions need to be adjusted because the standard approach applies only in a specific set of conditions. This results in a requirement for greater setbacks.

He testified that other considerations include ground attenuation, as well as the combined effect of all the wind turbines within the 5 km radius of any noise receptor. For each noise receptor, calculations must include all turbines, whether from the particular project or an adjacent one within a 5 km radius. This is consistent with the worst case scenario, because calculations are done in pairs from each turbine to that receptor and each turbine in turn, so that it is as if the wind were blowing in the worst case towards the receptor. He explained that the MOE requirement is that it be assumed that all the wind turbines are propagating sound towards the receptor simultaneously. In other words there is no correction for wind direction; if a receptor has wind turbines on both sides, the sound levels are combined as if the wind were blowing simultaneously towards the receptor, which, he said, is very unlikely to happen. As a result of the combined sound levels and higher predicted values, a higher setback is required, which is part of the predictable worst case scenario. He said that for those receptors near turbines situated in opposite directions, the unlikely wind conditions assumed in the calculation results in an overestimation of predicted noise levels.

Mr. Kowalewski explained that vacant lots that could potentially be developed are considered as noise receptors, which reduces the amount of available space for a project and has the effect of increasing the setback for many receptors between a wind turbine and some existing residences.

He testified that the MOE Noise Guidelines classify receptors in urban (MOE NPC-205 “Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban)” (October 1995) (“NPC-205”)) and rural areas (MOE NPC-232 “Sound Level Limits for Stationary Sources in Class 3 Areas (Rural)” (October 1995) (“NPC-232”)) according to the area’s population and expected background noise. This is significant with respect to wind projects, which are generally in rural areas. He explained that a Class 2 area refers to receptors which may be close to busy roadways with elevated background noise. In many rural areas, he stated, dwellings which are fairly close to the road would exhibit elevated background noise levels that would fit the Class 2 designation. This means that sound level limits for background noise would be higher, starting at 45 dBA. He stated that receptors in quiet areas are classified as Class 3, with sound level limits beginning at 40 dBA.

Mr. Kowalewski testified that for wind power projects, the MOE assumes that all receptors are Class 3, as the predictable worst case, meaning that lower sound level limits would apply. The only exception would be if it were clearly demonstrated by measurements or traffic counts that the night-time background noise at the worst hour would be higher than the sound level limits, in which case, that would be the new limit.

He testified that ISO 9613-2 is an international standard for calculating the attenuation of sound during outdoor propagation, being used for various industrial sources and wind power projects. He indicated that it forms part of the MOE Noise Guidelines for wind farms. He explained that the standard sets out the methodology for performing the calculations and provides a table with uncertainty values to prescribe the accuracy and range of the standard.

He explained that in the present version of the standard, the uncertainties are 30 m in height for noise sources and 1000 m for distances, which are the ranges for which there was data included in the standard indicating what those variances or uncertainties are. He added that the standard does not limit anyone from using it for longer distances or regular heights.

Mr. Kowalewski explained that page 6 of the MOE Noise Guidelines addresses sound level limits at receptors in wind power projects, with two sets of daytime sound level limits based on the wind velocity as measured at a 10 m height, a standard height for measuring wind. He stated that the Noise Guidelines adopted the reference height for wind as 10 m above grade to be consistent with current industry practice. The background noise levels due to wind alone were adopted from several references based on field measurements. These do not include signal noise caused by wind effects on the microphone. Therefore, the MOE sound level limits for wind farms were set relative to the wind-induced background noise level over a range covering the operation of wind turbines from 4 to 10 m/s. He testified that there are values for wind turbine sound level limits in a Class 3 area ranging from 40 to 51 dBA, the values being given in decibel A-weighted levels measured over a one-hour Leq, which is the energy equivalent level over a one-hour period.

He stated that, in practice, due to the relatively constant sound emissions of most commercial wind turbines at full operation, the critical wind category for assessing compliance for noise is the 6 m/s at 10 m height. Predicted wind turbine sound levels for higher wind speeds are generally much lower than the MOE sound level limit. He stated that the limits applicable to Class 1 and Class 2 areas, where there is higher background noise, are higher, ranging from 45 up to 51 dBA. He further explained the limits with reference to a plot found in the MOE Noise Guidelines.

Mr. Kowalewski indicated that the Hatch Noise Assessment Report addressed setbacks for property, roads, rail and other features in accordance with O.Reg. 359/09. He indicated that the Report identified about 292 non-participating locations on properties within the study area, including several outside the 1500 m contour from the sites of the closest proposed turbine. The Report also identified one participating dwelling within the properties associated with the Project.

Mr. Kowalewski stated that Hatch indicated that based on their measurements of wind profiles in the area, they concluded that the wind shear factor was high. When they adjusted the noise emissions to reflect the high wind shear condition, as required by the MOE Noise Guidelines, the result was that the noise emissions were essentially the same for all wind speed categories. This means that they had to use the maximum emissions levels for their predictions and that would have to be compared against the most restrictive MOE sound level limit. The result was the most restrictive limit of 40 dBA. He indicated that in this way, they demonstrated that for all wind categories, the sound level from the Kent Breeze Project would not exceed 40 dBA at any of the identified noise receptors. He stated that the Kent Breeze Wind Farm was designed for a maximum noise level of 40 dBA at any noise receptor within the project area and in all wind speed categories. Therefore, he said, the Project is not technically capable of exceeding this noise level.

Mr. Kowalewski indicated that the Report included the assumptions prescribed in the MOE Noise Guidelines for ground attenuation and the air absorption. They included all the turbines. He said that the results are based on all eight wind turbines operating simultaneously at maximum sound levels as if the wind were in the direction of each point of reception simultaneously, which reflects the principle of the predictable worst case.

He testified that the other adjustment for wind shear was in relation to the noise emissions provided by the manufacturer for the equipment, which was indicated to be an uncertainty of 0.9 dBA for daytime, which Kent Breeze added to increase the noise level of the wind turbines, resulting in a greater setback. He explained that Kent Breeze needed to meet the most restrictive noise level limit of 40 dBA.

Mr. Kowalewski stated that the regulation requires a minimum setback of 550 m for wind turbines. The proponent created a circle of a 550 m radius around each wind turbine to determine that there is no receptor. He stated that the only exception is one participating receptor, a dwelling which is part of the Project/facility and, therefore, they have the option to choose where the turbine is to be located.

He testified that in order to validate or verify that the calculations had been done properly, the proponent is required to provide in the noise assessment report a sample calculation. He stated that he reviewed it and carried out his own calculations for that sample, as well as for some of the more impacted predicted receptors. He said that his results and the proponent's results were in agreement.

Mr. Kowalewski stated that he completed a Noise Engineering Assessment for this Project. Based on the Project proposals and the fact that the calculations were done correctly and all required aspects for the Project were presented, he indicated that his conclusion was that the Project was in compliance with the MOE sound level limits. Therefore, he could recommend to the Director that the Project be approved.

Mr. Kowalewski's supplementary witness statement said that a REA is granted based on not exceeding sound level limits which range from 40 to 51 dBA, depending on the wind speed category from 4 to 10 m/s at the 10 m height. Consequently, in this case, there is ample margin during winds of 7 m/s or more for the wind farm operation to be well within the MOE sound level limits.

With respect to the product acoustic specifications provided by General Electric for the model of turbine used in the Project and, in particular, the octave band power spectra, Mr. Kowalewski agreed that the highest apparent sound power level occurs at 8 m/s of wind, not 6 m/s and that the manufacturer predicts 85.9 decibels for the 63 Hertz octave band at 8 m/s wind, with an uncertainty factor of 0.9 dBA, totalling 86.8 dBA; he also agreed that at the 63 Hertz value, at 6 m/s, a value of 79.4 would result, to which 0.9 would be added, for a total of 80.3. With respect to Table 3.1 of the Hatch Report, Mr. Kowalewski agreed that the number 86.8 appears under the 63 Hertz value at 8 m/s. Mr. Kowalewski agreed that GE modeling calculations use a wind shear co-efficient of .16, which is called "neutral atmospheric conditions". However, Table 3.1 refers to a wind shear co-efficient of 0.42, indicating that no adjustment has been made for the increased wind shear at the wind speed that is the highest sound output level for this turbine; Mr. Kowalewski explained that the number is identical in the manufacturer's calculation and the Hatch Noise Assessment Report because that is the maximum value of the noise emissions of the equipment and it would not be affected by the wind shear at that maximum value. He stated that wind shear does affect the lower wind speeds, however.

In his witness statement, Mr. Kowalewski stated that it is his opinion that engaging in this Project will not cause serious harm to human health, resulting from the setback distances approved. He stated that his opinion is based on medical information, including studies prepared by the WHO received by the MOE, indicating that average noise levels outdoors at night of 40 dBA or less have no significant impact on human health.

Dr. Cornelia Baines' Evidence

Dr. Baines was qualified as a physician epidemiologist with a special expertise in dealing with scientific evidence affecting public policy. Dr. Baines, who received a medical degree and Masters of Science from the University of Toronto, is a professor emerita at the Dalla Lana School of Public Health at the University of Toronto. In her work, Dr. Baines has looked at socio-economic controversies, such as the breast implant controversy.

Dr. Baines reviewed her history with respect to her involvement in the issue of wind turbines, which included writing a letter to the editor of the *Meaford Express* on June 24, 2009 respecting a letter written by Laurie Gillis the newspaper had published requesting that readers report to her all symptoms experienced because of exposure to wind turbines. Dr. Baines said she pointed out in her letter that to establish that symptoms were caused by exposure, it would be useful to have a comparison group. She indicated that she received responses from other people who asked her for information as to how to accumulate evidence to make their case.

She also explained that she spoke at a hearing of the Executive Committee of the City of Toronto on April 19, 2010 on the subject of establishing wind turbines in Lake Ontario. She said that she told the City that any report that claims adverse health effects are caused by wind turbines would not be persuasive, in the absence of comparative data from those exposed and similar people not exposed. When asked, Dr. Baines also confirmed that she had corresponded by email with Laura Humphrey in April 2010 in response to her request to be directed to the studies referred to in Dr. Baines' letter to the editor of the *Guelph Mercury*. The email response from Dr. Baines stated that she could not take long enough to outline the concerns she had about the false claims of adverse effects from wind turbines. She confirmed that at the time she believed that the claims about adverse effects were false.

Dr. Baines summarized her concerns with the Windvoice Survey and the Nissenbaum Study. Dr. Baines said that she was in a dilemma when commenting on the Nissenbaum Study because Dr. Nissenbaum indicated that it is a draft document rather than being a manuscript ready for submission. She said that to criticize a draft document on the basis of how it fails to meet the standards of documents submitted for publication seems unfair. However, she did outline her concerns pertaining to the expression of the research questions, the use of validated questionnaires and the use of non-standardized questions. She reviewed the implications of first having a pilot study and reviewed the Study's results. She also spoke to the issues of "convenience sampling," that is, sampling on certain persons rather than others. She further discussed interview and recall bias.

Dr. Baines testified that it is absolutely unacceptable to the epidemiological community to assert that a questionnaire survey can establish causation; it can establish an association, but higher levels of research are needed to establish causation. She testified that if one accepts the Study results as being valid, there is good reason to conclude that there is an association between wind turbines and health effects; however, for causation, analytic study, not an observational setting, is required.

She stated that the association is not strong for symptoms post wind turbine exposure, largely because of the considerable prevalence of symptoms in the non-exposed general population.

She suggested that the conclusion of the authors of the Study that they have demonstrated a dose-response relationship is not compelling, given the prevalence of similar symptoms in the general public and the inappropriately exaggerated attribution of statistical significance to their findings. She stated that one of the flaws not addressed in the Study criteria is that when a single exposure causes multiple system symptoms, finding a biological mechanism or explanation, is virtually impossible, as is determining cause and effect.

Dr. Baines concluded that one can accept that anger, stress, anxiety and irritability will diminish the quality of sleep and cause daytime sleepiness and that these feelings may be elicited by wind turbines. However, she stated that "it is not biologically plausible to associate hypertension, elevated cholesterol, diabetes, nausea, tinnitus and palpitations with IWTs."

Finally, Dr. Baines stated that if the Study were submitted in its current form, it would be rejected. If it conformed more to the standard criteria for manuscript preparation, she thinks it would be returned with a request for a revision with respect to some of the issues she raised in her testimony. She stated that it was her opinion that no valid conclusion can be drawn from the Study as it is presented.

Dr. Baines provided her opinion that, on the basis of what she knows, wind turbines situated half a kilometre away from a home do not cause serious adverse health effects. She admitted that there are other reasons for not liking wind turbines, such as their aesthetics, cost, blade breaks, and effect on property values. She stated that she is not bothered by the aesthetics and her property values have not been affected because wind turbines are not located close to her.

Dr. Baines indicated that, through the hearings in the United States respecting silicone breast implants, a new disease was created called “siliconosis” by the plaintiff lawyers. She stated that the women self-assessing themselves with respect to the effects of breast implants said that everything that happened to them after they got breast implants was due to the implants, whether it was heart failure, autoimmune disease, anemia, etc. She said that one must not ignore, one must listen, but one must be sceptical.

Dr. Mark Speechly’s Evidence

Dr. Speechly was qualified to give opinion evidence as an epidemiologist with special expertise in population science and psychosocial epidemiology.

Dr. Speechly testified with respect to the Windvoice Survey. He stated that the title of the survey “Wind Energy Concerns” does not accord with the way that an epidemiological study would normally be conducted and it would be preferable to title it something like “Health Survey” so that the outcome is not pre-judged in people’s minds. He stated that the title of the study and the fact that there was no control group is extremely problematic.

Dr. Speechly reviewed and commented on the report of Dr. Phillips. Dr. Speechly agreed with Dr. Phillips that many people living near wind turbines report symptoms. However, he noted that the real issue is whether the reported symptoms are caused by the turbines or by the idea that the turbines are harmful. He stated that the probability that an effect causes an outcome in the population cannot be known with absolute certainty but it can be estimated by studying samples. He stated that certainty is based on the totality of evidence from all relevant sciences and it can change over time as knowledge accumulates. In his opinion, it is premature at this point in time to act to prevent exposure to wind turbines. Dr. Speechly agreed with Dr. Phillips that the case series design of study can detect true causes. However he noted that the study of syndromes of non-specific, subjective symptoms that appear frequently in the general population, such as sleep disorders, is one of the most challenging tasks of epidemiology.

He agreed with Dr. Phillips that we do not need to understand causal mechanisms to be certain enough to act, but added that it is an important part of the totality of evidence that adds to

certainty. Dr. Speechly strongly agreed that the reported health problems are serious. However, he noted that symptoms can have many causes including psychological ones, such as stress, anger, fear and frustration. In his opinion, it is necessary to exhaust the possibility that these psychological factors are producing the physical symptoms before concluding causation. Dr. Speechly stated that an exposure that is perceived as harmful can cause real symptoms even if the exposure itself is harmless. He stated that the phenomenon of psychological reactivity seems capable of explaining most of the observed outcomes that Dr. Phillips refers to and in his opinion, this has not been adequately considered as an alternative explanation for the association between wind turbines and self-reported symptoms. Dr. Speechly stated that he does not consider the number of replications of adverse event reports convincing because the symptoms are self-reported and people are aware of their distance from a wind turbine.

Dr. Speechly reviewed and provided his opinion regarding the Nissenbaum Study and Dr. Wilson's review of the Nissenbaum Study.

Dr. Speechly stated that the Nissenbaum Study methodology is sufficiently flawed that alternative explanations are more likely to be true, and therefore, it does not provide compelling epidemiological evidence that wind turbines cause health problems in people living near them. He stated that a more plausible explanation for the Study's findings is that the reported symptoms are more likely to be psychological reactions to the highly emotionally charged social environment surrounding wind farms than they are to be caused by any physical emanations from the devices themselves.

Dr. Speechly admitted that he was not familiar with the scientific literature on the effect of wind turbine noise on health. He stated that his alternative explanation of psychological reactions was more plausible than the effects being caused by noise or amplitude modulation because the noise-related theory would not explain the results where people living close to the turbine experienced more symptoms before the turbines existed.

Dr. Speechly stated that there are two fundamental flaws with the Nissenbaum Study. The first was that the Study recruited participants using flawed procedures which are likely to introduce bias. The second fundamental flaw was the Study's reliance on self-reported outcome measures that were not clinically verified and could be the result of psychological suggestibility.

Dr. Speechly stated that the strongest causal evidence comes from studies where participants are randomized to exposure groups in a blinded fashion so that none of the participant, the physician, or the person doing the health assessment knows the exposure status of any person.

Dr. Speechly described his "Best Practices" criteria for conducting studies to include unbiased sampling, unbiased measurement and proper statistical analysis. Dr. Speechly testified that the SF-36 test is a very well known measure that has been in use for quite some time. He stated that it was a negative that the authors did not compare the results in the Study to the population norms for the SF-36. Dr. Speechly also provided evidence on the statistical approaches used in the Nissenbaum Study.

Dr. Speechly testified that the Nissenbaum Study does not support a causal association between industrial wind turbines and adverse health effects due to the measurement issues and the confounding variables that the authors did not consider. He stated that, at the very best, the Study is possibly suggestive of an association, but that there are enough problems with the way the Study was done that he would not recommend the Study for publication or feel comfortable funding further research based on the results.

Dr. William David Colby's Evidence

Dr. Colby was qualified to give opinion evidence as a medical expert in public health with special expertise and knowledge in the issue of public health and wind turbines.

Dr. Colby is the Acting Medical Officer of Health for the Municipality of Chatham-Kent. He is the author of the Health Unit Report, co-author of the AWEA/CanWEA Report and advisor with regards to the CMOH Report.

Dr. Colby testified that the Health Unit Report responded to a request from the Chatham-Kent Municipal Council for the Board of Health to identify health impacts and recommend mitigation measures for the placement of wind turbines in proximity to residences, public facilities and schools. The Report was intended to enable the Chatham-Kent Board of Health to make evidence-based decisions regarding the known health impact of wind turbines from the current literature. Dr. Colby testified that evidence-based medicine means that one should form one's opinions on the basis of the available facts that have been collected in a scientific manner.

The Health Unit Report stated that peer reviewed journals were utilized as the first information source in efforts to reduce potential bias. Dr. Colby testified that peer reviewed journals are preferable because the process of peer review ensures that the article is critically reviewed by knowledgeable people in the field.

The Health Unit Report noted that the Public Health Agency of Canada defines health impact as an immediate effect of a program, policy or process on health and a health outcome as a distant or ultimate effect on health. It noted that human safety has been defined as a judgement of the acceptability of risk, and risk as a measure of the probability and severity of harm to humans. The Workplace Safety and Insurance Board of Ontario defines a health hazard as something that results in an injury, illness or disease. The Report identifies that the potential health and safety issues associated with wind turbines include blade and structural failure, icing issues, sound emissions and noise concerns, shadow flicker and construction injuries. Dr. Colby testified that public health is a scientific weighing of all the risks and benefits associated with something.

In terms of turbine blade and structural failure, the Health Unit Report stated that wind turbines are required to meet strict international engineering standards. It stated that CanWEA's minimum setback recommendation to account for this risk is one blade length plus 10 m. The Report stated that lightning strikes pose the greatest potential for blade or turbine breakage. It

noted that no injuries or fatalities have occurred in North America due to blade or turbine breakage and/or collapse and that AWEA identified the leading causes of blade failure as vandalism, improper assembly or exceeding design limits. The Report stated that turbine failure has decreased dramatically with the introduction of International Electrotechnical Commission ("IEC") standards. It stated that there had been 74 known turbine failures since 2000 in Europe where whole blades have been thrown up to 150 m and blade fragments up to 500 m. Dr. Colby testified that it may no longer be true that no injuries have been documented, but that the occasional injuries that have occurred are few and far between.

Based on the Health Unit Report, he stated that monitoring by Ontario Hydro of the Huron County Wind Farm indicated that during the first six years of operation ice throw occurred 13 times with the furthest fragment found less than 100 m from the turbine. The Report presents the results of computer modeling of the risk of ice strike for a typical wind farm environment in Southern Ontario. The Report states that ice throw risk can be avoided by requiring appropriate setbacks and that the potential risk of ice shed is of greatest concern to turbine maintenance workers and operators.

The Health Unit Report stated that the health impact of noise created by wind turbines has been studied and debated for decades with no definitive evidence supporting harm to the human ear. It stated that while the audible noise from wind turbines can be annoying, it does not pose a health impact concern if turbines are located at appropriate setback distances. The Report stated that the literature indicates that the infrasound produced by wind turbines is not perceptible to the human ear and is not know to be harmful to human health. Dr. Colby testified that there is a great deal of evidence that has been published about sound and health and that the kind of sound that is known to damage the structures of the ears and hearing is orders of magnitude greater than that produced by wind turbines. He stated that no direct effects of harm to human health have ever been demonstrated at the levels of sound produced by wind turbines.

The Health Unit Report explained that shadow flicker occurs when the sun is located behind a wind turbine casting a shadow that appears to flick on and off as the wind turbine blades rotate. The Report stated that shadow flicker has been demonstrated to negatively affect about 5% of individuals who suffer from epilepsy. However, it stated, frequency of flicker from wind turbines is well below the frequency known to trigger epilepsy symptoms (above 2.5 to 3 Hz). The Report concluded that the research indicates that shadow flicker is not a health concern when appropriate setbacks are enforced. Dr. Colby testified that he is not aware of any known examples of people having epileptic seizures triggered by wind turbines. He stated that shadow flicker is more of a theoretical than real health hazard.

The Health Unit Report stated that a few construction injuries were identified in relation to wind farms that were caused by human error, failure to adhere to required safety measures and lack or misuse of protective equipment. The Report concluded that strict adherence to construction

guidelines and occupational health and safety laws will decrease the potential impacts to health and safety of construction crews.

The Health Unit Report referenced some of the work of Dr. Pierpont and it noted that none of this work has been published in scientific or peer reviewed journals. It stated that the information from her case series should not be discounted but generalizations should be avoided. Dr. Colby testified that Dr. Pierpont's case series (Pierpont 2009) constitutes the worst example of selection bias he has ever seen in any published work and he does not believe that it makes any worthwhile contributions to the literature on wind turbines and health.

The Report concluded that very little scientific evidence exists on the health effects of wind turbines and that, as long as the MOE guidelines for location criteria of wind farms are followed, there will be negligible adverse health impacts on Chatham-Kent citizens. Dr. Colby testified that the criteria for the siting of wind turbines is now stronger than what existed at the time of the Report.

Dr. Colby testified that following the release of the Report there were still a lot of complaints and allegations about the health effects of wind turbines. In June 2009, he wrote an additional letter to the Municipal Council confirming the position taken in the Report and providing further explanation about the different types of scientific evidence. In this letter, Dr. Colby categorized the types of evidence for medical conclusions into three categories ranging from the strongest evidence to the weakest. He stated that there is a lack of the stronger types of evidence regarding wind turbine effects and most of the studies documenting adverse health effects are self-reported accounts or open surveys of health issues. He stated that uncontrolled self-reporting eliminates any chance of scientific analysis and results in pre-selection bias.

In the letter to Council, Dr. Colby discussed the evidence with respect to different components of sound. He stated that infrasound from wind turbines is at a level of 50 to 70 dB, which is below the audible threshold. He concluded that there is a consensus among acoustic experts that infrasound from wind turbines is of no consequence whatsoever. He stated that low frequency sounds below 40Hz cannot be distinguished from background noise due to the wind. Perceptible low frequency noise can be produced in unusually turbulent wind conditions and this could be annoying to some people, but he concluded that there is no evidence that this level of noise could be harmful to human health. He stated that the fluctuating aerodynamic noise from wind turbines is the cause of most noise complaints. He stated that some people who are more sensitive to noise may be irritated at the noise levels imposed by the MOE and sleep disturbance can occur, but there is no evidence of direct effects to health by this level of noise.

Dr. Colby discussed the "nocebo effect" which refers to how stress, fear and hypervigilance over wind turbines can exacerbate or create problems which would not otherwise exist. He stated that these responses may be caused by the negative publicity about the health effects of wind turbines. He also discussed sensory integration dysfunction, which is a condition of abnormal sensitivity to any or all sensory stimuli. He stated that there is little data on the prevalence of this condition, but that such individuals would be more sensitive to turbine noise than most.

Dr. Colby also identified somatoform disorders, which are characterized by physical symptoms that have a psychological, as opposed to a physical, cause. He stated that conversion is a common disorder where stress and anxiety are unconsciously expressed as physical symptoms, such as sensations of tingling or discomfort, fatigue, abdominal pain, headaches, back or neck pain, weakness, loss of balance, and hearing and visual abnormalities. He noted that the similarities between conversion symptoms and wind turbine syndrome are striking.

Dr. Colby concluded that there is no scientifically valid evidence that wind turbines are causing direct health effects, although the body of valid evidence is limited. He further stated that it is unlikely that adverse health effects will emerge in the future because there is no biologically plausible mechanism known by which wind turbines could cause health effects. He stated that annoyance from wind turbines is possible for some people and that associated stress from annoyance, exacerbated by negative publicity, is the likely cause for those who report health effects. He added that stress has multiple causes and it is additive. He testified that stress is never due to one single factor and that it is methodologically difficult to identify one specific source of stress. He stated that stress, if prolonged, can lead to health hazards, but that stress is part of the physiological reaction to everyday life.

Dr. Colby was one of the co-authors of the AWEA/CanWEA Report. He stated that the expert panel review was created because the AWEA and CanWEA wanted to look into the allegations that wind turbines cause negative effects to health but the large government-based agencies, such as the American National Institute of Health, were unwilling to conduct this investigation because they felt there was not enough evidence to justify it. He stated that AWEA/CanWEA put together an independent panel of experts who are knowledgeable in the field and they were asked to look at all of the evidence and to bring to light any health effects that exist. He noted that the Report has been heavily criticized because of its industry funding, but not very much on the basis of its contents.

Dr. Colby testified that the AWEA/CanWEA Report concluded that there is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects. He stated that the sound energy produced by wind turbines is insufficient to harm tissues and that the sounds emitted by wind turbines are not unique in some way that could plausibly have direct adverse health consequences. Dr. Colby discussed how A-weighting is used in measuring sound levels in an attempt to conform the measurement of sound to the way that sound is perceived by the human ear. He explained that as the frequency increases, the level of sound intensity required to perceive the sound decreases; for example to hear a sound of 4 Hz would require a sound level of 107 dB, but to hear a sound at 200 Hz only 14 dB is required for it to be perceptible. He stated that the kinds of sound exposures required to have effects on hearing are orders of magnitude higher than what is produced from wind turbines.

Dr. Colby testified that the AWEA/CanWEA Report concluded that annoyance is not equivalent to an adverse health effect. He stated that annoyance is a highly subjective phenomenon that is influenced by a number of things. He referenced Pedersen's studies and noted how they found

only a weak correlation between sound pressure level and noise annoyance from the wind turbines. He also noted that there is evidence from Janssen, S.A., Vos, H., Eisses, A.R. and Pedersen, E., “Exposure-response relationships for annoyance by wind turbine noise: a comparison with other stationary sources” Proceedings of Euronoise 2009, UK Institute of Acoustics (2009) (“Janssen et. al. 2009”) that wind turbines are not more annoying than other forms of noise until you get to around 40 dB, or 48 dB for high levels of annoyance. He stated that the literature on the hypothesis that chronic noise exposure might lead to chronic health problems, such as hypertension, is limited and contradictory and that no real conclusions can be drawn about this hypothesis. Dr. Colby stated that sleep disturbance is a multi-factorial problem based on any number of factors. He noted that the noise levels from wind turbines are the same as levels in normal urban environments that are produced by furnace fans and refrigerator compressors. Dr. Colby stated that the authors found that 2.5% of the population have 12 dB more sensitive hearing than the average person and this could provide an explanation for why some people are bothered at sound levels that do not affect the majority of people. He stated that you cannot design public policy to encompass the extreme ends of the range. Dr. Colby also referred to somatosensory amplification, where people learn to feel body sensations more accurately and misinterpret the significance of those sensations by equating them with illness. He stated that this undoubtedly contributes to some of the complaints involving wind turbines.

Dr. Colby testified that VAD has only been described by one group of researchers, (Alves-Pereira and Castelo Branco papers), and has not been replicated by others or generally accepted by mainstream medicine. He stated that their original hypothesis relates to people exposed to extremely high levels of sound, aircraft maintenance workers, and is therefore not applicable to wind turbine noise.

In regards to the Report’s conclusion that the panel agrees that the reports of adverse health effects are insufficient to advocate for further funding, Dr. Colby stated that the panel did not mean that studies should be suppressed, but rather that funding of research is limited and that other health problems warrant funding over this topic.

In relation to criticism that there was not an epidemiologist or psychologist on the panel, Dr. Colby stated that there was a lot of combined expertise amongst the authors in a wide variety of health, medicine and scientific pursuits. He stated that the Report was read by a psychiatrist who agreed that their discussion on psychiatric issues was very good. In relation to criticism that the Report fails to take into account the WHO definition of health, Dr. Colby stated that this definition has been widely criticized as being inappropriate for the real world, as nobody meets that definition of health.

Dr. Colby testified that he was involved in advising for the CMOH Report and that he concurs with its conclusions.

Dr. Colby concluded that it is his opinion that there will not be direct health effects suffered by the residents of Chatham-Kent as a result of the Kent Breeze wind farm and he has confidence in the standards set by the MOE in its approval of these kinds of projects.

Dr. Colby stated that he is aware that there are more than 100 wind turbines in his jurisdiction and that the first ones were build about 4 or 5 years ago. He stated that he has had one email from a man who thought he might have effects due to wind turbines and that he responded to the man with his opinion about the alleged effects of wind turbines and suggested that he see his physician to discuss his health problems before he speculated as to what caused them. He stated that he has not heard anything else from this man.

Dr. Colby was asked about a presentation he delivered to the Nova Scotia Department of Energy on March 4, 2010, in which he rejected the idea of a specific wind turbine syndrome but stated that there are stress effects in low levels of noise, either high frequency or low frequency, which affect a small number of people and that it is the audible noise of the turbines that is the cause. He testified that that is still his belief but that noise level is not the main variable that causes the stress effects.

Mr. Brian Howe's Evidence

Mr. Howe was qualified to give opinion evidence as a mechanical engineer with expertise in acoustics, noise and vibration, with special expertise in infrasound, low frequency noise and wind turbine noise. He is a principal of Howe Gastmeier Chapnik Limited (HGC) and was involved in the preparation of the following reports: HGC "Wind Turbines and Infrasound: A Discussion" (2006) ("HGC Report 2006"), HGC "Wind Turbines and Sound: Review and Best Practice Guidelines" (2007) ("HGC Report 2007") and the HGC Report 2010.

The HGC Report 2006 was focused on wind turbines and infrasound. Mr. Howe testified that infrasound is usually defined as sound below 20 Hz and it is prevalent everywhere in the natural environment in sources such as wind, waves, or industrial sources. He stated that infrasound can cause health risks but extremely high levels would be required before this is an issue. The Report explained that research from the NASA space program found that significant effects from infrasound begin at levels of 125 dB (linear). He stated that it is very difficult to measure infrasound from wind turbines because infrasound is inherently in the wind and it is difficult to separate out the infrasound that is produced by the turbine. He stated that to overcome this problem, HGC measures infrasound from inside houses so that the measurement is shielded from the wind.

The HGC Report 2006 described infrasound measurements that HGC has taken at wind farms in Canada and Poland. They concluded that modern wind turbines in the power range prevalent at wind farms in Canada produce infrasound, but often the levels are sufficiently masked by ambient infrasound from other sources, though not always. Overall, infrasound levels of 80 to 90 dBG would typically be expected close to the wind turbines and levels would fall off as distance from the turbines increased. These levels are on the same order as the human perception limit for infrasound established by researchers, governments and agencies in other countries. The Report discussed how the amplitude modulation of wind turbines on the order of 1 Hz can be mistaken for infrasound, which it is not. Although the overall level rises and falls at a low

frequency rate, the frequency of the sound pressure waves that one hears peaks in the range of 1000 Hz.

Mr. Howe testified that the fundamental conclusion from the HGC Report 2006 is that infrasound from wind turbines is not markedly different from the ambient infrasound from other sources and there is no evidence that infrasound near wind turbines is perceptible to humans or that there are any health effects at the levels of infrasound that are produced by wind turbines.

Mr. Howe testified that the HGC Report 2007 was prepared as a best practices guideline for CanWEA and incorporated input from HGC's research as well as input from wind farm developers and regulatory bodies across Canada.

Mr. Howe testified that A-weighting is an attempt to take a sound and provide a single number to represent how the typical human ear would hear it. The HGC Report 2007 stated that an A-weighted spectrum provides the best indicator of the spectral makeup of a sound as perceived by the human ear, and accordingly, it is used worldwide in the assessment of the impact of environmental noise on people and in guidelines and criteria. He testified that from an engineering point of view, he would look at infrasound by looking at the linear pressure levels across the whole frequency range and weighting is only applicable if you want to take the whole spectrum of sound and make a single number. For infrasound, the ISO standard uses G-weighting to filter out sound above 20Hz.

The HGC Report 2007 explained that the ISO standard 9613-2 is a model that predicts sound pressure levels at any given point. The Report stated that this model considers propagation conditions equivalent to a moderate downwind condition in all directions simultaneously. However, it does not consider the absolute worst case scenario and thus, there may be times when the actual sound levels exceed those predicted due to extreme environmental conditions. Mr. Howe testified that ISO 9613-2 is internationally recognized and it gives reasonably accurate sound level predictions. He stated that for wind turbine noise, it is good at predicting the mean sound pressure levels, but because of the heights of turbines and fluctuations in the size of turbines, there is quite a variation around those means. He stated that HGC has consistently found statistical variation in the actual measured sound pressure levels from what is predicted and that because of this it is necessary to measure levels over various conditions for a certain period of time to be able to do a statistical analysis.

The HGC Report 2007 discussed the assessment criteria for noise from wind turbines in Ontario. It stated that the MOE Noise Guidelines require that the calculation methodology of ISO 9613-2 be used, and therefore, they share the limitations of the ISO 9613-2 in that a receptor sound level will be predicted under a single assumed propagation condition that does not reflect a realistic meteorological situation. The Report stated that consequently there may be times when the actual impact exceeds the predicted sound level. Mr. Howe testified that since the writing of the Report, Ontario has changed its guidelines and that other provinces and the federal government have followed what Ontario has developed. The Report stated that audibility is generally not an assessment criterion for industrial noise and it is not expected that

a receptor should be entirely free of industrial noise. Mr. Howe testified that he does not know of any situation where inaudibility is a realistic goal because of the subjectivity in hearing.

The HGC Report 2007 identified best practices that it suggested should be followed for future wind farm developments. Mr. Howe testified that the best practice guidelines are really aimed at promoting community involvement and good public relations. The best practice guidelines promote public education that is factual, is not vague, does not set unrealistic expectations and is done in an honest and straightforward manner. The Report recommended that setback distances should be determined by judging each application on its own merits and taking into account the topography of the area, the number and placement of turbines, the sound power produced by the turbines, and the ambient sound levels at the receptors. The Report suggested that an approach to the assessment criteria for wind turbines similar to that of the MOE Noise Guidelines should be followed.

Mr. Howe testified regarding a document that he and HGC prepared for the Canadian Acoustical Association “Recent Studies of Infrasound from Industrial Sources” published in 2008. He stated that the article summarizes three studies of infrasound that HGC had undertaken respecting wind turbine sound, a large ship engine, and a glass refining plant. He stated that in terms of wind turbine sound, they were able to measure a difference between the wind turbines on and off and thus confirm that wind turbines produce infrasound. However, they found that the levels were still considerably below any established thresholds for infrasound.

Mr. Howe testified that the HGC Report 2010 was prepared for the MOE following a competitive “request for proposal” process. He stated that the Report was originally intended as a literature review, but during the process a consultation session was added and the final Report was intended to provide advice to the MOE on dealing with infrasound and low frequency sound from wind turbines. He stated that the consultation included people from the MOE, Health Canada, some of the wind developers, consultants and academics who were involved with wind turbine sound, three or four people from the SWV and a couple of members of the public.

Mr. Howe testified that since the HGC Report 2006 his opinion with respect to infrasound from wind turbines has not changed markedly. However he recognized that infrasound is still being raised as an issue and so the 2010 Report recommended that the MOE endorse a method for measuring infrasound so that there is some way of quantifying the data to deal with complaints regarding infrasound.

The HGC Report 2010 found that there is strong evidence that, for infrasound in the range of 20 Hz or less, the sound pressure levels produced by modern wind turbines will be well below the average threshold of human hearing at the setback distances typical in Ontario. It stated that most literature on infrasound indicates that infrasonic noise below the threshold of hearing has no effect on human health. Therefore, infrasound from wind turbines is not expected to be heard by humans or pose an issue for human health. The Report also found that for sound in the audible range, the medical literature indicates that at the typical setback distances, the overall magnitude of the sound pressure levels produced by wind turbines does not present a direct

health risk. It stated that audible sound from wind turbines is nonetheless expected to result in a non-trivial percentage of persons being highly annoyed and research has shown that this annoyance can be expected to contribute to stress related health impacts in some people.

The HGC Report 2010 found that it is not common, internationally, for wind turbine noise assessment standards to have specific requirements for the consideration of infrasound or low frequency noise. The Report stated that the measurement of indoor low frequency noise is complicated by a number of factors and that internationally, sophisticated measurement and assessment guidelines have been developed to address these problems. The Report recommends that, since indoor low frequency sound levels and frequency spectra can differ markedly from those outdoors, the MOE should consider developing or adopting a protocol to provide guidance for addressing indoor complaints. However, the Report stated that this protocol cannot replace the compliance guidelines designed to assess sound outdoors. The Report stated that routine measurement of infrasonic sound pressure levels from operating wind farms is not warranted. However, it recommended that the MOE adopt or endorse a proven measurement procedure for infrasonic noise to allow the effective investigation of complaints and public concerns.

Mr. Howe testified with respect to the graph on page 25 of the HGC Report 2010 which shows the curves for threshold perceptibility of sound at different frequencies as a function of sound pressure level and also measurements from wind turbines of the sound pressure level at various frequencies. Mr. Howe stated that below 20 Hz there is no issue with respect to perceptibility of sound from wind turbines, as the measured sound pressure levels from the wind turbines are well below the threshold curves. He stated that wind turbine sound does not start to be audible until around the 50Hz and higher range.

Mr. Howe discussed the conclusions of the HGC Report 2010. He stated that the turbulence at the trailing edge of the blades of the wind turbines produces broadband noise, but the dominant frequency range in terms of human perception of the sound is not in the low frequency or infrasonic ranges. However, low frequency sound from wind turbines will routinely be an audible component of the acoustic impact, and will depend on the wind conditions, the degree of masking from ground noise and the distance from the wind turbine. He stated that a lot of the low frequency noise would be masked by the higher frequency sound.

Mr. Howe stated that the HGC Report 2010 concluded that infrasound from wind turbines does not seem to be an issue as it is well below the average threshold of human hearing. He noted that there are variations in individual sensitivities to infrasound. He stated that their review of the work by medical professionals found that the overall magnitude of the sound pressure levels from wind turbines does not pose a direct health risk. However, the Report concluded that audible wind turbine sound at levels experienced at typical receptor distances in Ontario, is expected to result in a non-trivial percentage of persons being highly annoyed and annoyance associated with sound from wind turbines can be expected to contribute to stress related health impacts in some persons. Mr. Howe testified that the relationship between wind turbine sound

and annoyance is not solely based on the sound level, but depends on a number of factors including a person's attitude towards the sources.

Mr. Howe testified that the windows and walls of a house filter out the higher frequency sounds much more than lower frequency sounds, so that you are more likely going to have an issue with low frequency sound indoors. The HGC Report 2010 concluded that there is evidence that suggests that some people may be particularly prone to annoyance from sounds with strong low frequency components.

The HGC Report 2010 concluded that, because the outdoor sound level impact is not chiefly a low frequency issue, the use of A-weighted criteria is appropriate for the assessment of overall sound impact and the MOE's instrumentation specifications and measurement procedures are suitable in this context. Mr. Howe testified that the MOE currently does not have procedures for addressing indoor noise due to wind turbines, and there are a couple of other jurisdictions, such as Denmark, that are further developed in dealing with this issue.

The HGC Report 2010 recommended that outdoor A-weighted sound levels should continue to be used to evaluate compliance and penalties for audibly distinctive characteristics should continue to be used. It recommended that the MOE should continue to monitor technical developments and regulatory policies in other jurisdictions and that any guidelines developed in respect of low frequency noise and infrasound should be flexible in order to adapt to changes or improvements in the future. The Report recommended that the MOE should consider adopting or developing a protocol to provide guidance for addressing complaints related to low frequency sound indoors. They also recommended that the MOE consider adopting or endorsing measurement procedures to quantify infrasonic levels in specific situations.

Mr. Howe stated that the Hatch Noise Assessment Report was completed in a manner consistent with the requirements of the MOE Noise Guidelines and the setback distance requirements of O. Reg. 359/09. He stated that the Hatch Report indicates that the tonal audibility from the wind turbines is expected to be less than 2 dBA which means that it does not invoke the 5 dBA penalty imposed on tonal sounds by the MOE but that it is not necessarily completely absent. Tones related to mechanical noises (eg. gearbox noise) may be present and their frequency can be in the low frequency range and audible. Mr. Howe stated that based on his research, audible wind turbine sound is expected to result in a small percentage of people being very annoyed at the sound levels experienced at the receptor distances for the Kent Breeze Project. He stated that given the small number of receptors expected to be impacted at sound levels between 35 and 40 dBA, it would be statistically invalid to predict the number of persons expected to be very annoyed. However, he said, those predisposed against the project are more likely to be annoyed.

Mr. Howe testified that modeling of sound levels is reliable for mean levels but in practice, there is going to be statistical variation with time that can vary by plus or minus 5 dBA on a fairly consistent basis. He stated that the MOE has not finished codifying the particulars for the

measurement and assessment of wind turbine noise to deal with that statistical variability to the same extent as the guidelines address steady noises.

Mr. Howe acknowledged that the new standard for sound level at receptors in New Zealand is 35 dBA, though he believes that New Zealand uses a slightly different descriptor than Leq. He stated that he is not familiar with whether the standard in Germany is also 35 dBA.

Mr. Payam Najafi-Ashtiani's Evidence

Mr. Ashtiani was qualified to give opinion evidence as a professional engineer with expertise in acoustical engineering.

Mr. Ashtiani is a project manager with Aercoustics Engineering Limited, which prepared the "Measurement of Audible Noise from Wind Turbines – Phase 1 Report" for the MOE (June 11, 2010) ("Phase 1 Report"). The Phase 1 Report included a literature review and a jurisdictional scan on issues related to noise measurements from wind turbines. The literature review involved collecting and reviewing scientific literature on measurement of wind farm noise, noise measurement procedures for wind turbine noise from other jurisdictions, evaluation of two wind farm compliance studies provided by the MOE and review of MOE NPC documents (NPC-205 and NPC-232). Mr. Ashtiani testified that most of the scientific literature they reviewed dealt with five key issues that are specific to measuring noise from wind turbines, including: general method for assessing the noise contribution from the wind farm at the receptor point, measurement parameters used, assessing ambient noise levels at the receptor and their influence on measured levels, addressing wind induced noise in the measurements, and assessment of tonality. Mr. Ashtiani stated that their review found that there are two general ways of assessing the noise at a receptor. The first is to measure the noise very close to the turbine and rely on the model to predict what the level would be at the receptor and the second approach is to measure the noise at the receptor point.

In terms of the jurisdictional scan and looking at how other jurisdictions assess noise at receptor points, Mr. Ashtiani testified that there are three main categories of jurisdictions: ones that do not actually have any policies specifically regarding the measurement of noise from wind turbines post-construction, jurisdictions that have requirements for measuring wind turbine noise at the source use a model to establish the noise level at the receptor, and jurisdictions that require the measurement of noise at the actual receptor point. Mr. Ashtiani stated that Ontario falls in the first category because the province does not have a specific policy regarding the measurement of post-construction noise from wind turbines. He stated that Ontario has guidelines for the measurement of general noise and they have been used for a long time for doing noise audits on various facilities.

Mr. Ashtiani testified that in conducting the literature review and jurisdictional scan, they looked at all the references they could find from all over the world. He stated that they reviewed over 100 documents and that the ones listed in the Cited References section of the Phase 1 Report are the ones that were the most relevant and which were referenced in the Report.

Mr. Ashtiani testified that the measurement of sound from wind turbines requires a high degree of specialization in personnel and equipment. He stated that it requires the person doing the measurements to have a good understanding of the theory behind data analysis, the limitations of the instruments, and the required analysis techniques and how they fit into assessing noise from wind turbines. He stated that instrumentation grade equipment and specialized wind screens are required to ensure accuracy in the noise measurements.

Mr. Ashtiani testified that he reviewed Mr. Palmer's January 4, 2011 submissions detailing his noise measurements from the Enbridge wind farm. Mr. Ashtiani stated that based on the recommendations they have provided in the Phase 1 Report, neither Mr. Palmer's equipment nor analysis method meets these recommendations.

Mr. Ashtiani testified that the recommendations in the Phase 1 Report are intended to provide a way of standardizing the measurement of wind turbine noise so that everybody is measuring everything the same way and the measurements are thus repeatable and reliable. He discussed the main aspects that differentiate measuring wind turbine noise from other types of noise. He stated that the main thing you have to deal with in measuring wind turbine noise is the presence of ambient noise. He stated that there can be a lot of ambient noise in these situations because you are taking measurements in windy conditions and you have to be able to separate this background noise from the turbine noise. Mr. Ashtiani stated that the second main difference is that wind speed must also be measured because the MOE's sound level limits vary as a function of wind speed. He stated that the MOE sound level limits are based on wind speed at a 10 m height, so the Phase 1 Report recommends that actual wind speed be measured at this same height to allow comparisons to the sound level limits. Mr. Ashtiani stated that the third main difference is the data analysis required with wind turbine noise data. He stated that the analysis has to take into account and be able to quantify the variability in conditions and noise levels over time.

Mr. Ashtiani testified that there are NPC documents (NPC-205 and NPC-232) in use in Ontario which are designed for measuring general noise from industrial sources. He stated that these documents recommend that measurements be taken when it is not windy, which is not appropriate for measuring wind turbine noise.

Mr. Ashtiani testified that the Phase 1 Report is part of a four phase process. He stated that Phase 2 included a consultation session and the development of a draft protocol. He stated that the consultations included members of the MOE, consultants, developers, equipment suppliers, community action groups including the SWV, the Ontario Agency of Health Protection and Promotion, and comments from Health Canada. Phase 3 is currently in progress and it involves field validation of the protocol at wind farm sites in Ontario.

Mr. Ashtiani testified that it is possible to measure and assess noise from wind turbines including audible and low frequency noise. Mr. Ashtiani stated that the purpose of the Phase 1 Report was to standardize the way that wind turbine noise is measured and quantified. He stated that, if you look at the scientific literature, many scientists are measuring noise from wind

turbines and they are quantifying it scientifically and it is accepted. He stated that he cannot comment on how the MOE determines whether or not some measurements are deemed compliant or non-compliant. Mr. Ashtiani stated that just because there is greater wind shear, does not mean that the turbine will create more sound. He stated that the difference is that at ground level the masking effect from background noise is less, so the audibility may increase but the actual sound power will not increase based on the wind shear co-efficient. He stated that it is the wind speed at the hub that determines how much sound the turbine will emit.

Mr. Ashtiani also testified about a document he created based on the Nissenbaum Study.

Suncor's Witnesses

Dr. Pierre Heraud's Evidence

Dr. Heraud was qualified to give opinion evidence in the area of wind turbine ice throw risk assessment with knowledge of turbine failure and tower collapse. He is a team leader of the wind farm design team with GL Garrad Hassan ("GLGH"), the company that was retained by Suncor to prepare the GLGH Risk Assessment. He said that the Risk Assessment followed a methodology which had been developed by GLGH in conjunction with the Finnish Meteorological Institute and the Deutsches Windenergie-Institut as part of a research project on the implementation of wind energy in cold climates. Their approach involved determining the periods when ice accretion might occur based on historical climactic data, determining when in those periods the wind speed conditions are within the operational range of the turbines, assuming that the wind control system is not functional and that turbines are operating during the icing events, using guidelines to determine the probability of fragments landing at certain distances, estimating the probability of members of the public being present at those distances, and then determining the probability of members of the public being hit by ice fragments.

Dr. Heraud responded to a number of discrepancies that Mr. Palmer pointed out between the GLGH Risk Assessment and the REA approval. He testified that he wished to amend Figure 2.1 in the Assessment to correct the labelling of the Kent 5 and MacLeod 5 turbines. He explained that the land area used in his Assessment was the same as the land area stated in Suncor's November 24, 2010 and January 5, 2011 setback reports.

Dr. Heraud explained that in preparing his Risk Assessment, he performed a Montecarlo simulation, which is used to estimate a probability. This process performs one million simulations and determines the number of times that an event happens and then divides this by the number of simulations to get a probability. In this case, the results of the simulation represent the probabilities, given an ice fragment has been released, that any one ice fragment will land in one square meter of ground area, as a function of distance and direction from the turbine. He stated that this simulation takes into account the wind speed statistics of the site, the wind direction statistics, the technical specification of the wind turbine, including tip speed, and the equation of the trajectory. He explained that software was used to run one million

simulations of one ice fragment of 1kg being thrown from an operating GE 2.5xl turbine at Kent Breeze Wind Farm. Dr. Heraud stated that the results of the Montecarlo simulation showed that there were no ice fragments that went beyond 240 m. He stated that the formula that was used in the simulation is based on continuity of movement rules and was obtained from Bossanyi, E. and Morgan, C., “Wind turbine icing- its implications for public safety” Proceedings of European Union Wind Energy Conference, 1996.

The GLGH Risk Assessment stated that an analysis of the on-site meteorological data, suggested that icing conditions may occur for an equivalent duration of six days per year at the Kent Breeze wind farm. However, based on their previous assessment experience in Chatham-Kent, Dr. Heraud said that GLGH used a more conservative estimate of 10 days of icing per year in their Risk Assessment. He explained that in determining the size of ice fragment to input in the Montecarlo simulation he used the geometrical specifications of the blade, such as length and width, and ice accretion rates based on wind tunnel experimentation and observation on site. He explained that with this model he determined the mass of ice that can be built up on the blades during one icing day.

The GLGH Risk Assessment stated that the results of the risk assessment indicated that the typical distance range (90% of the time) of ice throw and ice drop from the Kent Breeze turbines is approximately 100 m and 39 m, respectively. The exceptional distance range, which represented a probability of 10% of the time, was 100 to 240 m for ice throw and 39 to 59 m for ice drop.

Dr. Heraud stated that in his Risk Assessment for ice drop, he found that assuming 10 days of icing per year and assuming that a person was ever present during these 10 days at 50 m from the base of the tower, the risk is once in 126 years that a person would be struck with falling ice. He stated, however, that members of the public are not supposed to be this close to a wind turbine and that the protocol for icing events has procedures for maintenance personnel requiring that a temporary perimeter should be set up and they should wear appropriate safety equipment.

The GLGH Risk Assessment also looked at the risk of an ice fragment striking a stationary person located at the limit of their property and ever-present during the 10 icing days for each of the wind turbines proposed for Kent Breeze. For the K1 turbine, which is located 188 m from the neighbouring property, the individual risk was once in 17,938 years. The K2 turbine is 205 m from a road and based on the road use count by the Chatham-Kent County, it was assumed that 221 vehicles travelling at 50 km/h would pass the turbine during one day of icing event. The resulting risk of an ice fragment striking a vehicle was calculated to be once in 22,380 years. The K4 turbine is located 156 m from the railroad and based on data from Canadian Pacific Railway, it was assumed that 4 passenger trains travelling at 100 km/h and 14 freight trains travelling at 50 km/h would pass during 1 day of icing event. The resulting risk of an ice fragment striking a passenger train was calculated to be once per 43,586 years and once per 361 years for a freight train. The K4 turbine is also located 188 m from the neighbouring

property and it was found that the risk of ice striking a person was once in 5,567 years. The M3 wind turbine is 143 m from a road and the risk of ice striking a vehicle was calculated to be once per 4,732 years. The M3 turbine is also located 205 m from the neighbouring property and this risk was calculated to be once in 35,779 years. The M4 turbine is located 145 m from the railroad and the risk was found to be once per 18,882 years for a passenger train and once per 156 years for a freight train. M4 is also located 166 m from the neighbouring property and the risk was found to be once in 6,260 years.

Dr. Heraud explained that there are variances in the individual risk for the different wind turbines even when the receptors are located the same distance away because of differences in the wind directions, which is an important parameter in the risk calculation. He stated that the risk level for an individual turbine was determined by taking the probability of being struck by an ice fragment at a particular direction and particular distance from the wind turbine and then multiplying this by the number of fragments estimated per year.

The GLGH Risk Assessment described the control measures that are used in the industry to deal with ice related risks. It stated that ice detectors are typically mounted on the turbines or on nearby meteorological towers and are monitored by the wind farm control system, which triggers an automatic or remote manual shutdown in the event that icing conditions are detected. In addition, it is generally accepted that ice build-up on the blades of an operating turbine will lead to additional vibration, which is detected by vibration sensors installed on the turbines and will trigger shutdown in these conditions. There are also control systems which detect aerodynamic performance loss of the wind turbine caused by ice build-up on the blades and will trigger shutdown. The Risk Assessment stated that Suncor has indicated that it will implement an operating procedure for icing events that if applied, will curtail the operating of wind turbines in the event of icing.

Dr. Heraud explained that the mitigation measures described in the report will be in place at Kent Breeze to deal with potential ice throw. He stated that there will be an ice detector system installed on site on the meteorological towers and the turbines will be equipped with vibration sensors to detect imbalance in the blades. In addition, there will be a power curve monitoring system that detects when the blades are not operating as efficiently as they should be and will respond to shut down the turbines. He stated that Suncor has provided an operating protocol for icing events which is fully in line with what he would expect to see for a wind farm in Canada.

Dr. Heraud stated that assuming the operating protocol for icing events is installed and properly implemented and since the GE turbines are equipped with two ice related safety systems, he is of the opinion that there is no significant risk of ice being thrown or dropped on the public. However, he also explained that his Risk Assessment was conducted not taking into account these mitigation measures. His assessment assumes that the wind turbines will be operating during all the icing events and will throw the totality of the mass of ice that can be accumulated during that time. Dr. Heraud referred to a wind farm in the Gaspe Bay Peninsula where they have more than 15 days of icing per year and he stated that he was informed that they have

installed the same operating protocol and safety control system and they have had no problem of ice throw within the last four years.

In terms of Mr. Palmer's blade failure rates, Dr. Heraud stated that statistics calculated from such a small data set of two, or four, events are prone to statistical error and are inadequate. He stated that to be able to accurately assess failure rates you need at least 20 failures to happen on which you can accurately calculate the failure rate. He stated that, provided the conditions on site are within the IEC envelope for the design of the wind turbine and the wind turbines are correctly certified by a certification agency, it is his opinion that the Project will not present any significant risk for safety of the public due to blade failure or tower collapse.

Dr. Heraud acknowledged that in North America there is currently no mandatory reporting system in place for accidents such as blade failure, tower collapse or ice throw.

Mr. Grant Arnold's Evidence

Mr. Arnold was the Director of Wind Energy Joint Ventures for Suncor and he provided factual evidence regarding the process that Suncor undertook to apply for the REA and Suncor's experience with other wind projects.

Mr. Arnold stated that Suncor has been involved in developing and operating wind projects across Canada for 10 years. Suncor currently has projects operating in Alberta, Saskatchewan, and Ontario, the oldest of which has been in operation for almost 10 years. Mr. Arnold explained that the Kent Breeze Project was initiated by another developer and that Suncor acquired the project in May of 2010. He stated that prior to the acquisition, Suncor reviewed the experts' work and the consultation process undertaken by the previous developer and they were satisfied with everything that had been done. He stated that at the time of the acquisition, Suncor was not aware of either of the Appellants. He stated that Ms. Erickson's name was on the mailing list for public consultation because her property is located within 120 m of the project boundary. Mr. Arnold stated that his staff found no record of Ms. Erickson or Chatham-Kent Wind Action Inc. participating in any public consultation and no record of any emails, phone calls, or written correspondence from the Appellants. He noted that there was also no record of any participation by the predecessor group to Chatham-Kent Wind Action Inc., the Chatham-Kent Wind Action Group.

Mr. Arnold stated that the Kent Breeze Project has one participating land owner who is located within the 550 m setback and that all other participating land owners own vacant land. He stated that the participating receptor house is located 332 m from the nearest wind turbine. Mr. Arnold stated that there are no provisions in Suncor's lease agreements which would prevent anyone bound by them from disclosing any issues, health or otherwise. He stated that the leases entered into with participating land owners are standard leases that are placed on title, which give Suncor permission to be on the land and set out the compensation that will be provided to the landowner.

In terms of his role, Mr. Arnold stated that all incidents that occur on their wind farms are immediately reported to him from the field and he is responsible for reporting these incidents to executive management. He stated that in the last two years, in relation to their four operating wind farms there have been four incidents ranging from a banged knee to a chipped tooth. He stated that there have not been any other incidents that are more serious to human health. He also stated that he is made aware of any changes, upgrades, or fixes that are required due to failures. He stated that for all Suncor's wind farms, with cumulative operations of 24 years, there has never been an incident of ice throw. He stated that he is not aware of any evidence that engaging in the Kent Breeze Project in compliance with all applicable laws will result in harm to human health.

Mr. Arnold explained that his role in the development aspect of a wind project is accountability for the profits and loss of Suncor's wind energy business. He acknowledged that Suncor compensates its employees with base pay and the opportunity to earn additional long term incentives, performance bonuses and stock options based on performance, and he stated that he has received such additional rewards. He stated that the outcome of this Hearing and whether the Kent Breeze Project goes online would be a factor that would be considered to some degree, among other factors, in determining the bonus for an employee who was involved with the Project.

He stated that his staff consists of a business development individual, an engineer, and surface land people who have worked on the Project since the start, as well as staff elsewhere at Suncor who have worked on the Project but who do not regularly report to him every day. He confirmed that no medical doctors or epidemiologists were consulted as part of the project development until Suncor received the Notice of Appeal.

Mr. Arnold stated that Suncor is not aware of any evidence that any of its wind farm projects have caused serious harm to human health, nor of any evidence that engaging in Kent Breeze wind farms in accordance with the REA and all applicable laws will cause serious harm to human health. He stated that Suncor is not aware of any evidence indicating that low frequency noise emissions from Kent Breeze wind farm will cause serious harm to human health. He stated that Suncor is not aware of any evidence to support the contention that the effects of the Project on human health will be serious or that the effects on the health of participating landowners will be even more serious.

Mr. Arnold stated that he is aware of the regulatory process that Ontario has been going through to bring in the *Green Energy Act* and regulations. Mr. Gillespie presented Hansard evidence documenting the comments of Ms. Sandy MacLeod to the Standing Committee regarding the Ripley wind project to Mr. Arnold. Mr. Arnold indicated that Suncor is involved in a joint venture wind project in Ontario with Acciona Canada called the Ripley wind farm. He stated that he is aware of who Sandy McLeod is. He stated that he is aware that two families residing in the area of the Ripley wind farm stayed in motels. He stated that these families had concerns and that Suncor was trying to work with them to understand their concerns and they helped them move

to a motel out of an abundance of caution and because there was no other solution that the families would consider. He stated, however, that Suncor was presented with no credible evidence of harm to human health. He stated that there were people who brought issues regarding nuisance noise to Suncor's attention. He stated that one of the families had an issue because they believed that there was interference between the wind farm's electrical system for collecting power and their local electricity distribution with Hydro One Networks Inc. He stated that the complaints related to noise and possible electrical interference, but they were not presented with evidence that there was harm to human health.

In response to questioning regarding the symptoms that were experienced by residents in the area of the Ripley wind farm, Mr. Arnold corrected his statement to say that he personally, not Suncor, does not have any knowledge of harm to human health from Suncor's wind projects. Mr. Arnold indicated that he was aware that his supervisor, Mr. Provias, has had conversations with Carol Mitchell, the provincial Member of Parliament for Huron Bruce where the Ripley project is located. He also indicated that, although he was not aware that Suncor had met with the Grey Bruce Health Unit, he did see correspondence where landowners who felt that they were experiencing health issues were instructed to contact the Grey Bruce Health Unit. Mr. Arnold confirmed that, despite this evidence, it was still his position that there is no evidence of any harm or effect on humans from Suncor's projects. Mr. Arnold indicated that he was aware that third party testing by Jacques Whitford was occurring in Ripley and that he knew that there was discussion with Hydro One who was also trying to address concerns on both issues. He stated that Suncor has indicated in the past that it would support an independent health study and that this is still true today. Mr. Arnold indicated that the third party testing by Jacques Whitford in Ripley has been completed and that he was aware of the results of this study when giving his statements regarding health effects.

With respect to the risks of ice throw/fall and turbine failure, he stated that Suncor will have measures in place to minimize these effects, as set out in the Operations and Maintenance Manual in accordance with the REA. He stated that prior to the operation of the turbines, once the information is received from the turbine vendor, the specific operating and maintenance procedures for the protection and controls equipment regarding ice throw will be included in the Operations and Maintenance Manual. He stated that although Suncor was not required to analyze ice throw as part of the REA application, they undertook preliminary analysis of the issue and were satisfied that the risk of ice throw for the Project was minimal. He stated that Suncor recognizes that there is a remote risk that on rare occasion the Project may result in ice throw; however, they are not aware of any evidence that this possible effect will cause serious harm to human health at this Project.

Mr. Arnold confirmed that Suncor is a corporate member of CanWEA. He stated that he is aware that CanWEA is engaged in lobbying at the federal level and that in order to be able to do this you must be a registered lobbyist.

Mr. Robin Skinner's Evidence

Mr. Skinner was qualified to give opinion evidence as a mechanical engineer with specific expertise in wind turbine layout, including application of the MOE Noise Guidelines. Mr. Skinner is the Project Manager at Hatch who is overseeing the engineering, procurement and construction of the Kent Breeze Project.

Mr. Skinner stated that the Noise Assessment Report follows the template required by the MOE Noise Guidelines. He stated that the Project is actually two power purchase agreements each with a nameplate rating of 10 MW of power to be injected into the local distribution network. He stated that the projects are separated by Huff's Sideroad and were known as the Kent Breeze Wind Farm and MacLeod Windmill Project and subsequently, the Kent Breeze Wind Farms in the REA. He stated that the Project consists of 8 GE 2.5xl wind turbine generators, which have a hub height of 85 m and rotational speeds of 5 to 15 rpm. He stated that the original equipment manufacturer ("OEM") data regarding things like product acoustic specifications and frequency spectra were provided by GE. He stated that the maximum noise from the wind turbines, as stated in the OEM data, is 104.2 dBA and that 0.9 dBA was added to this to reflect uncertainty in the OEM data due to the instrumentation and measurement error. He stated that tonality, which the MOE Noise Guidelines require to be addressed, is not an issue with these wind turbines. He stated that the Project has one switching station which does not emit any noise.

Mr. Skinner stated that the wind shear adjustment is very important and it is calculated so that the maximum sound power level from the wind turbines is used in the noise modeling. He referred to the sound level limits per wind speed at 10 m height for wind turbines in Table 1 of the Noise Guidelines. He stated that the wind shear adjustment must be performed because the reference conditions that are used in the manufacturer's data do not reflect the reality of some of the summer night-time cases where there is high wind shear. Mr. Skinner stated that in performing the wind shear adjustment calculations, he used a logarithmic profile to determine the wind speed at hub height that corresponds to the manufacturer's data for noise level at reference wind speeds of 6, 7, 8 and 9 m/s at 10 m above the ground. He stated that the corresponding wind speeds at hub height were 8.2, 9.6, 10.9 and 12.3 m/s respectively. He said that this data showed that the maximum sound power level of 104.2 dBA was achieved at 8 m/s reference wind speed or 10.9 m/s wind speed at hub height. He stated that from this data the wind shear at the test site was determined using a power law relationship and found to be 0.161 wind shear co-efficient. He then calculated the average summer night-time wind shear from data collected at the Project site and found that the average wind speed was 3.5 m/s at 40 m height, 4.5 m/s at 60 m height and 5.2 m/s at 80 m height, which was extrapolated to 5.33 m/s at 85 m height (the hub height). He noted that 5.33 m/s is even lower than where GE starts registering the noise emission (102.1 dBA at 6 m/s reference wind speed). From this wind speed data, he determined the wind shear co-efficient to be 0.42. He stated that this wind shear adjustment was then used to model the sound power level for all conditions required by the MOE Noise Guidelines (6, 7, 8, 9, 10 m/s wind speed).

Mr. Skinner referred to Table 3.1 in the Hatch Report and stated that sound power levels were determined using the manufacturer's data for the 8 m/s reference wind speed case because this was when the maximum noise emission of 104.2 dBA would be produced. He said this data was used for the adjusted sound power levels at 6, 7, 8, 9 and 10 m/s wind speeds because it is the maximum noise emission.

He noted that the values in the table reflect the manufacturer's data with an addition of 0.9 dBA for the uncertainty, but do not appear to include the adjustment for wind shear coefficient. Mr. Skinner explained that for the 6 m/s adjusted wind speed, the calculated sound power levels were in fact greater than 0.9 dBA above the manufacturer's data (for the corresponding reference wind speed). However, he said, at the 8 m/s adjusted wind speed the value reflects only the manufacturer's data plus the uncertainty because the maximum sound power is produced at the 8 m/s reference wind speed and it does not get any louder than that level. He explained that as the wind speed at the hub height and the wind shear increases beyond 8 m/s at 10 m or 10.9 m/s at hub height, the sound power from the turbine actually decreases, so the worst case condition when the turbine is producing the most sound is at the vendor's 8 m/s mark. He stated that, because at maximum sound power the turbine produces noise level at the receptor under 40 dBA, no greater wind speed would produce a sound level at the receptor of greater than 40 dBA.

Mr. Skinner explained that, because there were noise receptors located within 1500 m of a turbine and the noise emission from the turbine was in excess of 102 dBA, a detailed noise impact assessment was required according to the MOE Noise Guidelines. He stated that the work was carried out using the CADNA-A software. Table 6.1 of the Hatch Report presents the calculated sound level for each receptor at wind speeds of 6 to 10 m/s. Mr. Skinner noted that the sound levels are the same for all wind speeds in this range because the maximum noise emission was used. He stated that for all points of reception the calculated sound level was under 40 dBA and, therefore, in compliance with the noise limits required by the MOE Noise Guidelines. He said that, for the participating receptor, the calculated sound level was 45.8 dBA. He stated that these results are depicted in the map of the noise contours which shows that all of the non-participating receptors fall outside the 40 dBA noise contour line, with the exception of receptor 211 which touches the line and which was calculated to have a sound level of 39.8 dBA. Mr. Skinner stated that a different wind shear coefficient would produce a different noise contour line. However, he found that at or around the 0.3 wind shear coefficient mark, wind shear does not affect the noise contour as it increases because the maximum noise has been reached under the model.

Mr. Skinner stated that the MOE Noise Guidelines did not require the addition of 3 dBA to the calculated noise impact and, from his understanding, this is not industry practice. Mr. Skinner stated that the wind shear adjustment was made and that as a result, the turbine's maximum noise was modeled and therefore, it is not necessary to add 5 dBA as suggested by Mr. James. He stated that GE carried out rigorous tests in accordance with IEC standards to determine that

the maximum noise emission was 104.2 dBA, and that Hatch added the 0.9 dBA uncertainty and used 105.1 dBA as the maximum noise emission for the purposes of the noise impact assessment. Mr. Skinner confirmed that, based on the data they possessed, the input from the OEM, and the modeling methods, the 40 dBA noise contour predicted by Hatch is the worst case scenario.

Mr. Skinner confirmed that Hatch is a member of CanWEA. He stated that Hatch has provided services to Suncor on other wind projects in Ontario, including Merlin Quinn, Cedar Point Camlachie, and Ripley Wind Farm. Mr. Skinner stated that he was never personally involved with the Ripley project.

Dr. Geoff Leventhall's Evidence

Dr. Leventhall was qualified to give opinion evidence as an acoustician with expertise in noise and vibration and subjective response to noise and special expertise in infrasound, low frequency noise and wind turbine noise.

Dr. Leventhall explained that infrasound is popularly considered to be sound at frequencies below 20 Hz which a person cannot hear. Low frequency noise is popularly considered to be audible noise that starts at 20 Hz and goes up to 200 Hz. However, he explained that there is no actual division between 20 Hz and 19 Hz, but rather the perception of sound is actually based on a continuum whereby the level required for perception increases as the frequency reduces. He noted that, in his opinion, the important area is from about 10 Hz to 200 Hz because diesel machinery typically produces sound in the range of 10 Hz. He stated that there is no real difference between infrasound and low frequency noise, except that to hear infrasound it has to be at a higher dB level and also that sound tends to lose its tonal nature as it gets into low frequencies. He stated that, for example, to hear a sound at 10Hz you would need a sound level of just under 100 dB, but at 1000 Hz, this sound level would be very loud. Dr. Leventhall stated that wind turbines produce sound in the infrasound and low frequency sound ranges but this sound is not audible because it is below the hearing threshold. He stated that infrasound is below the hearing threshold up to 20 Hz, and that lower frequency noise tends to become audible at frequencies above 40 Hz. However, he said, the level of the noise produced by the wind turbine drops rapidly as the frequency increases. Dr. Leventhall also explained that there are sources of infrasound existing naturally in the body, for example, the heart beats at 1 to 2 Hz, movement of muscles produces muscular vibrations, sounds from the stomach and vibrations from the diaphragm as it moves. He stated that the body's own sources of low frequency sound combined with the loss in sound level as sound travels from outside to inside the body means that there is no way that the levels of sound from wind turbines are going to get into the body and have any effect on it because the sound levels are too low.

Dr. Leventhall stated that there is a great deal of misunderstanding about infrasound and low frequency noise, initially arising from the papers on infrasound published by Gavreau in the 1960's (Gavreau, V., "Infrasound" (1968) 4 Science Journal 33 and Gavreau, V., Condat, R.,

and Saul, H., “Infra-sons: generateur, detectuers, proprietes physique, effets biologiques” (1966) 17 Acustica 1.) and propagated throughout the years to now, where it is being applied to wind turbine noise. He referred to the work by Dr. Nina Pierpont (Pierpont 2009) which asserts that there are direct adverse effects of infrasound from wind turbines on the body, particularly acting on the vestibular system in the ear and the related balance receptors in the body. Dr. Leventhall stated that on reviewing Dr. Pierpont’s work, he concluded that in his opinion, her hypotheses are weak and unfounded, she has a rather poor understanding of acoustics, her work has not been peer-reviewed, and she misuses other people’s findings in reaching her conclusions. In his oral testimony, he stated that her conclusions with respect to sound in the range of 1 to 8 Hz were not based on any evidence and were not plausible. He referred to the report of the New South Wales Parliament Legislative Council “Rural Wind Farms” General Purpose Standing Committee No. 5 (December, 2009) (“NSW Legislative Council Report 2009”) which reached similar conclusions expressing concern with the scientific merit of Dr. Pierpont’s work.

In comparison, Dr. Leventhall referred to a number of reports which conclude that there is no evidence of a direct patho-physiological effect from wind turbines, including the AWEA/CanWEA Report, the CMOH Report, the NHMRC Report, and Sims, N.E., “The Effects of Wind Turbine Sound on Health” Springfield Sangamon County Regional Planning Commission (2010) (“Sims 2010”). In addition, he mentioned in his oral testimony work that was carried out in the 1960’s in the United States in regards to the Apollo space program and the high levels of infrasound from the rockets that astronauts were exposed to during lift-off. He stated that criteria were developed for 24-hour exposure which stated that you could be exposed to 120 dB from low frequencies right up to 100 Hz without suffering any permanent effect. He acknowledged, however, that the period of exposure was short and the astronauts were young and fit and wore hearing protection.

Dr. Leventhall explained that, in general, there is very little annoyance or disturbance from noise when it is at a very low level, but as the noise level increases, more people become annoyed. He stated that annoyance response curves are determined using a combination of noise level measurements and surveys of subjective reactions, from which an average response is found. Dr. Leventhall referenced the response curves produced by Janssen et al. 2009 comparing wind turbine noise with industrial noise. He stated that this work is the latest information on annoyance from wind turbine noise and it is different from some of the other work that has been presented on this topic because it compares wind turbine noise to other industrial noise sources rather than road, rail, and aircraft noise. He stated that Janssen’s results show that up to 40 dB Lden there is little difference in the annoyance of wind turbines and other industrial sources. He stated that the divergence at higher levels may be attributed to the fact that industry is often located in more populated areas where background noise is higher and expectations of quiet are lower. He noted that these results showed that the 10% highly annoyed level, which is often used to develop noise criteria, is at about 48 dBA Lden externally for wind turbine noise heard indoors. In his oral testimony, he explained that it is generally believed that only about 25% of

annoyance is due to the level of the sound, and the major part of annoyance is due to a person's attitude and concerns about the noise.

Dr. Leventhall discussed the work done by Professor Alec Salt (Salt 2010) which found that outer hair cells respond to infrasound at lower levels than those which can be heard. Dr. Leventhall explained that at lower frequencies there is a response from the outer hair cells which is not transmitted to the inner ear and, therefore, there is not a hearing sensation. He stated that at frequencies in the infrasound range, the response from the outer hair cells, which is not transmitted through, may occur at 20 to 40 dB lower than the hearing threshold. He stated that Salt's paper acknowledges that the fact that the outer hair cells respond to infrasound at frequencies and levels generated by wind turbines does not necessarily mean that they will be perceived or disturb function in any way. However, he noted that in subsequent presentations, Salt has taken a strong "infrasound is harmful" stance and has claimed that infrasound from wind turbines will have adverse effects on a human receptor. Dr. Leventhall acknowledged that there is no reason to believe that Salt's work on the hearing mechanisms of guinea pigs is faulty, but rather, in his opinion, it does not provide evidence that it is the infrasound component of wind turbine noise that might bother people. He stated that Salt's conclusions ignore the fact that similar levels of infrasound are common in many urban and other environments as those found in the vicinity of wind turbines. Dr. Leventhall explained that it is likely an evolutionary development that the outer hair cells do not pass on information to the inner hair cells at lower frequencies, otherwise we would be hearing these naturally occurring low frequency sounds which would mask important information related to danger and communication.

Dr. Leventhall reviewed Mr. Palmer's material and noted his concerns with the veracity of Mr. Palmer's measurements relating to the Enbridge Wind Farm. Dr. Leventhall stated that in his measurements, Mr. Palmer did not use the normal class of equipment that is expected in acoustical investigations and that the instruments which he used would not be accepted as suitable for an Environmental Impact Assessment.

Dr. Leventhall also reviewed the witness statement of Mr. James and stated that he did not agree with his description of the work of the American Society of Heating Refrigerating and Air-conditioning Engineers ("ASHRAE"). He stated that he is a member of the ASHRAE 2.6 Noise Committee and that they have never been concerned about inaudible low frequency noise from the point of view of people but rather they were concerned from the point of view that it might cause vibrations in loose building components, such as ceiling tiles or partitions, and that vibration is what annoys people. Dr. Leventhall also reviewed some work by Mr. James regarding infrasound or low frequency sound from wind turbines penetrating through buildings. Dr. Leventhall stated that any sound can penetrate through buildings but most of what comes through is not audible, and further, that an audible noise is not necessarily an annoying noise unless the person hearing it is antagonistic to the source. In his witness statement, Dr. Leventhall also expressed his concerns with some of Mr. James' other work.

Dr. Leventhall stated that research has found that environmental low frequency noise problems are generally tonal problems occurring in continuous noise from machinery, which does not apply to noise from wind turbines.

Dr. Leventhall stated that response to a noise is strongly determined by attitude to the noise and its source. He stated that research has shown that the level of a noise is not the most crucial factor but that attitudes toward and fear of a source are important, particularly for sources which produce low levels of noise such as wind turbines. He noted that fear and anxiety about a noise are real beliefs to the person who holds them and they can cause stress, which in turn may lead to a range of stress related problems including poor sleep quality. However, he noted that it is the audible component of the noise which the person is reacting to, and he stated that there is no evidence for direct physiological effects from the inaudible component of wind turbine noise. He stated that his experience in helping people cope with their sensitivity to noise has been that attitudes can be changed and desensitization achieved.

Dr. Leventhall noted that the symptoms attributed to wind turbines are not very different from the symptoms associated with annoyance from audible noise. He attributed the negative attitudes and fear that people hold towards wind turbine noise to the claims of health effects from the objector groups. Dr. Leventhall described his work on a project carried out for the British government to help people cope with noise problems. Through this work, he said, he has found that lives can be turned around from being harassed and virtually destroyed by noise to coming back to normality. He stated that the people in this program had very negative attitudes toward the noise and this was causing them stress which can cause physical symptoms. He believes that this is what is happening with “wind turbine syndrome”. He stated that it is not the noise itself which is causing the health problems, but the fear.

Dr. Leventhall stated that he has deliberately kept his work on the Coping With Noise Project away from wind turbine noise problems because he knew how complex it would be. He stated that the work they are doing on this project offers solutions for anybody who is troubled by noise problems which they cannot cope with and which cannot be dealt with by technical control or other measures. He stated that it is applicable to any noise problem, including those of wind turbine noise, but practically he does not know what the responses would be for a wind turbine problem because the people in the program need to want to be helped before they can be helped.

Dr. Leventhall explained that the study, which was sponsored by the Department of Environment, Food and Rural Affairs of the English government, was a self-reporting, within group, repeated measures design with participant recruitment occurring through a publication on a website or through local environmental health noise experts. He stated that there were 46 participants that completed the “Low Frequency Noise Reaction Questionnaire”. He stated that participants self-reported their symptoms, they were not blinded to the purpose of the study, and they acted as their own controls because they were questioned before and after the treatment. He stated that looking at the change that is achieved is an accepted method of control. He

stated that the study found that the treatment works best for people for whom the noise source is unknown, and that it is more difficult to apply to people for whom the noise source is known and resented.

Dr. Leventhall stated that the commonly used assessment method of A-weighting cuts out the low frequencies and that in the rare circumstance where there is a real low frequency noise problem, using A-weighting will cut out the component which is causing the problem. He stated that, in his opinion, A-weighting is appropriate for wind turbine noise because the vast majority of low frequency noise problems are from tonal noise like machinery and compressors and this does not occur with the wind turbine noise.

In his oral testimony, Dr. Leventhall stated that VAD is a controversial concept which arises out of one particular research group that no longer exists and has not been replicated. He explained that VAD was noted in aircraft maintenance workers who were working around aircraft with their engines running, which would produce very high sound levels around 130 to 140 dB and a peak frequency in the higher end of the low frequency spectrum around 150 to 160 Hz.

Dr. Leventhall stated that infrasound and low frequency noise are never felt rather than heard. He stated that infrasound can be felt by the body only at very high levels which are audible levels. He explained that the ear is the most sensitive receptor to sounds in the body, and therefore, if you do not get something through the ear you do not get it any other way.

Dr. Leventhall stated that he has reviewed the Hatch Noise Assessment Report and the REA for the Kent Breeze Project. He stated that the Hatch Noise Report shows that the noise limits set out by the MOE will be achieved at all of the non-participating locations. He stated that these levels have been determined using internationally accepted prediction methods and widely used software packages, the input data is appropriate, and corrections have been made where required. He stated that there is no reason to believe that the required noise levels will be exceeded. He stated that in his opinion, the Kent Breeze Project will not cause direct patho-physiological serious harm to human health of the noise receptors set out in the Noise Assessment Report, including the participating receptor.

Dr. Leventhall stated that the problems with wind turbines described by Dr. Thorne and Dr. Shepherd occurred in very hilly areas where it was much more difficult to make an accurate prediction of the sound levels and also that predictions were based on old experience and methods have improved since then. He stated that prediction methods for flat, undulating land, which exists at Kent Breeze, are very accurate.

Dr. Leventhall stated that, based on Janssen's results (Janssen et. al. 2009), it can be expected that some people at the Kent Breeze Project will be annoyed. He stated that judging by Janssen's work, it can be expected that 10% of people may be annoyed at sound levels above 40 dBA, as this is the common level for annoyance for noise criteria. He added that annoyance is not necessarily a serious health effect; although it may produce deterioration in health, it is very unlikely that it will become a serious effect except in a very, very small number of people.

Dr. Leventhall was one of the authors of the AWEA/CanWEA Report. He stated that he agreed with the conclusions of the Report that there is no need to conduct any further study on the direct patho-physiological effects of wind turbine noise. He stated that the definition of direct patho-physiological effects comes from Dr. Pierpont's work (Pierpont 2009) and includes infrasound entering the body and vibrating the diaphragm or infrasound entering the ear and disturbing the vestibular system. He stated that annoyance is a completely different thing; it is a psychological effect which can induce physical problems due to high levels of stress. He stated that he accepted the symptoms that Dr. Pierpont described as wind turbine syndrome (sleep disturbance, headache, tinnitus, ear pressure, dizziness, vertigo, nausea, visual blurring, tachycardia, irritability, problems with concentration and memory, panic episodes) as the effects of extreme annoyance. He stated that they are largely somatoform disorders that occur when stress goes from your brain into your body and they occur in a very small number of people. Dr. Leventhall acknowledged that sleep disturbance is an adverse health effect. He stated that the conclusion in the AWEA/CanWEA Report that "sound from wind turbines does not pose a risk of hearing loss or any other adverse health effects in humans" was referring to direct effects on the body and he acknowledged that the words direct patho-physiological effects could be inserted in the conclusion to make it more accurate.

In the AWEA/CanWEA Report, the panel refers to a report of the National Research Council (NRC) (National Research Council, "Environmental Impacts of Wind-Energy Projects" (2007) Washington, DC ("NRC Report")) as support for their conclusion that low frequency sound is not a concern for modern wind turbines. However, in that NRC Report it is also stated that "more needs to be understood regarding the effects of low frequency noise on humans" and "studies on human sensitivities to very low frequencies are recommended." In response, Dr. Leventhall stated that the NRC did not seem to be aware of the work that has already been done on low frequencies. He explained that in making these conclusions regarding further studies, they are probably responding to Dr. Pierpont's findings, even though, in his opinion, they are incorrect.

Dr. Leventhall stated that he agreed with the comments from the NSW Legislative Council Report 2009 regarding how having a negative attitude towards wind turbines can lead to annoyance and adverse health effects. However, he stated that he did not agree with the Committee's recommendation that a minimum setback distance of 2 km between wind turbines and neighbouring residences be used. He stated that a 2 km setback is not necessary to achieve a good sound level if people have not become antagonistic to the wind farm.

Dr. Kenneth Mundt's Evidence

Dr. Mundt was qualified to give opinion evidence as an expert in epidemiology.

Dr. Mundt reviewed and evaluated the peer-reviewed, published epidemiological literature on noise emissions from industrial wind turbines and human health. He stated that he considered primary research studies as well as scientific reviews and applied standard and widely accepted methods for critically reviewing and synthesizing the epidemiological literature. Dr. Mundt

stated that the validity and strength of epidemiological study results depends on the research approach, study design and data quality and completeness. Factors determining the quality of studies include the ability to avoid biases, such as selective participation of certain subsets of individuals (selection bias), systemic errors in ascertaining disease outcomes or exposure estimation (information or misclassification bias) and the mixing of possible effects of other strong risk factors for the same disease (confounding bias).

Dr. Mundt stated that the two basic epidemiological approaches to evaluating associations between risk factors and disease are cohort studies and case-control studies. In cohort studies, disease rates are compared between exposed and unexposed people within a defined study population. He stated that the strength of this type of study is the ascertainment of individual level exposure prior to the occurrence of disease. He explained that this type of study gives the soundest evidence for purposes of causation. In case-control studies, exposure history among individuals with disease is compared with exposure history among those without disease within a defined study population. He stated that the strength of this study is its efficiency; however, it is difficult to avoid information bias. A third approach is the cross-sectional study in which exposure and disease outcome are simultaneously ascertained at a point in time and correlations between them evaluated. Dr. Mundt explained that the strength of this type of study is that it is simple, inexpensive and can be used to narrow the scope of the inquiry and generate hypotheses. However, he said, it is subject to many potential sources of bias. He stated that evidence based on cohort and case control studies is preferable to evidence from cross-sectional studies and other approaches for evaluating causation.

Dr. Mundt also identified the case-crossover study, which is a variation of the case-control study design where cases serve as their own matched controls. In this design, exposure status is compared in control periods of time where the outcome of interest did not occur and in the period when the outcome is occurring. He indicated that these studies are most appropriate for evaluating relationships between intermittent exposures and acute outcomes. Dr. Mundt explained that case reports and case series are reports in the medical literature of observed occurrences of a specific disease of interest. He stated that these are not epidemiological studies, though they are often published in medical journals and do serve a number of purposes. He stated that they may be useful for generating hypotheses and may reflect underlying causal associations, but determining causation is not among their strengths.

Dr. Mundt explained that in epidemiology, bias refers to systemic (or methodological) errors that lead to inaccurate and potentially invalid study results. He stated the following in relation to bias. Selection bias results from incomplete and/or selective participation of certain subsets of individuals in a study, resulting in distorted or invalid results. Random selection of an adequately large sample will usually generate a study sample that is representative of the study population and minimizes selection bias. Self-selection may result in a biased sample which tends to include certain groups of individuals or individuals who have a particular interest in the study topics. Comparing characteristics of study participants (eg. age, gender, socioeconomic status)

with non-participants can be used to determine the degree to which the results may be biased, but cannot undo such bias. Information bias results from systemic errors in questionnaire responses or measured data. This type of bias may be reduced or prevented by blinding participants to the purpose of the study or validating self-reported information against a more objective record. Confounding bias occurs due to the failure to account for other risk factors for the same disease outcome that are correlated with the exposure or risk factor of interest. These confounding risk factors can be controlled for statistically, if they are appropriately identified and measured. If uncontrolled for, these confounding factors can result in inaccurate or invalid study results. Random error or measurement error can also lead to inaccurate or invalid results. Tests of statistical significance can be used to evaluate the probability that an observed result is due to chance and are usually set to accept a 5% rate of incorrectly identifying a result as statistically significant. Confidence intervals describe a range of values for an estimated parameter that are consistent with the study data and indicate the precision in the estimated parameter.

Dr. Mundt stated that general causation concerns whether an exposure can cause an adverse event or disease. The determination of general causation is a judgement primarily based on a critical review and synthesis of all available epidemiological evidence. He stated that specific causation addresses whether specific exposures or risk factors caused disease in a specific individual.

Dr. Mundt stated that the terms “serious harm” and “serious health effects” are not scientific terms with a standard or practical definition, but are used in regulatory decision making. In his witness statement, he referenced definitions of “serious harm” and “serious health condition” from the New Zealand *Health and Safety in Employment Act* and the United States *Family and Medical Leave Act*, respectively. He explained that there is a continuum from exposure to serious disease. He stated that “serious harm” would fall at the far end of the spectrum and would usually involve some residual damage, incapacity, treatment, hospitalization, or loss of limb or life. He stated that he does not place annoyance in the category of a pathological response. In his witness statement he referred to the WHO Guidelines for Community Noise which state that annoyance is “a feeling of displeasure associated with any agent or condition, known or believed by an individual or group to adversely affect them.” He stated that the term annoyance is not found in the International Classification of Diseases.

He stated that he agrees with the WHO definition of health which states “health is a state of complete physical, mental and social well being and not merely the absence of disease or infirmity.” Dr. Mundt referred to Health Canada “Community Noise Annoyance” (2005) (“Health Canada 2005”) which stated that “the most common effect of community noise is annoyance.” Dr. Mundt admitted that he omitted from his witness statement the rest of the sentence in that document, which stated “which is considered an adverse health effect by the World Health Organization.” He stated that he omitted this because he was unable to verify it within the WHO document.

Dr. Mundt stated that some positive associations have been observed between noise exposure (in general) and cardiovascular health outcomes such as hypertension, myocardial infarction, heart rate variability and changes in blood pressure. However, he stated, the overall evidence is insufficient to conclude a causal association between noise exposure and these outcomes due to inconsistency in results, difficulty in characterizing noise exposure, the high prevalence of these outcomes in the general population and methodological limitations in studies reporting these observations. The WHO Guidelines for Community Noise suggest a weak association may exist between hypertension and ischemic heart disease and chronic exposure to noise greater than 65 to 70 dB, but find inconsistent evidence for other effects such as changes in stress hormones, immunological effects and gastrointestinal issues.

Dr. Mundt stated that he conducted a comprehensive review and synthesis of the peer-reviewed, published epidemiological literature specifically addressing potential health impacts of noise emissions from IWT's. He stated that articles were reviewed in detail if they reported relevant epidemiological results based on standard and appropriate research methods. Dr. Mundt stated that in the published literature relating to noise from wind turbines, he found six observational cross-sectional studies and a laboratory experiment pertaining to the perception of noise from wind turbines but not necessarily health effects (Persson Waye, K., and Ohrstrom, E., "Psycho-acoustic characters of relevance for annoyance of wind turbine noise" (2002) 250:1 J. Sound and Vibration 65 ("Persson Waye 2002")). Dr. Mundt discussed Pedersen and Persson Waye 2004, Pedersen and Persson Waye 2007, Pedersen 2008, Pedersen and Larsman 2008, Pedersen et. al. 2009, and Harry 2007. Dr. Mundt concluded that the peer-reviewed literature on exposure to wind turbine noise is limited and provides no convincing evidence that it causes disease or serious harm. He stated that associations between sound levels and annoyance have been reported and may reflect visual attitude towards wind turbine or perceived economic benefit or loss. He noted that diseases such as hypertension and self-reported conditions such as headaches were not found to differ with annoyance or sound pressure level in any of the studies and that some associations were observed between sleep disturbance and annoyance, but the cross-sectional designs of the studies do not allow for conclusions on whether this association is causal. He stated that there was no indication of a correlation between annoyance from wind turbine noise and adverse health effects in these studies.

Dr. Mundt also reviewed studies of health effects and low frequency noise by Persson Waye, K. and Rylander, R., "The prevalence of annoyance and effects after long-term exposure to low-frequency noise" (2001) 240 J. Sound and Vibration 483, Pawlaczyk-Luszczynska, M., Dudarewicz, A. et. al., "Evaluation of annoyance from low frequency noise under laboratory conditions" (2010) 12 Noise Health 166, Pawlaczyk-Luszczynska, M., Dudarewicz, A. et. al., "The impact of low-frequency noise on human mental performance" (2005) 18 Int. J. Occup. Med. Environ. Health 185, and Inaba, R. and Okada, A., "Study of the effects of infra-and low frequency sound on the sleep EEG Recordings" (1988) 7 J. Low Freq. Noise, Vibration Active Control 15, and reviews on low frequency noise and sleep by Persson Waye, K., "Effects of low

frequency noise on sleep" (2004) 6 Noise and Health 87, Berglund, B., Hassmen, P. et. al. "Sources and effects of low-frequency noise" (1996) 99 J. Acoust. Soc. Am. 2985, and Schust, M., "Effects of low frequency noise up to 100 Hz" (2004) 6 Noise Health 73. Dr. Mundt concluded that the available literature indicates that low frequency noise less than 200 Hz at less than 60 dBA has not been found to cause adverse health effects.

Dr. Mundt stated that the literature linking noise generated by wind turbines with risk of specific diseases or serious harm has not been published in peer reviewed journals, is incapable of demonstrating causation and is prone to substantial selection bias that renders the results invalid. He stated that these non-peer reviewed studies often misuse epidemiological terms, particularly with respect to the type of study that is being conducted.

Dr. Mundt concluded that the epidemiological evidence available through the peer-reviewed published literature to date is not sufficient to support the claim that wind turbine exposure causes serious harm to human health at the proposed setbacks and sound levels anticipated at Kent Breeze. He stated that, although the literature inconsistently associates turbine noise with annoyance, the medical literature does not equate annoyance with disease or serious harm to human health. He stated that, therefore, it is not reasonable or valid to conclude that exposure to the proposed wind turbines at Kent Breeze Wind Farms will cause disease or serious harm to human health.

Dr. Mundt stated that Dr. McMurtry does not cite peer-reviewed scientific evidence that supports an association between any of the phenomena associated with wind turbines (infrasound, low frequency noise, audible noise, visual impact, or shadow flicker) and significant harm, while ruling out other possible causes for any reported health effects, chance, or bias. He stated that Dr. McMurtry's evidence on the adverse health effects of noise fails to consider the sound levels at which adverse health effects from noise are likely to occur. Dr. Mundt stated that the case reports and personal interviews that Dr. McMurtry relies on to form his opinion on the risk of serious health effects are insufficient as scientific evidence to support a causal conclusion.

Dr. Mundt asserted that Dr. Shepherd does not provide scientific evidence to support his claims regarding stress related health effects caused by noise induced sleep deficits and annoyance. He stated that many of the references that Dr. Shepherd includes in his report are not peer-reviewed published scientific research. Further, the interpretation of the results cited by Dr. Shepherd is severely limited due to the methodological issues in the designs and methods used in conducting these studies. Dr. Mundt also stated that Dr. Shepherd mischaracterized results from the van den Berg et. al. 2008 and Pedersen and Persson Waye, 2007 studies, as neither of these studies found evidence for health effects from wind turbine noise exposure, only associations between annoyance and sleep disturbance. Dr. Mundt stated that Dr. Shepherd did not explain how he identified and assessed the literature for quality and comparability, and therefore, it cannot be determined whether his conclusions are based on a thorough review of the literature or only a few selected studies. Dr. Mundt noted that Dr. Shepherd included a figure comparing annoyance levels to different sound levels from various noise sources. He raised

concerns over this figure because the data is attributed to information from three studies, one of which is unpublished and it does not include the most current results from Pedersen et. al. 2009. Dr. Mundt questioned the data presented in Dr. Shepherd's evidence, as he included no description of methodology for collecting or analyzing his data. Dr. Mundt stated that Dr. Shepherd fails to define "degradation of amenity" in his report and provides no scientific evidence to support his opinion that degradation of amenity at the Kent Breeze Wind Farms will cause serious adverse health effects.

Dr. Mundt stated that from his review of Dr. Phillips' evidence, it appears that Dr. Phillips did not conduct a systematic or comprehensive critical review of the epidemiological literature. Dr. Mundt criticized Dr. Phillips' evidence for failing to include specific scientific publications to support his claims. Dr. Mundt asserted that Dr. Phillips' position that any available evidence may be adequate to make a causal conclusion contradicts current standard methodologies for critically reviewing and synthesizing epidemiological evidence for purposes of drawing valid causal conclusions. Dr. Mundt stated that "the determination of causation requires consideration and weighting of all valid and relevant epidemiological evidence – supportive of, as well as refuting the hypothesis". Dr. Mundt asserted that a proper evaluation of the epidemiological literature on the health effects of wind turbines demonstrates that the level of quality and validity in the available evidence is inadequate to permit a conclusion of causation. Dr. Mundt stated that Dr. Phillips' assertion that individuals moving away from turbines or taking reduced sales prices is evidence of serious harm to human health should not be relied on, as it is scientifically unsubstantiated and speculative. Dr. Mundt stated that his fundamental criticism of Dr. Phillips' statement is that it is not a scientific review or report; rather, it resembles a commentary or editorial in which standard methods used in epidemiology are challenged. He stated that this type of report does not contribute to a clearer understanding of the underlying scientific issues.

Dr. Mundt concluded that the reports submitted by these experts present a subset of surveys and reports that are not true epidemiological studies published in peer-reviewed medical or health journals. He stated that the experts' reports lack any systematic approach for identifying and reviewing the epidemiological literature and appear to rely on a select subset of reports, which consists largely of surveys of self reported complaints among residents living near wind turbines. In his own critical review and synthesis of the published epidemiological literature, he stated the conclusion that there is clear scientific evidence that wind turbines cause serious harm to human health cannot be drawn with any reasonable degree of scientific certainty.

Dr. Mundt said that he reviewed the Nissenbaum Study in the same manner that he would review a submission for publication and applied the framework for a good epidemiological study. Dr. Mundt discussed the Study title, whether there were measurements of exposure, including wind turbine noise, visibility, traffic and he discussed the issue of bias. He also reviewed the questionnaire and the type of standard and non-standard questions asked, although he indicated that he had never worked with the SF-36, ESS or PSQI. He also commented on the modeling used and the review of the Nissenbaum Study.

Dr. Christopher Ollson's Evidence

Dr. Ollson was qualified to give opinion evidence as an expert in environmental health science, practicing in the evaluation of potential risks and health effects of people and the ecosystem associated with environmental issues.

Dr. Ollson is the Practice Leader for the Environmental Health Science division of Stantec Consulting Ltd. He stated that he has conducted scientific literature reviews of the potential health effects associated with living in proximity to wind turbines for a number of companies engaged in wind farm development projects. In relation to the proposed Kent Breeze wind farm, Dr. Ollson said he used a weight-of-evidence approach and reviewed the peer-reviewed scientific literature and government (medical) agency reports on wind turbine health effects. In conducting his literature review, Dr. Ollson said he followed the approach in the Cochrane Handbook for conducting systematic reviews. He testified that this is the gold standard in the medical community for conducting systematic evaluations of literature in healthcare and pharmaceutical industries. He stated that the Cochrane Handbook's format and methodology has also been adopted in the environmental field and it uses a weight-of-evidence approach to make conclusions on the available information. He stated that his review of the scientific literature on wind turbines that is presented in his witness report was prepared in the same manner as the systematic review process. However, he stated, it does not contain all the detailed appendices of a full Cochrane Handbook style review. He stated that his review followed the principle that science is cumulative and by considering all available evidence, decisions can be made that reflect the best science available.

Dr. Ollson explained that the peer-review process ensures that the methods employed and the findings of the research receive a high level of scrutiny and that the published research is of a high standard of quality, accurate, can be reproduced and demonstrates academic and professional integrity.

Dr. Ollson explained that, from his literature search, he found 13 peer-reviewed articles that had been published in scientific journals between 2003 and 2010. He summarized these articles in his witness statement. He summarized van den Berg 2004 which assessed sound transmission from a 30 MW, 17 turbine wind farm at 400 m and 1500 m from the closest turbine. The study found that wind turbine sound was the dominant sound in the environment 25% of the time (72% of the time at night) in the close location and 38% of the time at night in the further location. At the close location the sound levels ranged from 25 dBA to 50 dBA depending on wind speed, and at the further location sound levels ranged from 20 to 37 dBA. Wind speed at hub height at night was found to be up to 2.6 times greater than predicted by the turbine operator causing higher sound levels at night of up to 15 dBA relative to the same wind speed in daytime. The study concluded that actual sound levels were considerably higher than predicted and wind turbines produce sound with an impulsive character that is more pronounced at night.

Dr. Ollson summarized Pedersen 2004 which was a cross-sectional study performed in Sweden in 2000 to evaluate the prevalence of annoyance due to wind turbine noise and assess any dose-response relationships. Participants living near wind turbines were given questionnaires in which the purpose was masked and questions were asked regarding annoyance, wind turbines, health and employment and working hours. The study found that the proportion of those annoyed by wind turbine noise outdoors increased with higher sound levels at sound levels exceeding 35 dBA, and that 20% in the 37.5 to 40 dBA sound category and 36% in the greater than 40 dBA sound category reported that they were very annoyed by wind turbine noise. The study found that 7% of respondents were annoyed by wind turbine noise indoors and 23% of respondents were disturbed in their sleep by noise. Attitude to visual impact, attitude to wind turbines in general, and sensitivity to noise were found to be related to the way people perceived noise from wind turbines. The study also found that the proportions of respondents annoyed by wind turbine noise was higher than for other community noise sources at the same sound pressure levels.

He also summarized Pedersen and Persson Waye 2007 which was a cross-sectional study conducted in Sweden to evaluate the prevalence of perception and annoyance due to wind turbine noise among people living near wind turbines. The study found that differences in terrain did not significantly influence the perception of noise but degree of urbanization did with the odds that a person would be annoyed by noise from wind turbines 1.8 times greater in rural than suburban environments. The study found that 6% of people in the 37.5 to 40 dBA category and 15% of those in the greater than 40 dBA category reported being annoyed by wind turbine noise and that 36% of the respondents who were annoyed by noise reported disturbed sleep. The study also found that visual exposure and negative attitudes towards wind turbines impacted annoyance.

Dr. Ollson also reviewed Pedersen 2008 which looked at whether low and moderate stressors such as wind turbine noise could have an impact on health. The study found that the proportion of respondents fairly or very annoyed was level through the 29 to 37 dBA range and increased at levels above 37 dBA with peaks at 38 dBA and 41 dBA. At 40 dBA, less than 10% of respondents were very annoyed and 15% were fairly annoyed. Noise level and visual impact were found to be significantly related to annoyance.

Dr. Ollson reviewed Pedersen, E., Hallberg, L.R.M., and Persson Waye, K., “Living in the vicinity of wind turbines – a grounded theory study” (2007) 4 Qualitative Research in Psychology 49 (“Pedersen et. al. 2007”). The main findings of this study indicated that the relationship between exposure and response is complex and possibly influenced by variables not yet identified.

Dr. Ollson reviewed Pedersen, E. and Larsman, P., “The impact of visual factors on noise annoyance among people living in the vicinity of wind turbines” (2008) 28:4 J. Environ. Psychol. 379 (“Pedersen and Larsman 2008”). The main findings of the study were that respondents in a landscape where turbines could be perceived as contrasting with their surroundings (flat areas)

had a greater probability of noise annoyance than those in hilly areas regardless of sound pressure level, if they had negative attitudes to wind turbines. The authors suggested that these results highlight the importance of visual attitude towards the noise source when exploring responses to environmental noise.

Dr. Ollson reviewed Pedersen et. al. 2009. The results suggested that wind turbine noise was more annoying than transportation or industrial noise at comparable levels. The results also showed that visibility of the turbines significantly increased the risk of annoyance and that annoyance was strongly correlated with a negative attitude towards the visual impact of wind turbines. In addition they found that people who benefited economically from wind turbines had a significantly decreased level of annoyance despite being exposed to the same sound levels as those who do not benefit. Dr. Ollson testified that Figure 3 in this study shows that at 38.5 dBA little to no % of exposed people would be very annoyed and about 8% of people would be annoyed by wind turbine noise, and at 42.5 dBA about 5% of people would be very annoyed and 10% of people would be annoyed. He testified that Pedersen and colleagues have never equated annoyance to serious harm to human health within these studies.

Dr. Ollson also reviewed Pedersen et. al. 2010 which found that the relationships between sound levels and annoyance with noise were separate for wind turbine and road traffic and not interacting. The results showed that road traffic may provide a significant masking effect of wind farm noise in the 35 to 40 dBA range but only when road traffic is 20 dBA louder than the noise from the turbines.

Dr. Ollson summarized Leventhall, G., “Infrasound from wind turbines: fact, fiction or deception” (2006) 34:2 Can. Acoust. 29 (“Leventhall 2006”) which discussed infrasound in relation to wind turbines. He explained that Leventhall concluded that the infrasound from wind turbines is produced at low sound levels in the inaudible range and is too insignificant to have an effect on humans. He also reviewed Salt 2010. He stated that their results show a physiological response of the human ear to low frequency noise and infrasound and they hypothesize that if infrasound is affecting cells and structures at levels that cannot be heard, this leads to the possibility that wind turbine noise could be influencing function or causing unfamiliar sensations.

Dr. Ollson reviewed Keith, S.E., Michaud, D.S. and Bly, S.H.P., “A proposal for evaluating the potential health effects of wind turbine noise for projects under the Canadian Environmental Assessment Act” (2008) 27:4 J. Low Freq. Noise Vib. Active Control. 253 (“Keith et. al. 2008”) which provided information for criteria for evaluating the potential health effects of wind turbine noise. The authors suggest that the predicted sound level from a wind turbine should not exceed 45 dBA at a sensitive receptor location situated in a quiet rural setting. Dr. Ollson noted that this report was published prior to the release of the WHO Night Noise Guidelines which recommend that exposure not exceed 40 dBA. The authors calculated that at a sound level of 45 dBA, there would be a 6.5% increase in the percentage of highly annoyed people.

Dr. Ollson reviewed Harding, G., Harding, P. and Wilkins, A., “Wind turbines, flicker, and photosensitive epilepsy: Characterizing the flashing that may precipitate seizures and optimizing

guidelines to prevent them" (2008) 49 Epilepsia 1095, which applied known parameters of the seizure producing effect of flicker to wind turbines. The study found that flicker from turbines at frequencies greater than 3 Hz poses a potential risk of inducing photosensitive seizures at an incidence of 1.7 per 100000 of the photosensitive population. It also found that the seizure risk does not decrease significantly until beyond 4 km. To keep the flash frequency at or below 3 Hz, the maximum speed of rotation for turbines with three blades is 60 rpm, which is the normal practice for large wind farms. Dr. Ollson also reviewed Smedley, A.R.D., Webb, A.R. and Wilkins, A.J., "Potential of wind turbines to elicit seizures under various meteorological conditions" (2010) 51 Epilepsia 1146, which concluded that there is a risk of photosensitive seizure when flicker is more than three times per second, but that wind turbines rotate at a rate below this risk.

Dr. Ollson referred to the works of Dr. Nissenbaum in Maine (the Nissenbaum Study), Dr. McMurty and Carmen Krogh in Ontario, Lorrie Gillis, Carmen Krogh and Dr. Kouwen in Ontario (Windvoice Survey) and Dr. Pierpont in New York (Pierpont 2009), whose findings of self-reported health effects associated with proximity to wind turbines have been presented in various forums. He stated that these studies have not been subjected to scientific peer-review, do not incorporate the fundamental principles of epidemiology, do not contain noise measurements, do not have adequate statistical representation of potential health effects, provide limited rationale for the selection of study participants, and suffer from a small number of participants and a lack of objectivity.

Dr. Ollson also reviewed government medical agency reports on wind turbines and health effects, including: the CMOH Report, the Health Unit Report, and the NHMRC Report. Dr. Ollson testified that the NHMRC review concluded that there are no direct pathological effects from wind turbines. He testified that none of the government documents or agency reports that he reviewed equate annoyance to serious harm to health.

Dr. Ollson concluded from his review that it is clear that some people living near wind turbines experience annoyance and experience disturbed sleep due to wind turbines. He stated that the 40 dBA maximum sound pressure level required by O.Reg. 359/09 is lower than the proposed value by Health Canada (Health Canada 2005) and based on the studies of Pedersen and colleagues, less than 10% of people would be expected to be very annoyed at this sound level and roughly 15% would be expected to be fairly annoyed. He also concluded that based on his review, the link between wind turbine generated infrasound and health effects is not substantiated. He stated that annoyance appears to be more strongly related to visual cues and attitude than to noise itself and that the self-reported health effects of people living near wind turbines are, therefore, more likely attributed to physical manifestation from an annoyed state than from infrasound. He stated that, in his opinion, the setback and sound level requirements of O.Reg. 359/09 are reasonable and sufficient to protect against adverse health effects. He stated that, provided the Kent Breeze Project operates in accordance with the REA, it will not cause serious harm to human health.

Dr. Ollson acknowledged that the WHO Night Noise Guidelines were not developed based on wind turbine noise and that none of the literature on wind turbine noise that he has reviewed was cited in the WHO document. He also acknowledged that the literature shows that wind turbine noise can be more annoying than the types of noise sources on which the WHO Night Noise Guidelines are based. Dr. Ollson also agreed that annoyance is a health effect and that this is a statement that he has made on previous occasions, in particular a conference call with the Saskatchewan Chief Medical Officer of Health. He also agreed that in regards to a discussion of the Leventhall paper (Leventhall 2006) he stated in a report he prepared for a previous wind project “regardless of whether perceived impacts by affected individuals are physiological or psychological in nature, they are a serious matter and are considered as adverse health effects.” He noted however that this statement does not go on to state that it represents serious and irreversible harm to health.

Dr. Ollson also reviewed and provided comments on the witness statements and testimony of Dr. Nissenbaum, Dr. Aramini, Dr. Phillips, Dr. McMurtry, Dr. Thorne, and Dr. Shepherd. He concluded that he did not review any documents or hear any statements that would cause him to alter his opinion that if the Kent Breeze Wind Farms operates in accordance with the REA it will not cause serious harm to human health.

After reviewing Dr. McMurtry’s witness statement, Dr. Ollson stated that Dr. McMurtry has not provided any evidence of a causal link between the health effects described and noise levels from wind turbines, nor has he provided any information on the noise levels or distances to wind turbines of the people who are experiencing health effects that he has interviewed. Dr. Ollson asserted that Dr. McMurtry has not provided clear scientific evidence to support his conclusion that the Kent Breeze Wind Farms will more likely than not cause serious harm to human health. Dr. Ollson stated that he supports the WHO’s definition of health, which was raised by Dr. McMurtry. However, he stated that it is his belief that the WHO Night Noise Guidelines took into account this definition. He noted that these Guidelines establish that night-time outside sound levels of 40 dBA are equivalent to the lowest observed adverse effect level for night-time noise. The Guidelines state that within the 30 to 40 dBA range, there could be effects on sleep. However, he said, they would be expected to be modest. Dr. Ollson noted that the WHO Guidelines do not specifically state that they excluded considerations of wind turbine noise in setting the standards. He stated that it is his belief that these Guidelines are equally applicable to wind turbine noise. Dr. Ollson stated that Pedersen’s most recent findings (Pedersen et. al. 2009) indicate that only a very small percentage of people that experience wind turbine noise below 40 dBA would be very annoyed and that annoyance is strongly correlated with a negative attitude toward the visual impact of the turbines. Dr. Ollson further noted that Pedersen does not attempt to correlate annoyance with a degree or level of health effects and that reviewers should be cautious in applying her findings of reported annoyance to actual health effects.

Dr. Ollson stated that Dr. Shepherd’s opinion that 30 dB would be required to protect residents from adverse health effects is not supported by the WHO Night Noise Guidelines. He stated that

the WHO has already accounted for sensitive and vulnerable groups in their recommended night-time noise levels of 30 to 40 dBA. Further, he reiterates that annoyance is not simply a function of the noise level, but is heightened by negative attitudes and visual cues. Dr. Ollson concludes that Dr. Shepherd's report does not provide any additional scientific information that suggests that the Kent Breeze Project as proposed will result in serious health effects.

Dr. Ollson also reviewed Dr. Phillips' witness statement. He stated that Dr. Phillips acknowledges that there is no empirical evidence to support the claim that people are suffering serious health effects directly caused by living near wind turbines. Dr. Ollson stated that Dr. Phillips relies on non peer-reviewed, unpublished reports which have considerable shortcomings and do not credibly establish that wind turbines cause serious health effects. Dr. Ollson asserted that Dr. Phillips overstated the number of case reports to be in the thousands, which he believes is not accurate based on his searches. Dr. Ollson asserted that Dr. Phillips' binomial distribution calculation of whether it is more likely than not that someone would suffer health problems at Kent Breeze is based on unsupported assumptions, chance and speculation and is not made on any scientific foundation of the actual probability of residents experiencing health effects based on published research. He stated that, therefore, this calculation should not be relied on to inform decisions of whether living in proximity to a wind turbine will result in serious adverse health effects. Overall, Dr. Ollson concluded that Dr. Phillips has not substantiated his claim that there is ample scientific evidence that wind turbines sited near residences cause serious health problems for some people living in those residences.

Dr. Ollson said he reviewed the Nissenbaum Study with respect to his concerns of bias, the statistical approach used in the Study, the type of questions asked and the interpretation of the findings. He also discussed the appropriateness of having Dr. Wilson review the Study.

Dr. William Holley's Evidence

Dr. Holley was qualified to give opinion evidence as an expert in wind turbine technology and system design. Dr. Holley is the Chief Consulting Engineer, Wind Systems for GE.

Dr. Holley testified that GE follows generally accepted wind turbine design practices according to national standards and certification requirements. He stated that GE follows rigorous quality control standards in the manufacturing of their wind turbines and that the level of structural reliability of their turbines is consistent with other buildings and steel structures.

Dr. Holley explained that GE has recommended setbacks for different identified risks. He stated that for ice throw/fall risks, GE generally recommends a commonly accepted setback value of 1.5 x (hub height + rotor diameter) when icing conditions are likely at the wind turbine site. He stated that this equation is based on the paper by Siefert, H. et. al., "Risk Analysis of Ice Throw from Wind Turbines" Presented at BOREAS 6, Pyha, Finland (April 9-11, 2003) He testified that beyond this distance, GE's investigations indicated that the risk of ice throw is minimal and that it is generally safe for occupancy at any time outside this distance. He stated that it is also possible, depending on the conditions of the site and specific frequencies of exposure, that

shorter setback distance would also be safe. He stated that this equation is the general recommendation, but it is not absolute. He stated that for shorter setback distances, GE recommends that a more intensive safety analysis be conducted. He stated that GE recognizes that setback considerations depend on many factors such as population density, road usage frequency, land availability and proximity to other publicly accessed areas and buildings.

Dr. Holley stated that the setback distance recommended by GE for risks such as tower collapse or blade throw is 1.1 x blade tip height. He stated that this distance corresponds to an improbable tip-over and fall of the whole structure. He stated that blade throw risk is estimated to be much smaller than ice throw risk, but the potential distances can be analyzed similarly. He stated that for the risk of falling objects due to maintenance activities, GE does not recommend that any occupied structure be closer to the tower base than 1.1 x blade length.

Dr. Holley discussed Mr. Palmer's materials and his references to two incidents of blade failure of GE turbines in Ontario. He stated that GE rigorously investigates all known incidents of structural failure to determine the root cause and they use this information to take subsequent action where necessary and to improve their products. He stated that GE has investigated the two incidents referred to by Mr. Palmer. He stated that the first incident at the Burwell Wind Farm occurred when the turbine was struck by lightning and the blade buckled due to localized burn damage, which de-bonded the structural web that holds the blade together. He stated that the turbine was shut down on a vibration alarm trip and the damaged blade was subsequently replaced. According to reports, the blade remained attached and there was minimal fallen debris from this incident. He stated that subsequently, GE has improved the lightning protection system for all of their blades, including those on their 2.5xl turbines. He stated that these improvements improve the ability of the turbine to conduct lightning currents safely to the ground. He stated that the best industry knowledge regarding lightning protection is incorporated into GE's most recent designs. He noted that although these improvements help to mitigate damage, rare structural damage to blades from lightning cannot be completely prevented.

Dr. Holley described the second incident referred to by Mr. Palmer at the Prince Wind Farm. He testified that in this incident there was ice build-up on the blade that induced stall behaviour which interacted with the turbine structure in a way to create unstable oscillation. He stated that this type of failure has also been experienced at a wind farm in the United States. He stated that subsequently, the control and safety protection system on GE turbines has been changed to provide shutdown protection when such stall or vibratory behaviour is encountered. He stated that for the 2.5xl turbines there are two sensor paths that will shut down the turbine to protect against this type of failure.

Dr. Holley stated that GE has 867 turbines installed in Canada. He stated that there have been no known tower collapse failures for GE turbines in Canada and there have been three blade failures since 2006 involving more than a minimal debris field, including the Prince Wind Farm event. One of the other two blade failures occurred on November 22, 2008 during strong gusty

winds. He stated that there were several earlier vibration and wind deviation shutdown trips from turbines at the site. However, he stated, there were neither indications of icing nor any clear manufacturing defects and it was not possible to determine a conclusive root cause of the failure. He stated that the blade was replaced and there have been no subsequent failures. The second blade failure occurred on December 8, 2010. He stated that investigations into the root cause are still ongoing but initial indications are that the blade struck the tower while the turbine was operating in strong gusty winds. He stated that improved turbine control software is under development to mitigate tower strike possibilities during the rare conditions of strong wind gusts accompanied by large simulated wind direction changes. He stated that the 2.5xl turbines will benefit from this software once it is complete. Dr. Holley testified that GE is not aware of any injuries that have resulted from ice throw or blade failure with respect to their turbines in Canada.

Dr. Holley testified that for each wind turbine project that GE is involved with, a mechanical load analysis is performed to determine whether the specific turbines are suitable for the site. He stated that for the mechanical load analysis, GE used data provided by Suncor and concluded that the GE 2.5xl turbines are appropriate for the Kent Breeze site. The mechanical loads analysis takes into account detailed turbine location information, including local wind shear and turbulence, and is based on dynamic simulations of turbine behaviour under these conditions. He stated that data provided by Suncor indicated that the maximum annual average wind shear at the site is 0.34. He stated that the analysis also includes calculated load cases where the maximum wind shear is equivalent to a wind shear exponent of 1.1. He stated that the maximum wind shear of 0.42 quoted by Mr. Palmer is well within the range that GE analyzed for the mechanical loads analysis.

Dr. Holley stated that the GE Wind Turbine Controller is currently designed to protect the wind turbine from failures relating to icing conditions, and it can also be configured to accept input from an ice detection system when requested by the customer. He stated that because of questions of reliability for ice sensors in general, GE does not rely on such sensors for protection of the turbine itself and instead uses a low-power-vibration detection method. He stated that this protection prevents turbine operation under more severe icing conditions, but that it is possible that a turbine could start up and operate with lesser amounts of ice on the blade.

Dr. Robert McCunney's Evidence

Dr. McCunney was qualified to give opinion evidence as a medical doctor, board certified in occupational and environmental medicine, with particular expertise in the health implications of noise exposure.

Dr. McCunney was one of the co-authors of the AWEA/CanWEA Report.

In his witness statement, Dr. McCunney explained that the lower the frequency of a sound, the higher the sound pressure needed for the sound to be heard by the average person. He stated

that studies conducted to assess low frequency noise from wind turbines have found that wind turbine noise is not audible below 50 Hz. He stated that acousticians have reached consensus that infrasound from wind turbines is not a health problem. Dr. McCunney referenced experiments related to the Apollo space program which found that 24-hour exposures to 120 to 130 dB noise are tolerable below 20 Hz. He noted that wind turbines typically produce infrasound at levels of 50 to 70 dB, which is below the hearing threshold at those frequencies. He stated that low level sounds from outside the body do not cause a high enough excitation within the body to exceed internal body sounds.

Dr. McCunney discussed the conclusions of the CanWEA/AWEA Report. He stated that the panel concluded that there is no reason to believe that the sounds from wind turbines could plausibly have direct adverse health consequences. The Report concluded that the known scientific literature provides no evidence that audible or sub-audible wind turbine sounds have any direct adverse physiological effects.

Since co-authoring the Report, Dr. McCunney said that he has continued to monitor the scientific literature and he noted that two additional papers have been published since the Report. He stated that the first is Salt 2010, which looked at the effect of infrasound on the guinea pig ear. He stated that the authors found that the response to infrasound of the outer hair cells of guinea pigs could be considered normal but it could be associated with unfamiliar sensations or subtle changes in physiology, and this raises that possibility that exposure to infrasound from wind turbine noise could influence the physiology of the ear. He noted that this study does not make any firm conclusions about health implications from exposure to infrasound. He testified that outer hair cells have not been demonstrated to send signals to the brain and are of unknown functional significance, meaning that a response of the outer hair cells does not necessarily mean that the response is detrimental or harmful to human health. He noted that the results of the study are hypotheses only and are based on studies on non-human ears. Dr. McCunney concluded that this study is not persuasive of a risk of adverse health effects to humans from infrasound. Dr. McCunney agreed that Dr. Salt's work was funded by the National Institute on Deafness and Communication Disorders, which was asked but declined to participate in the AWEA/CanWEA Report.

The second study that has been published since the AWEA/CanWEA Report is a field study of noise measurements in the vicinity of wind turbines in Texas which was presented at a scientific meeting in April 2010 (O'Neal, R.D. et. al., "Low frequency sound and infrasound from wind turbines" Noise-Con., Baltimore, MD, (April 19-21, 2010)). He stated that in this study measurements were collected from 15 wind turbines at distances of 305 m and 457 m and the results indicated that infrasound is not audible to even the most sensitive people 305 m from the wind turbines, though low frequency sound above 40 Hz may be audible depending on background sound levels. It was found that the 31.5 Hz and 63 Hz sound levels were below 65 dB and the combined sound level in the 16, 31.5, 63 Hz bands are less than 70 dB. The results also indicated that at maximum noise and more than 305 m from the nearest residence, sound

from wind turbines does not pose a low frequency or infrasound problem, it produces no audible infrasound to the most sensitive listeners, and it met all required standards. He stated that these results are consistent with others in the field.

Dr. McCunney also indicated that Dr. Pierpont's book (Pierpont 2009) was published since the date of the Report, though the prepublication copy of the book was available to the expert panel. Dr. McCunney stated that Dr. Pierpont's case series has serious methodological flaws due to lack of noise measurements, lack of a control group and selection bias. He stated that case series are not used by medical societies or regulatory bodies to draw causal connections between any exposure and any health effect. He stated that this case series is of no credible scientific value in drawing causal connections between noise from wind turbines and the symptoms reported.

Dr. McCunney testified that a major concern with retrospective exposure assessments is recall bias. He stated that recall bias must be addressed in a study of this type, whether it is cross-sectional or case control. He stated that studies that use distance instead of noise measurements as a proxy for exposure may have confounding factors, such as visual impact, which could affect the results.

Dr. McCunney testified about the Pedersen studies that were reviewed in the AWEA/CanWEA Report (Pedersen et. al. 2009, Pedersen 2008, Pedersen and Persson Waye 2007, Pedersen et. al. 2007, Pedersen 2004). He stated that Pedersen and colleagues conducted at least three cross-sectional studies which evaluated a variety of symptoms via questionnaire and calculated noise measurements of people living in the vicinity of wind turbines in the Netherlands and Sweden. He noted that in the Pedersen et. al. 2009, only a few respondents who were exposed to noise levels in the 35 to 40 dB range reported annoyance. He stated that the authors found that visual impact of wind turbines had the strongest relationship with annoyance. In Pedersen and Persson Waye 2007, he stated that only 31 people (out of 700) reported that they were very annoyed and about 6% of respondents in the 37.5 to 40 dB range reported that they were annoyed. He stated that of those who reported annoyance, 36% also reported sleep disturbance. He noted that the authors concluded that there were no adverse health effects other than annoyance that were directly related to wind turbine noise.

Dr. McCunney indicated that he was not aware of a case-series study by Dr. Robin Phipps (Phipps 2007) that was published in Australia in 2007 (though not in a peer-reviewed journal), which documented an additional 92 cases of people who live near wind turbines experiencing health effects. He also acknowledged that the unpublished case series study of Harry 2007 and the Windvoice Survey were not referred to in the AWEA/CanWEA Report. Dr. McCunney stated that the panel focused on published, peer-reviewed literature in medical and scientific databases because it is of higher quality and because you cannot guarantee in any type of search that you can get all the unpublished material out there. He stated that the panel reviewed some non-peer-reviewed literature where appropriate, such as Dr. Pierpont's study (Pierpont 2009). He stated that case series and case reports are important and do have value, but that it

is important to go through the peer-review process because it adds quality to the literature that is introduced. He stated that in light of the additional reports referred to by the Appellants' Counsel, the next step is not controlled studies, but to submit these unpublished case series to a refereed journal to be published. He stated that these case studies have been unpublished for three to five years and one of the reasons for that may be due to the quality of the work.

Dr. McCunney stated that he was not aware that the NHS, which is the world's largest publicly funded health service, based in the United Kingdom, has reviewed the CanWEA/AWEA Report. He stated that he has heard calls for more research on wind turbine noise and health effects. He disagreed with the NHS conclusion that the Report had no clear description of the methods used to search for available research and indicated that the Report states that the panel conducted searches of PubMed. He stated that he has heard the Report criticized because the panel did not include an epidemiologist. In response, he stated that he has a fair amount of experience in epidemiology and is comfortable reviewing epidemiological articles, though he is not an epidemiologist. He agreed that further exploration of some of the psychological aspects of symptoms in the context of wind turbines would be a worthy endeavour. In light of the Report's conclusion that case reports of adverse health effects are insufficient to advocate further funding of studies, Dr. McCunney stated that the panel was of the view that there was enough information in the scientific literature about environmental noise exposure from a variety of sources to formulate some conclusions. He stated that from an academic perspective, more research could be done, but they were considering priorities and whether that research is necessary for formulating good public policy decisions.

Dr. McCunney testified that, based on his review of the scientific literature, the Hatch Noise Assessment Report, and the information about receptors and noise levels, in his opinion, the noise levels that have been estimated for the Kent Breeze Project should not present serious harm to people living in the vicinity. He stated that the WHO has concluded that exposure to noise levels less than 40 dB should not present a risk of serious harm to people. He stated in his witness statement that annoyance associated with wind turbines is a subjective phenomenon related primarily to attitudes to the visual impact of wind turbines and economic benefit associated with wind farms. In his oral testimony he corrected the conclusion in his witness statement to say that annoyance per se is not an adverse health effect, but that each situation needs to be evaluated on its own merits and in some cases, protracted annoyance can lead to stress, which may lead to sleep disturbance, which if chronic and untreated, may lead to harmful adverse effects.

Legal Issues Relating to the Interpretation of the Statute:

Background to the Legal Issues: The Grounds of Appeal

The statutory requirements to be met by the Appellants are set out in sections 142.1 and 145.2.1 of the *EPA.* The Appellants are relying on sections 142.1(3)(a) and 145.2.1(2)(a) in their four grounds of appeal. They allege that engaging in the Kent Breeze Project in

accordance with the REA will cause serious harm to human health and that the REA should, therefore, be revoked. The Appellants have not raised any issues regarding harm to plant life, animal life or the natural environment pursuant to sections 142.1(3)(b) and 145.2.1(2)(b).

Submissions on Statutory Interpretation Principles

The Appellants submit that the Tribunal will be engaging in an exercise of statutory interpretation, to which the follow principles are relevant. As articulated by the Supreme Court of Canada in *Rizzo & Rizzo Shoes Ltd. (Re),* [1998] 1 S.C.R. 27 ("*Rizzo*") at para. 21, there is only one approach to statutory interpretation, "namely, the words of an Act are to be read in their entire context and in their grammatical and ordinary sense harmoniously with the scheme of the Act, the object of the Act, and the intention of Parliament." The Director also cites this passage and notes that in *Crest Centre (Meadowcrest) Inc. v. Ontario (Ministry of the Environment),* [2007] O.E.R.T.D. No. 35, the Tribunal affirmed that it will interpret statutory provisions in accordance with the principles enunciated by the Supreme Court in *Rizzo*.

The Appellants also refer to section 64(1) of the *Legislation Act*, *2006*, S.O. 2006, c. 21, Sched. F, which provides that an Act shall be interpreted as being remedial and shall be given such fair, large and liberal interpretation as best ensures the attainment of its objects. The Director agrees that the *EPA* must be interpreted in this manner.

The Appellants also rely on *Ontario v. Canadian Pacific Ltd.,* [1995] 2 S.C.R. 1031, in which the Supreme Court of Canada held that the first task in construing a statutory provision is to consider the meaning of its words in the context of the statute as a whole, and, if the meaning of the words when they are considered in this context is clear, there is no need for further interpretation.

The Director states that the words of the section 142.1 test "must be read and interpreted in their grammatical and ordinary sense, in their context as environmental legislation, in accordance with the scheme and purpose of the *EPA*, the [*Green Energy Act, 2009,* S.O. 2009, c. 12, sch. A ("*GEA*")], and other environmental legislation and regulation."

Suncor does not dispute the Appellants' submissions on the relevant principles of statutory interpretation.

The Parties cite several sources of legislative purpose as part of their submissions on statutory interpretation. The Appellants point out that section 47.2(1) of the *EPA* states "(t)he purpose of this Part [Part V.O.1 "Renewable Energy"] is to provide for the protection and conservation of the environment." They state that, although the *EPA* contains no definition of "environment", section 47.1 provides that "(i)n this Part, 'environment' has the same meaning as in the *Environmental Assessment Act*, [R.S.O. 1990, c. E.18]" ("*EAA*"), which states:

> "environment" means,
>
> (a) air, land or water,
>
> (b) plant and animal life, including human life,

(c) the social, economic and cultural conditions that influence the life of humans or a community,

(d) any building, structure, machine or other device or thing made by humans,

(e) any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities, or

(f) any part or combination of the foregoing and the interrelationships between any two or more of them,

in or of Ontario.

The Appellants submit that the provisions of the *EPA* relevant to these appeals should be read in the context of the stated purpose, which includes the broad definition of environment found within the *EAA*. The Appellants suggest that "the Legislature particularly intended to ensure that human life and human activities are protected and conserved." As a result, they say, "these purposes should inform the interpretation of matters relating to REAs."

The Director disagrees with the Appellants' submissions on the Legislature's intentions and instead argues that "by incorporating this definition in the REA amendments to the *EPA*, the Legislature did not especially and particularly intend to protect "human life" or health in the context of the "natural environment". The Director notes that the *EAA* definition of environment also captures economic and cultural conditions. The Director suggests that "the protection of all of these elements of the environment, and their inter-relationship, must be weighed and balanced, and that no single element should be afforded disproportionate attention or protection."

The Director submits that the statutory test must also be interpreted in accordance with the purpose of the *GEA*. The Director states that the purposes of the *GEA* are set out in the preamble of the Act which states: "(t)he Government of Ontario is committed to fostering the growth of renewable energy projects, which use cleaner sources of energy, and to removing barriers to and promoting opportunities for renewable energy projects and to promoting a green economy."

Suncor agrees that the purpose set out in section 47.2(1) of the *EPA* referenced by the Appellants is relevant to REA appeals. Suncor also states that the overall legal context requires consideration of the *Green Energy and Green Economy Act, 2009,* S.O. 2009, c. 12 - Bill 150 ("*GEGEA*"), which included among other things, the *GEA* and the new REA provisions of the *EPA*. Suncor submits that, when the statutory scheme is read as a whole, it is clear that the government considers wind power as clean energy to be promoted. Suncor states that this is contrary to the Appellants' position that wind turbines cause serious harm to human health.

In addition, Suncor submits that consideration of O.Reg. 359/09 made under the *EPA* is required. Suncor states that "O.Reg.359/09 is important to understanding the context for these appeals because it sets out the detailed legal process and requirements set out by the Ministry

to obtain the REA." In particular, Suncor notes that the regulation requires consultation to take place in advance of the REA application and the submission of detailed documents to support the application. Suncor states that "it flies in the face of a newly constructed regime of detailed review and consultation to say that there is going to be serious harm from it." Suncor submits that, given the requirements of O.Reg. 359/09, the legal context for harm to human health is an Appellant showing that there will be serious harm to human health due to noise emissions from the project despite:

- the Ministry guidance on noise assessments;
- the Ministry determination that the noise assessment addressed all requirements for such assessment;
- the Ministry determination that the predicted noise levels were within guidance limits; and
- the existence of an approval that demands compliance with Ministry of Environment guidance and seeks to ensure that the project will not result in an "adverse effect", as defined.

Findings on Statutory Interpretation Principles

The Parties agree on the appropriate approach to statutory interpretation, as set out in numerous cases including *Rizzo*. It is in this context that the Parties put forward differing approaches to various aspects of section 145.2.1. As for the question of whether the Tribunal should look only to the relevant provisions of the *EPA* or to other related statutes, as set out above, none of the specific interpretation questions turn on this distinction. Therefore, the Tribunal need not directly decide whether all of the sources of legislative intention that were submitted by the Parties are relevant to each question. It is sufficient to state that the Tribunal is aware that the REA provisions are embedded within a Part of the *EPA* that has its own purpose section, that the *EPA* also has a purpose section, and that the REA provisions were enacted as part of a larger package of legislation related to renewable energy. The Tribunal finds that the approach summarized in *Rizzo* applies to the specific statutory interpretation questions raised by the Parties, a matter to which the Tribunal now turns.

Submissions on Statutory Interpretation and the Precautionary Principle

The Appellants submit that the precautionary principle is useful as an interpretive tool, particularly with respect to environmental protection legislation. They say that "the precautionary principle instructs that governments must take anticipatory action to prevent or reduce the serious or irreversible adverse environmental effects of activities where such harm is a possibility." In addition, they argue that "the principle is a tenet of international environmental law and has been considered and applied by a number of courts in Canada including the Supreme Court."

The Appellants submit that in *Baker v. Canada (Minister of Citizenship and Immigration)*, [1999] 2 S.C.R. 817 at para. 70 ("*Baker*"), the Court stated that "the values reflected in international human rights law may help inform the contextual approach to statutory interpretation and judicial review." Specifically, the Supreme Court of Canada in *114957 Canada Ltée (Spraytech, Société d'arrosage) v. Hudson (Town),* [2001] 2 S.C.R. 241 at para. 31 ("*Spraytech*") cited the precautionary principle:

> In order to achieve sustainable development, policies must be based on the precautionary principle. Environmental measures must anticipate, prevent and attack the causes of environmental degradation. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

The Appellants state that the Supreme Court, at para. 30 of *Spraytech*, expressly relied on its interpretation respecting the precautionary principle as being "consistent with principles of international law and policy" on the basis of the principle being enshrined in international law. The Appellants state that "the Court ultimately read the statute in question so as to agree with the precautionary principle."

The Appellants submit that the applicability of the precautionary principle is confirmed by its presence in the MOE's Statement of Environmental Values ("SEV") developed according to the *Environmental Bill of Rights, 1993*, S.O. 1993, c. 28 ("*EBR*"), which states:

> The Ministry will exercise a precautionary approach in its decision-making. Especially when there is uncertainty about the risk posed by particular pollutants or classes of pollutants, the Ministry will exercise caution in favour of the environment.

The Appellants point out that with respect to these appeals, this Panel stated in *Erickson 2* that:

> Mr. Gillespie argued that section 142.1 exists within a larger statutory and policy framework, which includes the SEV, and that the statute needs to be interpreted in that full context. This statutory interpretation issue is a matter of legal argument best left for final submissions.

The Appellants submit that "it is fully in keeping with the guidance of the Supreme Court as set out in *Baker* and *Spraytech* to interpret sections 142.1 and 145.2.1 of the *EPA* in a manner that is protective and precautionary with respect to human health."

The Director submits that, based on the case law, the precautionary principle supports the position of the Director, not the Appellants. The Director referred to *Tsawwassen Residents Against Higher Voltage Overhead Lines Society v. British Columbia (Utilities Commission)* (2007), 67 B.C.L.R. (4th) 376 (C.A.) where the British Columbia Court of Appeal stated that a risk must be demonstrated in order for the precautionary principle to be engaged. The Director submits that this means that "where scientific evidence regarding the risk is inconclusive, the precautionary principle is not engaged." The Director cites *Homalco Indian Band v. British*

Columbia (Minister of Agriculture, Food and Fisheries) (2005), 39 B.C.L.R. (4th) 263 (Sup. Ct.), in support of the assertion that the "application of the precautionary principle does not require the MOE to take steps to avoid any identified risks or halt all activity which may pose a risk until further research reduces or eliminates the uncertainty with respect to the extent of those risks." Finally, the Director cites the Tribunal's decision in *Greenspace Alliance of Canada's Capital v. Ontario (Director, Ministry of the Environment),* [2009] O.E.R.T.D. No. 38 where the Tribunal states at paras. 138-139:

> Where there is credible evidence that shows that harm is unlikely, the degree of uncertainty is significantly reduced and it is consistent with the precautionary approach for the Director to approve the activity and include measures to prevent harm or to confirm the predictions.
>
> …
>
> **For the Applicants to demand absolute proof that there will be no harm overstates the holding in the *Dawber* case and is not a realistic expectation of science**, or of the Director. (emphasis added)

The Director states that absolute proof of no risk to human health is impossible to obtain.

Suncor states that the Appellants have failed to provide a definition of the precautionary principle on which they are relying. Suncor also notes that the Appellants use the terms "precautionary principle" and "precautionary approach" interchangeably without providing any basis for doing so. Suncor notes that it is the "precautionary approach" that is used in the SEV. Suncor states that the Appellants do not provide any guidance on what their assertion that "the applicable sections of the *EPA* should be interpreted in a manner that is protective and precautionary with respect to human health" means.

Findings on Statutory Interpretation and the Precautionary Principle

The Appellants submit that sections 142.1 and 145.2.1 should be interpreted in a manner that is protective and precautionary with respect to human health. As noted by the Appellants, the precautionary "principle" was referred to by the Supreme Court of Canada in *Spraytech*. As well, the MOE's SEV makes reference to the precautionary "approach". Suncor points out that the Appellants have presumed that the precautionary principle and the precautionary approach are synonymous. Birnie, Boyle and Redgwell *International Law & the Environment*, 3rd ed. (United States: Oxford University Press, 2009) at pp. 155 note:

> Whether viewed as a principle or as an approach, the essence of precaution is aptly explained by Freestone:
>
> > The precautionary approach then is innovative in that it changes the role of scientific data. It requires that once environmental damage is threatened action should be taken to control or abate

> possible environmental interference even though there may still be scientific uncertainty as to the effects of the activities.

In this case, it is unnecessary to determine whether there is a material difference between the precautionary "principle" cited in *Spraytech* and the "approach" referred to in the SEV. Both are relevant to environmental decision-making and the Tribunal's work by virtue of their status in international and domestic environmental law and provincial policy. (As well, there are examples of the use of precaution in the "public health" context, as opposed to "environmental" context. See: SARS Commission, *"Spring of Fear"*, SARS Commission Final Report: Volume Three, at pp. 1157-1158.) With regard to statutory interpretation specifically, the precautionary principle is clearly relevant. For the purposes of this Decision, the Tribunal will refer to both the precautionary principle and approach simply as the "precautionary principle".

The Tribunal finds that the precautionary principle can play an important role in applying section 145.2.1. More specifically, the Tribunal finds that the precautionary principle is most likely to play a significant role in guiding action under section 145.2.1(4) if a determination of harm has taken place in accordance with section 145.2.1(2). However, the precautionary principle does not act to fundamentally change the nature of the test in section 145.2.1(2). The Legislature has clearly set out that the Tribunal must assess whether the harms listed will occur. In cases where that finding is made, the precautionary principle may constitute an important source of guidance in the Tribunal's subsequent exercise of discretion under section 145.2.1(4), just as it is for the Director under the *EBR* and section 47.5 of the *EPA*. In light of the clear wording of section 145.2.1(2), the precautionary principle does not allow the Tribunal to exercise discretion if an appellant only establishes that there is a <u>threat</u> of serious damage (using the wording of the principle). The statutory test has a higher burden, that is, "will cause serious harm". In this regard, section 145.2.1(2) is materially different from other more precautionary statutory tests in the *EPA* such as section 143(3).

It should also be noted that the precautionary principle is structured differently than section 145.2.1 of the *EPA*. The precautionary principle sets out situations where lack of certainty should not be a reason to postpone environmental measures. This is an important development in environmental decision-making in light of historical examples where environmental measures came too late. The precautionary principle does not act as a mandatory condition precedent to the adoption of environmental measures nor does it prevent proactive decision-makers from adopting environmental measures in other situations. What the principle does is prevent decision-makers from using uncertainty as an excuse for inaction when it comes to threats of serious or irreversible damage. Section 145.2.1 is structured differently. It first sets out a test in subsection (2), which essentially acts as a statutory precondition to the Tribunal exercising discretion under subsection (4). That is the direction given by the Legislature and the Tribunal must follow it.

In keeping with its status in the SEV (and the role of the SEV in decision-making under the *EBR*) and international environmental law, the precautionary principle plays an important role in

the process of establishing regulations (including setback standards and standards relating to which important areas should not be developed for renewable energy projects or other types of development). The precautionary principle also plays an important role when MOE Directors are considering applications for approval and the conditions attached to an approval under section 47.5.

To summarize, the precautionary principle does not act to change the nature of the clearly worded test set out in section 145.2.1(2). It is, however, an important principle for environmental decision-makers such as the Director or Tribunal. For statutory provisions that are more discretionary and/or subject to different interpretations, the precautionary principle is an important source of guidance, as noted in *Spraytech*. In this case, however, the legislation clearly establishes a different test that must be met before the Tribunal may take measures.

Submissions on Standing of the Appellants

Suncor submits that "unless the Tribunal considers there to be no test of standing for an Appellant in these appeals, it is submitted that the present Appellants do not meet a standing test." Suncor states that neither of the Appellants ever communicated with Suncor prior to their appeals or with the Director prior to his REA decision. It states that, therefore, there is no record of concern for the Appellants to rely on in their appeals. Suncor submits that there is no evidence of an impact on either of the Appellants. Suncor further submits that the Appellants do not meet the test for public interest standing. In its final oral submissions, Suncor stated that standing is not a key issue in this appeal. Suncor's real concern on this issue is that the Appellants are bringing this appeal without having made any prior submissions to the Director or to Suncor or participated during the lengthy approval process. Suncor states that if the Appellants had participated as the regime expected, then they would have some matters on the record for the Director to consider in issuing the approval.

The Appellants state that standing in a REA appeal is granted as of right under section 142.1 of the *EPA* to any person resident in Ontario. Both of the Appellants state that they are "resident" in Ontario and therefore, they have standing. The Appellants submit that the right of appeal does not depend on demonstrated interest or prior participation in the REA process.

Findings on Standing of the Appellants

In its closing argument, Suncor questioned the Appellants' standing. Suncor argues that the Appellants did not participate in the public consultation process that preceded the issuance of the approval. Suncor also argues that there is no basis to conclude that the Appellants can meet a public interest standing test.

Normally, it is best to raise threshold issues such as standing at the outset of a proceeding, not the end. Nevertheless, the Tribunal will deal with Suncor's argument here.

The Tribunal finds that there is a test for standing. It is the one explicitly set out in section 142.1 of the *EPA*:

> 142.1 (1) This section applies to a person resident in Ontario who is not entitled under section 139 to require a hearing by the Tribunal in respect of a decision made by the Director under section 47.5.
>
> (2) A person mentioned in subsection (1) may, by written notice served upon the Director and the Tribunal within 15 days after a day prescribed by the regulations, require a hearing by the Tribunal in respect of a decision made by the Director under clause 47.5 (1) (a) or subsection 47.5 (2) or (3).

There is, therefore, no need to look to other general tests for standing or public interest standing. The Appellants in this case are "persons resident in Ontario" who do not have a right of appeal under section 139. With both of those arms of the standing test met, there is no merit to Suncor's argument on standing. Both Appellants have standing.

The Tribunal wishes to add, however, that Suncor raises an important practical point. The scope of appeals under section 142.1 is limited, whereas the public consultation process required for REAs takes into account a wide array of issues. Appeals to the Tribunal can consider only the matters listed in section 145.2.1(2). It, thus, makes practical sense for those who have concerns with a proposed project to fully engage in the public consultation process rather than to wait and file an appeal.

Submissions on Onus of Proof

The Appellants point out that section 145.2.1(3) of the *EPA* determines the onus of proof when reviewing a REA decision:

> 145.2.1(3) The person who required the hearing has the onus of proving that engaging in the renewable energy project in accordance with the renewable energy approval will cause harm referred to in clause (2) (a) or (b).

Findings on Onus of Proof

It is clear from the wording of section 145.2.1(3) that the Appellants have the onus of proving that the test for harm has been met. There is no dispute about that among the Parties.

Submissions on the Powers of the Tribunal

Section 145.2.1(2) of the *EPA* places limits on the scope of a REA hearing:

> 145.2.1(2) The Tribunal shall review the decision of the Director and shall consider only whether engaging in the renewable energy project in accordance with the renewable energy approval will cause,

(a) serious harm to human health; or

(b) serious and irreversible harm to plant life, animal life or the natural environment.

Section 145.2.1(4) of the *EPA* sets out the powers of the Tribunal on appeal:

145.2.1(4) If the Tribunal determines that engaging in the renewable energy project in accordance with the renewable energy approval will cause harm referred to in clause (2) (a) or (b), the Tribunal may,

(a) revoke the decision of the Director;

(b) by order direct the Director to take such action as the Tribunal considers the Director should take in accordance with this Act and the regulations; or

(c) alter the decision of the Director, and, for that purpose, the Tribunal may substitute its opinion for that of the Director.

The Appellants point out that section 145.2.1 only applies to renewable energy projects and differs from section 145.2, which sets out the standard for appeals from decisions to issue other approvals (among other decisions). Section 145.2 states:

145.2(1) Subject to sections 145.3 and 145.4, a hearing by the Tribunal under this Part shall be a new hearing and the Tribunal may confirm, alter or revoke the action of the Director that is the subject-matter of the hearing and may by order direct the Director to take such action as the Tribunal considers the Director should take in accordance with this Act and the regulations, and, for such purposes, the Tribunal may substitute its opinion for that of the Director.

(2) Subsection (1) does not apply in respect of a hearing required under section 142.1.

The Appellants note, therefore, that section 145.2 continues to apply to appeals from decisions of a Director to issue a Certificate of Approval, with the exception having been created for REA appeals under section 142.1. The Appellants submit that "sections 145.2 and 145.2.1(4) are markedly similar".

The Appellants state that the reference to a "new hearing" in section 145.2, which is absent from section 145.2.1, was discussed in *Associated Industries Corp. v. Ontario (Director, Ministry of the Environment)* (2008), 40 C.E.L.R. (3d) 101 (Ont. Env. Rev. Trib.) at para. 59, quoting from *RPL Recycling & Transfer Ltd. v. Ontario (Director, Ministry of the Environment)* (2006), 21 C.E.L.R. (3d) 80 (Ont. Env. Rev. Trib.) at paras. 19-20:

> As per the terms of section 145.2 of the *EPA*, the Tribunal is not overly constrained in its approach to dealing with an issue. While it can simply confirm, alter or revoke the Director's action (which is how the role of the Tribunal's

> predecessor Environmental Appeal Board was described in the *EPA* until 1981), it can also, because of the "new hearing" provision, go beyond those options that were considered by the Director and fashion a new solution by substituting its opinion for that of the Director.

The Appellants submit that, in this case, they are requesting that the Tribunal revoke the decision of the Director and they make no request that the Tribunal "fashion a new solution". Therefore, they state, "the powers that the Tribunal would have at a 'new hearing' are not necessary or sought by the Appellants."

Suncor states that the powers of the Tribunal in this Hearing are not identical to its powers in a hearing under section 145.2(1). Suncor points to section 145.2.1(5) of the *EPA,* which requires the Tribunal to confirm the Director's decision if it determines that engaging in the project in accordance with the REA will not cause the specified harm. Such a condition requiring the Tribunal to confirm the Director's decision does not apply to new hearings under section 145.2(1).

Suncor states that, in accordance with section 145.2.1(2) of the *EPA*, the present Hearing is not a new hearing. Suncor submits that instead, a REA appeal is a review of the Director's decision, which is comparable to an appeal on the record. Therefore, the nature of the evidence to be called is different from the other appeals before the Tribunal which are conducted as new hearings. Suncor submits that "the issue of a new hearing is not limited to the remedy available at the end of a hearing. It is also about the evidence available to be considered."

Suncor submits that "the Appellants' case depends completely on the present Hearing occurring as a new hearing because neither Appellant had any participation in the decision of the Director, and because both Appellants seek to set aside the decision of the Director on the basis of evidence that was not before the Director." Suncor states that this is not consistent with an appeal based on the record. Suncor submits that "absent express guidance to the contrary, the record on an appeal is the record before the decision-maker that is subject to appeal." It states that in this case, the record would consist of Suncor's REA application and supporting documentation, the comments submitted to the EBR Registry, the Ministry's record of reviewing these documents and comments and preparing a decision for the Director, the Director's decision and the REA. Suncor submits that "the Appellants have paid virtually no regard to this record." It states that the Decision Document, which summarizes the Ministry's review of the EBR Registry comments, was not submitted as evidence in this Hearing and does not form part of the Tribunal's record. Also, the consultation report that was filed with the REA application, though part of the Tribunal's record, was not addressed by the Appellants. Suncor submits that the Appellants are advancing and relying on a different record than what was before the Director when making his decision on the REA.

The Appellants object to Suncor raising the issue of the record for the Hearing at the close of the Hearing after significant time and resources had been spent by the Tribunal and by all Parties. The Appellants note that Suncor itself called numerous witnesses and entered evidence

that was not before the Director in making his decision on the REA. The Appellants submit that, if it was Suncor's position that the record for this Hearing is limited to the record before the Director, the proper time to raise this issue would have been at the commencement of the Hearing. The Appellants state that "in principle, courts and tribunals are rarely persuaded by parties who have "slept" on issues they later seek to raise." They state that, "if the Approval Holder chooses to pursue this approach, the Appellants respectfully submit that by raising these issues months after, and in contradiction to the many actions of this same party, the *bona fides* and costs of its delay should be examined."

In its oral submissions, Suncor argued that requiring it to bring a motion at the beginning of the Hearing to define the record and clarify the law would unfairly and improperly shift the onus from the Appellants to Suncor. Suncor stated, in its closing oral submissions, that "procedurally, there was and is no better time to make this kind of submission than right now." Suncor states that if they had been required to bring a motion at the commencement of the Hearing or at end of the Appellants' evidence, this would have taken too much time out of the already compressed schedule for the Hearing.

In their oral reply, the Appellants objected to Suncor's suggestion that it would shift the onus to require a motion to be brought at the beginning of the Hearing. The Appellants noted that, in fact, the Director brought a motion regarding the issues at the beginning of the Hearing. The Appellants stated that if a Party has a concern, it is not a shifting of onus to try to resolve the concern in the early stages, but rather such an approach respects the Tribunal's time and resources. They stated that responding parties cannot wait throughout the entire hearing process to raise concerns just because the onus of proof in the case is on another party.

The Appellants also argue that Suncor's position on the scope of the record is unreasonable and incorrect in law. The Appellants submit that the record is not limited solely to the information before the Director. The Appellants state that such an approach would preclude any appellant from saying that the record was incomplete and there was more information available. Accordingly, an appellant would have no opportunity to meet its onus of proving, in this case, serious harm to human health. The Appellants state that this is a matter of natural justice and procedural fairness. The Appellants submit that the design of the statutory framework makes it clear that a REA appeal is not a standard appeal on the record. The Appellants note that sections 145(1) and (2) of the *EPA* automatically make the Director and the approval holder parties to the appeal, who then have full rights of participation. They state that this is unlike a typical appeal on the record or judicial review where the decision maker is not a party before the court. The Appellants submit that this is one of the clearest indications that this appeal should not be treated in the same way as a court appeal.

Findings on the Powers of the Tribunal

Suncor submits that the record on these appeals includes only the record of the decision-maker whose decision is subject to the appeals; that would include the REA application and supporting

documents, the *EBR* public comments, the Ministry's review documents, the Director's decision and the REA. The Tribunal finds that this is too narrow a view of the record. Certainly there are other documents that could be considered part of the record, although no attempt will be made in this Decision to definitely outline the parameters of the record. For this proceeding, it should be made clear that the Decision Document relating to the REA was adduced as evidence and it was not contested.

In its closing argument, Suncor questions the fact that the Appellants rely on materials that were not before the Director having regard to the language of section 145.2.1(2).

As noted by the Appellants, parties to an appeal may wish to bring a motion to determine the scope of evidence at the outset of a proceeding. This occurred to some extent with respect to the Director's challenge to a specific ground of appeal in this case, where the Tribunal noted (*Erickson 2* at paras. 24 and 25):

> …a tribunal is a creature of statute and performs the tasks assigned to it (see: *R. v. 974649 Ontario Inc.*, [2001] 3 S.C.R. 575 at para. 26 and *Tranchemontagne v. Ontario (Director, Disability Support Program)*, [2006] 1 S.C.R. 513 at para. 16). The appeals in this case fall under section 145.2.1(2)(a) of the *EPA*…
>
> …
>
> …The "shall consider only" phrase is evidence that the Legislature wished to place limits on the Tribunal's considerations. This conclusion flows not only from the wording of section 145.2.1(2) but also section 145.2.1(4), which limits the Tribunal's powers to actions that flow from its conclusions on harm to "human health" or "plant life, animal life or the natural environment", and sections 142.1(3) and 142.2(1), which also focus on the listed harms. Especially in light of the tight timelines imposed on decisions respecting appeals of renewable energy approvals (section 145.2.1(6)), it is important that the Tribunal not engage in a review of extraneous matters.

In its closing submissions, Suncor argues that it would not be fair to require respondents to file motions regarding the permissible scope of the evidence at the outset of a hearing and that doing so would effectively reverse the onus. The Tribunal disagrees with this proposition. If a party has an interpretation of the statute that would operate so as to significantly limit the necessary evidence in a hearing, it should raise such an issue as soon as possible in the proceeding. In fact, Rule 132 of the Tribunal's Rules of Practice lists several matters that can be raised at a preliminary hearing, including: hearing preliminary motions; identifying, defining or narrowing issues; and any other matters that may assist in the just and expeditious disposition of the proceeding. It is very important for Tribunal proceedings to proceed efficiently. If a Party believes that several days or weeks of proposed testimony will be outside the jurisdictional scope of an appeal, then it is important for that point to be raised at the preliminary hearing.

At this final stage of the proceeding, the Tribunal does not have adequate submissions from all Parties on the statutory interpretation issues raised by Suncor to determine the question of

whether new evidence ought to be heard in appeals under section 142.1. As well, the Tribunal has not been provided with more specific argument on the nuances of Suncor's position. For example, is it arguing that would-be appellants have an onus to raise all necessary evidence during the public consultation? Is it arguing that an appeal could not consider new evidence that came to light after the consultation phase? These are just some of the questions that were not fully addressed in Suncor's decision to raise the issue of the scope of the appeal record so late in the proceeding. Ignoring for the moment the fact that Suncor and the Director have also relied extensively on materials that were not before the Director, the Tribunal also finds that the issue is now moot given the Tribunal's overall finding in this case and the fact that the Hearing is over and the new evidence from all Parties has already been heard.

However, if some aspects of Suncor's interpretation of section 145.2.1 with the respect to the scope of evidence prove to be correct (recalling that the Tribunal is not making a finding on that issue here), it makes it even more important for concerned persons to fully participate in the public consultation process such that their issues about human health, plant life, animal life and the natural environment are on the record prior to an appeal being initiated.

In light of the substantive findings set out below, it is also not necessary to fully resolve the Parties' apparent disagreement during closing submissions about how a hearing such as the present one is different from a hearing under section 145.2 of the *EPA*. That question can also largely be left for a future case. Nonetheless, some related aspects of this issue, which were the subject of more detailed submissions, are explored below.

Submissions on Deference

Suncor submits that the Tribunal should take a deferential approach in reviewing the decision of the Director. Further, Suncor submits that the general approach to deference used by the courts should also be used by the Tribunal, whereby the Director's decision would not be set aside unless it is found to be unreasonable. Suncor argues that in making its own finding as to whether the Project, as approved, will cause serious harm to human health, the Tribunal should consider the legal standard applied by the Director. Suncor submits that "the Director sought to ensure that the REA would prevent the project from causing an "adverse effect"" which is evidenced by the specific references to "adverse effect" in the Decision Document and the REA. Particularly, Suncor notes that "adverse effect" is referred to in the REA in several places, including: the defined terms, Conditions 9, 25, 26, and 29, and in reasons 5 and 8 of the reasons for the Conditions. Suncor submits that "the Director's efforts in the REA to prevent an 'adverse effect' are directly relevant to this Tribunal's obligation to determine whether the REA will cause 'serious harm to human health'." Suncor submits that the Tribunal should grant deference to the Director in considering whether the Director was reasonable in concluding that the REA would prevent an "adverse effect".

The Appellants agree that deference should be shown to the decision of the Director. However, they submit that deference is conferred within the statute. The Appellants state that the *EPA*

requires that the Director review the REA application on the basis of "adverse effects" whereas the Tribunal is required to conduct its review on the basis of "serious harm." They argue that, because the Tribunal must apply a more stringent standard, the statutory language has built in discretion for the Director's decision. They state that "the Director can still have been incorrect in his determination that a project will not cause adverse effect(s). It is only where the Director's decision is sufficiently unreasonable so as to reach the level of serious harm that the Tribunal is permitted to intervene."

Findings on Deference

In their closing submissions, the Parties appeared to be in partial agreement on the fact that the matters to be considered by the Tribunal are different from those considered by the Director. They pointed out that the Director looked at "adverse effects" (which includes "an adverse effect on the health of any person"), while this Hearing looked only at "serious harm". The Parties look at these differences as a form of deference to the Director. The Tribunal agrees that this is one way to look at the issue, in that there are obviously aspects of the Director's decision (i.e., all those parts of the decision-making process that do not relate to the harms listed in section 145.2.1(2)) that are not subject to review or alteration by the Tribunal. Conceivably, this could include specific types of adverse effects that are not "serious harm". This could also include any number of procedural decisions made by the Director (e.g., a conclusion on the completeness of the application). However, the fact that these other decisions or sub-decisions are not before this Tribunal is not necessarily a situation of true deference by the Tribunal to the Director's decision.

Looked at another way, it is simply a case that the Tribunal does not address those other parts of the Director's decision at all, by virtue of the statute. It is perhaps better to state that the Legislature is requiring that parts of the Director's decision be deferred to as a matter of jurisdiction. They are not to be raised before the Tribunal. To that extent, this is not a full "new hearing" of what was or could have been raised before the Director.

This statutory deference could be important if a person sought judicial review of an aspect of the Director's decision, but it is not something that has any effect on this Tribunal Decision. In this proceeding, the Tribunal is simply applying the section 145.2.1(2) test. It is not deferring to the Director on the other parts of the decision-making process. The Tribunal is not even addressing those other parts because of the "consider only" wording. It may be the case that the Parties are simply using the word "deference" in a different way than the Tribunal. The Tribunal itself does not grant "deference" to parts of the Director's decision that cannot be appealed to the Tribunal. The Tribunal does accord a level of deference, using the reasonableness standard, to some Director's decisions according to the direction provided by other provisions of the legislation (e.g., sections 145.3(1)(b)(ii) and 145.4(2) of the *EPA*).

The Tribunal has to assess whether there will be "serious harm" regardless of what other considerations the Director had in mind and regardless of whether the Director ever turned his

mind to the question of "serious harm". The Tribunal is to apply the distinct test set out in section 145.2.1(2) and exercise discretion under section 145.2.1(4) if the test is met. It is not replicating or even directly addressing the full and detailed process required by Part V.0.1 of the *EPA* or the regulations. It is, therefore, the Tribunal's finding that the question of deference raised by the Parties is largely irrelevant to this Hearing before the Tribunal.

The Tribunal also wishes to add that the Parties' arguments about deference were clearly situated in the traditional realm of "adverse effects" that have been addressed under the *EPA* for many years (i.e., those that result from discharges of contaminants such as sound, vibration, or radiation). The concepts of "serious harm" and "serious and irreversible harm" in section 145.2.1(2) are not limited to harm resulting from the discharge of contaminants. For example, the loss of a particular environmental feature, which meets the "serious and irreversible" standard, can come about through direct habitat modification and not just from the emission of a contaminant. The Tribunal and parties to a hearing under section 142.1 must be mindful that this new regime applies to many types of renewable energy projects and not just those, such as this one, where discharges of contaminants are the main concern. Sections 142.1 and 145.2.1 need to be interpreted in this unique context and not just viewed as subsets of the processes with which parties have become familiar under the *EPA* before it incorporated the REA amendments. The *EPA*, as it was then, did not focus on entire classes of environmental degradation such as the direct harmful alteration of the natural environment (e.g., direct habitat modification or destruction). The new REA process attempts to address some of these issues through land use controls (as opposed to emission controls) such as those found in sections 37 to 46 of O.Reg. 359/09. Section 145.2.1(2) must be read in that light, as opposed to simply constituting a narrower version of the old approach to adverse effects emanating from the discharge of contaminants.

Submissions on Proper Considerations: "Accordance with the REA" and Other Projects

In its closing submissions, Suncor states that according to section 145.2.1, the Tribunal is confined to a review of the Director's decision and is limited to considering only the action of engaging in the renewable energy project. Suncor states that this allows the Tribunal to consider the specific features of the Project, but not other projects. Suncor submits that "an Appellant has no automatic right to have the Tribunal consider another project, such as its location, design, technologies, noise level, and/or effects." Suncor also states that the Tribunal is limited to considering the Project in accordance with the REA, restricting the scope of the appeal to considering the Project under compliance with the REA. Suncor submits that "the hearing is required to focus exclusively on whether engaging in the project will cause serious harm to human health where the project complies with the REA. Conversely, it is not within the legal authority of the Tribunal to consider impacts or issues that arise from a project failing to comply with the issued REA."

The Director agrees with Suncor's position that the Tribunal can only consider the project and any potential effects that would cause serious harm to human health when the Project is operating in compliance with the REA. The Director states that this is clear from the statutory language in section 145.2.1(2) of the *EPA*. The Director states that any risks of non-compliance are not relevant to this Hearing. The Director states that the Tribunal does not have jurisdiction to speculate about the Project operating out of compliance with the REA. The Director stated that compliance issues are properly left until after the project is in operation, as "the MOE is perfectly capable of dealing with and prosecuting compliance problems."

The Appellants submit that "the REA appeal provisions cannot be interpreted to limit all evidence to that of the Project alone. This approach would not be reasonable." The Appellants state that they have provided extensive references linking the evidence before the Tribunal to the Kent Breeze Project in a variety of ways. The Appellants also submit that it would be unreasonable to limit the proceeding to considering the Project as if it will be in compliance with the REA. They state that such an approach would deem the approval holder to be in compliance for the purpose of any appeal, and accordingly, an appellant would not have an opportunity to bring any evidence to the contrary or question that something has not been assessed correctly. The Appellants submit that "this would be a barrier to participation, pursuant to natural justice and procedural fairness." The Appellants state that, nonetheless, they have provided evidence demonstrating that the Project will cause serious harm to human health, even if operated in compliance with the REA.

The Appellants state that the words "consider only" are used to restrict the Tribunal from engaging in a debate about the efficacy of renewable energy projects beyond the scope of the Project before it. They state that the purpose of this wording is to prevent extraneous considerations from entering the process, such as whether wind energy is a good thing or not and whether it helps reduce climate change.

In addition, the Appellants state that considering the Project in accordance with the REA relates to the Tribunal's jurisdiction in granting a remedy. The Appellants submit that the wording in section 145.2.1(2) acts to impose limits around how much variation the Tribunal can make from what was actually approved. The Appellants state that, despite the Tribunal's powers in section 145.2.1(4)(b) and (c) to alter the Director's decision and substitute its own decision, "it would be a hearing *de novo* to go beyond what the Director has approved" and considered. Given the requirement in section 145.2.1(2) to consider the project in accordance with the approval, it "would not be harmonious to say that the Tribunal has unlimited jurisdiction." However, the Appellants submit that the Tribunal is not required to, nor should it decide on the extent of its powers, as this has not been raised in the present appeal. The Appellants are asking the Tribunal to revoke the approval in accordance with section 145.2.1(4)(a); they are not asking the Tribunal to vary the decision of the Director.

Findings on "Accordance with the REA"

Under section 145.2.1(2)(a), the Tribunal is to assess "whether engaging in the renewable energy project in accordance with the renewable energy approval will cause" serious harm. Suncor argues that the Tribunal is to presume that the Project will be operated in a manner that accords with the approval. For example, the approval includes requirements for sound levels (Condition 9(1)) and setbacks (Conditions 10 and 11). Does the "in accordance" wording of section 145.2.1 operate so as to exclude any evidence on whether conditions in an approval are likely to be complied with?

In this case, the Appellants have serious concerns about whether the Project will be operated in a manner that accords with the approval. For example, they called evidence that sound levels may be higher than predicted. Suncor argues that, in order to maintain the expedited nature of the section 142.1 hearings, such important issues have been left to other fora, such as enforcement actions. If this argument is correct, then the scope of evidence that appellants can call will be more limited than what occurred in this Hearing.

It is clear that section 145.2.1(2) does narrow the types of evidence and arguments that can be presented. For example, as pointed out by the Appellants, the section's focus on harm means that the Director and the approval holder are not able to attempt to justify a project simply on the basis of its purported benefits, notwithstanding any expected harm. To some extent, Suncor attempted to put forward such an argument in its closing submissions. It pointed out that the REA provisions of the *EPA* were enacted as part of a larger bill, which signalled an intention by the Legislature to promote green energy. Suncor argued that wind power, by virtue of its legislated status as "green" or renewable energy, must be positive for the environment. The Tribunal finds that this argument is too simplistic because there are obviously locations where certain types of renewable energy projects should not be sited because the environmental costs of doing so are too high. This is one of the reasons why the regulations prohibit the siting of projects in certain locations.

If a proposed project would cause serious and irreversible harm to a particular environmental feature (because either the regulations did not adequately protect that feature or the decision-making process leading to the approval failed to do so), it would be a stretch to conclude that the project is nonetheless "green" because it involves a cleaner technology than others. The promotion of green energy needs to be done in an informed manner that results in significant net benefits. One cannot simply label an entire suite of technologies as "green" in order to use that label as an excuse to allow them to be operated anywhere.

As is evident from the wording of section 145.2.1(2), the Tribunal is not conducting as wide an inquiry as it would under other provisions of the *EPA* or the *EAA*. Rather, it is conducting a narrow expedited Hearing to determine whether the Project will cause the specified harm and, if so, what should be done about it according to the legislation and regulations. If the section 145.2.1(2) test is satisfied, then the Tribunal proceeds to exercise its powers under section

145.2.1(4) in a manner that supports the purposes of the legislation. It is interesting to note that, under section 145.2.1(2), the Tribunal is not asked to weigh any potential harm against the benefits. It is also not asked to compare the harms that may stem from a renewable energy project to those that may result from other forms of energy production that may cause even greater harm or risks of harm. Because of the "shall consider only" phrase, the Tribunal is not asked to engage in a further inquiry into any potential benefits, weigh the advantages and disadvantages of a project or look at whether the harm will be counterbalanced or compensated for. The Tribunal finds that the Appellants are correct that the statute's approach is to keep the focus of the inquiry narrow (i.e., on "harm"), rather than to weigh a wider range of factors in a "balance sheet" approach.

This is not to say that the balancing is not being done at all. For example, the Legislature has engaged in that balancing exercise to some extent by providing a special expedited approval regime for those technologies that are considered renewable. As well, fiscal policies have been enacted to encourage the development of green energy.

It is clear from the wording of section 145.2.1(2) that entire classes of evidence that would be heard in other types of hearings, such as those involving environmental assessment, will not be included in appeals such as this one. However, at this late stage of the Hearing, the Tribunal does not need to answer the specific narrow question now raised by Suncor regarding evidence about possible non-compliance with the approval (i.e., whether the 105.1 dBA maximum noise emission calculation was correctly done having regard to a perceived need to make upward corrections in the calculations due to issues such as high wind shear). The disputed evidence about compliance with the sound level conditions of the approval has already been heard. In this case, if the disputed evidence about increased potential harm from the Project stemming from the uncertainties identified by the Appellants is factored into the equation, the Tribunal would not find that such evidence would affect the Tribunal's overall conclusion on harm. The evidence marshalled by the Appellants, taken at its highest, simply indicates that there are risks associated with turbines that merit further research. As noted in the factual findings later in this Decision, the Tribunal has not found that any upward correction in the expected maximum sound levels of the Project is required or that the 40 dBA modeling was incorrectly carried out as a result. Consequently, the question raised by Suncor about the effect of the "in accordance" wording will be left to a future case. If future parties wish to raise that argument, it will be necessary for the Tribunal to hear additional argument on this important issue of statutory interpretation.

In order to reduce uncertainty in future cases, the Tribunal does wish to dispose of one aspect of the "in accordance" debate, however. The Appellants posited that the "in accordance" wording places limits on the remedial power of the Tribunal. In this case, the Appellants simply ask for a revocation of the approval as opposed to a modification. While it is clear that the power of the Tribunal is limited by the statutory provisions, the Tribunal does not agree with the proposition that the provisions effectively limit the Tribunal to giving a "yes or no" answer to a

proposed renewable energy project. It is quite evident from the wording of section 145.2.1(4) that the Tribunal has wider options available to it. It is also quite evident that circumstances could arise where part of a project satisfies the section 145.2.1(2) test, but only in a limited geographic extent (e.g., where a portion of an extensive renewable energy project is proposed to be located in a manner that would cause the harm listed). Surely, in such circumstances, the Tribunal could act to reduce the size of the proposed project by exercising its powers under section 145.2.1(4). The Tribunal would not be forced to simply say “yes” or “no” to the whole project.

Findings on Other Projects

Suncor takes issue with the fact that the Appellants called evidence concerning other projects, some of which have been operating for some time. Suncor interprets section 145.2.1(2) as limiting the permissible evidence to evidence that is in respect of the project under appeal. The Appellants counter with the argument that evidence from other projects can be relevant to the question about whether harm will be caused by this project.

The Tribunal does not read section 145.2.1(2) as narrowly as Suncor. Normally, appeals for renewable energy projects will be heard before a project is operating. In such cases, determining whether a project “will cause” harm will involve expert evidence about what is predicted to happen. In many fields of expertise, predicting future effects relies on extrapolating from the experience gained in other situations. Thus, it stands to reason that evidence gathered from other projects is admissible and useful so long as the evidence is used as an input into the evidence concerning the predicted effects of the project under appeal. Parties should point out how the witnesses they have called have used the information gathered about other projects in providing relevant evidence about the project under appeal. In some cases, one witness may speak about a previous project while another ties that evidence to the project in question.

The Tribunal sees nothing improper about such an approach and sees nothing in the legal test that stipulates that evidence about the harm that will be caused by a project can only come from evidence about the proposed project itself. Suncor’s interpretation would amount to putting “blinders” on a hearing and would lead to a situation where the Tribunal would be precluded from hearing relevant evidence on the question of whether harm will be caused. Having said that, it will often be important for parties to point out the differences between the available evidence about other projects (relative location of receptors, type of wind turbine, local topography, etc.) and the proposed project under appeal. If a party fails to show how transferable the experience gained in one locale is to another, then the evidence will be of little use in a hearing. In this case, the evidence from the Appellants about other projects or situations involving noise emissions in general varied in its utility as a predictor of the future effects from this Project. This is another reason why further research in this area will help to address many of the uncertainties highlighted throughout this Hearing.

Submissions on Standard of Proof

The Appellants submit that the Tribunal has consistently applied a balance of probabilities standard of proof to its proceedings. The Appellants refer to the following passages:

> Based on these competing views, the Tribunal must now reach its own conclusions based on the evidence on a balance of probabilities standard. In other words, the Tribunal must approach afresh the problem of whether it is probable that the operation of the waste management system is not in the public interest (*Associated Industries Corp. v. Director, Ministry of the Environment* (2008), 40 C.E.L.R. (3d) 101 (Ont. Env. Rev. Trib.)).
>
> This would be in keeping with the general presumption that appellants must make their case before an administrative tribunal on a balance of probabilities except where a statute provides otherwise (*Starnino Holdings Ltd. v. Ontario (Ministry of the Environment)*, [2007] O.E.R.T.D. No. 68).

The Appellants state that the Tribunal has applied a balance of probabilities standard in the many cases it has adjudicated under section 145.2 of the *EPA* and that it is clear that the standard to be applied to REA appeals should be the balance of probabilities standard.

The Appellants point out that, conversely, the two-pronged leave test under section 41 of the *EBR* is subject to a standard of proof that is lower than the balance of probabilities. They submit that, as set out in the Tribunal's decision in *Simpson v. Ontario (Director, Ministry of the Environment)* (2005), 18 C.E.L.R. (3d) 123 at paras. 7-8 (Ont. Env. Rev. Trib.) and cited in *Dawber v. Ontario (Ministry of the Environment)* (2007), 28 C.E.L.R. (3d) 281 at para. 12 (Ont. Env. Rev. Trib.):

> This section does not require that the Applicants establish that no reasonable person could have made the decision, or that significant harm will result. Instead, the Applicants must show that it *appears that there is good reason to believe* no reasonable person could have made the decision in question, and that it *appears that the decision could result* in significant harm to the environment.
>
> While the two-pronged test in section 41 is a stringent one, the standard of proof is a lower standard than a balance of probabilities, and must be applied in conjunction with the stated intent of the *EBR* to enable the people of Ontario to participate in the making of environmentally significant decisions by the government of Ontario. (Emphasis in original)

The Appellants submit that the fact that the Tribunal has applied this lower standard to leave to appeal cases suggests that "the Tribunal intends that the balance of probabilities standard be reserved for the final determination of issues."

The Appellants argue that, as stated by the Supreme Court of Canada in *F.H. v. McDougall*, [2008] 3 S.C.R. 41, it is the norm that the only standard of proof applicable in civil matters is on a balance of probabilities. They say that, more specifically with respect to administrative law, the

Ontario Court of Appeal definitively held in *Stetler v. Ontario (Agriculture, Food and Rural Affairs Appeal Tribunal)* (2005), 76 O.R. (3d) 321 (C.A.) ("*Stetler*") at para. 79, that:

> [t]here are only two standards of proof used in legal proceedings. In civil and administrative matters, *absent an express statutory provision to the contrary, the standard of proof is on a balance of probabilities*. (Emphasis added)

Here, the Appellants argue that neither the *EPA* nor the *Statutory Powers Procedure Act* R.S.O. 1990, c. S.22 ("*SPPA*") contains any express provisions which would alter the civil standard of proof as it applies to sections 142.1 and 145.2.1 of the *EPA*, and therefore, the balance of probabilities standard applies. The Appellants submit that, according to *Stetler*, the balance of probabilities standard can only be changed by statute, not by judicial discretion.

The Appellants say that "if, at the end of a tribunal hearing, on all the credible evidence it has been proven that the alleged harm would probably result, the case has been proven." The Appellants rely on Sara Blake, *Administrative Law in Canada* (4th ed.), (LexisNexis, 2006), at pp. 69 as an underlying basis for their submission.

Suncor takes issue with the Appellants' reference to Ms. Blake's text as support for their arguments on the standard of proof. Suncor states that "Ms. Blake was expressly discussing past events and applying a standard of proof to such events. By contrast, the Appellants are seeking to address future events and harm alleged to result in the future." Therefore, Suncor submits that this reference is not useful to the determination of the standard of proof in the present case.

The Director argues that REA appeals are novel and unique, and therefore, the Tribunal must carefully consider the question of the applicable standard of proof. The Director submits that for REA appeals a higher than normal standard of proof should apply.

The Director notes that prior to the legislative amendments to the *EPA,* which enacted section 142.1, third parties could only challenge a Director's decision to issue an approval through the process set out in the *EBR*, which is a two-step process requiring the Tribunal to grant leave to appeal the decision before the Director's decision can be challenged. The Director notes that the standard of proof required for *EBR* leave to appeal proceedings, which are preliminary in nature, is a lower standard than the balance of probabilities. This standard of proof was confirmed by the Divisional Court in *Lafarge Canada Inc. v. Ontario (Environmental Review Tribunal)* (2008), 36 C.E.L.R. (3d) 191 (Div. Ct.) ("*Lafarge*"). The Director, however, points out the number of differences between the *EBR* leave to appeal proceedings and the REA appeal proceedings. First, the test for relief in a REA appeal requires a demonstration of serious harm, whereas the *EBR* leave test requires only that harm could result. Secondly, the Director submits that unlike the *EBR*'s two-step process, the REA appeal process is meant to be expeditious, setting out a strict six month timeline for the Tribunal's decision.

The Director notes that, under section 145.2.1(3), the Appellants have the onus of proving that the project will cause serious harm to human health. The Director submits that "since absolute

proof of a future event cannot be provided, a very high probability of harm must be shown for the appeal to be granted and the Director's decision revoked or altered. Accordingly a higher than normal standard of proof should be required." The Director states that "will cause does not mean might or may or probably. The language itself engages a higher standard of proof."

The Director agrees with the Appellants that the balance of probabilities standard is generally applicable in administrative tribunal hearings. However, the Director states that "the Tribunal has acknowledged that it is not and should not be bound to a single standard of proof in all cases" and it may be appropriate to depart from the normal civil standard in certain cases. The Director submits that "the standard of proof rises with the gravity of the allegation and the seriousness of the consequences. In each case, the Tribunal must strive to find the right balance between the consequences for the individual and the consequences for society of the revocation or continuation of an approval."

The Director submits that the nature of the proceedings under section 145.2.1 is analogous to civil applications for preventative injunctive relief, also known as *quia timet* actions or injunctions. The Director states that a REA appeal is comparable to a *quia timet* injunction because the action is brought before any harm is actually suffered and is intended to prevent future harm. The Director states that "a plaintiff seeking a *quia timet* injunction must demonstrate to a high degree of probability that the feared harm is imminent and practically inevitable, and will be substantial." The Director refers to the Supreme Court's decision in *Operation Dismantle v. Canada,* [1985] 1 S.C.R. 441 ("*Operation Dismantle*") and states that the "use of the terms "high degree of probability" and "very strong probability" suggests that a higher standard is required to satisfy a court that future harm will occur than the ordinary civil standard used to prove the occurrence of past events." The Director cites a number of cases where the courts have held that a high standard of proof is required for a *quia timet* injunction. In particular, the Director refers to *McKinnon v. Martin (Rural Municipality, No. 122)* (2010), 316 Sask.R. 249 (Q.B.) where an injunction was sought to prevent the construction and operation of a wind farm project based on similar health concerns as have been raised by the Appellants in this case. The Director notes that the Court held that a high degree of probability that the harm will in fact occur was required to grant the injunction sought. The Director submits that the harm alleged and the relief requested in that case are factually identical to the situation currently before the Tribunal.

The Director submits that the Tribunal should apply a higher standard of proof because "the Appellants' fear of potential harm must be balanced against the actual harm that will result both to the proponent and to the public interest if the REA is revoked." The Director submits that "public interest" includes the protection and conservation of the environment, a purpose of Part V.0.1 of the *EPA*, and societal concerns, including the intention to foster green energy projects as expressed in the *GEA*.

The Director concludes that a higher standard of proof should be applied in this appeal "in light of the specific language and requirements of the legislation, the statutory scheme and the societal interest in promoting green energy."

Suncor takes a similar position as the Director and submits that "the closest analogy to this term comes from the language developed by the courts in dealing with a '*quia timet*' injunction. Like the present appeals, such an injunction applies to prevent future harm - harm 'yet to occur'." Suncor also references the decisions in *Operation Dismantle* and *McKinnon v. Martin* for the proposition that such injunctions require "a high degree of probability that the harm will in fact occur."

In reply, the Appellants argue that injunctions are a form of equitable relief that is awarded at the discretion of the court. They state that "while courts of equity have developed rules, including *quia timet*, to guide the exercise of a court's discretion when a party seeks equitable relief, the Appellants have been given the right to appeal at law, pursuant to *EPA* section 142.1." The Appellants argue that because the Appellants' right to appeal exists in law and is not discretionary, the rules of equity do not apply. The Appellants argue that if all cases where the alleged harm will occur in the future were treated in this way, then a number of hearings before this, and other, tribunals would have to be judged on a *quia timet* standard, as they regularly consider harm from projects not yet in existence. However, the Appellants note, the majority of proceedings are not judged on this basis and instead follow a balance of probabilities standard, as discussed above. The Appellants conclude that, because the Appellants in REA appeal proceedings have been granted statutory rights, the rules of equity do not apply and accordingly, the standard of balance of probabilities should be applied.

Findings on Standard of Proof

It is clear that the Appellants must prove that the harm listed in section 145.2.1(2) "will" be caused. However, the Parties differ significantly on what standard of proof applies. Is it the balance of probabilities standard, as argued by the Appellants, or some higher standard, as argued by the Director and Suncor?

The general starting point for proof in an administrative tribunal proceeding is the civil standard of a balance of probabilities (Blake, *supra* and *Starnino Holdings Ltd., supra*). It is also clear that the Legislature can enact a different standard through specific language (*Stetler, supra*), as has been done under the *EBR* (*Lafarge, supra*). In the case of section 145.2.1(2), the Tribunal can find no indication of a legislative intention to change the typical standard of proof. The Tribunal cannot import the extraordinary standards used in other types of proceedings without there being some indication of such an intention in the statute. Therefore, under section 145.2.1(2)(a), an appellant must satisfy the "will cause serious harm" test on a balance of probabilities.

Submissions on the Statutory Test

The Appellants say that an examination of the test to be applied by the Tribunal under section 145.2.1(2)(a) involves a legal analysis of three areas: (a) “will cause”, (b) “serious harm”, and (c) “to human health”.

Suncor submits that section 145.2.1(2)(a) should be read as a whole and not fragmented into separate analyses as the Appellants’ submissions suggest. In support of this argument, Suncor refers to the principle of statutory interpretation discussed above, which states that terms within a single provision should be “read in their entire context” and “in their grammatical and ordinary sense” and “harmoniously with the scheme of the Act”.

“Will Cause”

The Appellants submit that in *Resurfice Corp. v. Hanke*, [2007] 1 S.C.R. 333, “the Supreme Court of Canada confirmed the “but for” test as the foundation of the causation analysis, together with two recognized exceptions to that test, neither of which appear to be relevant to these appeals.”

They note that the Ontario Superior Court decision in the medical malpractice case *Goodman v Viljoen,* 2011 ONSC 821 summarizes the law on causation as it stands in Ontario today. The issue of causation in that case was whether a steroid treatment, which was not provided due to the doctor’s negligence, would have prevented the development of cerebral palsy in twin babies or materially reduced its effects.

The Appellants note that the trial judge referred to *Laferrière v. Lawson*, [1991] 1 S.C.R. 541, another medical malpractice case, where the Supreme Court of Canada stated:

> Cases in which the evidence is scarce or seemingly inconclusive present the greatest difficulty. It is perhaps worthwhile to repeat that a judge will be influenced by expert scientific opinions which are expressed in terms of statistical probabilities or test samplings, but he or she is not bound by such evidence. Scientific findings are not identical to legal findings. Recently, in *Snell v. Farrell*, [1990] 2 S.C.R. 311, this Court made clear (at p. 328) that "[c]ausation need not be determined by scientific precision" and that "[i]t is not . . . essential that the medical experts provide a firm opinion supporting the plaintiff's theory of causation" (p. 330). Both this Court and the Quebec Court of Appeal have frequently stated that proof as to the causal link must be established on the balance of probabilities taking into account all the evidence which is before it, factual, statistical and that which the judge is entitled to presume. [Emphasis in original]

The Appellants state that the trial judge in *Goodman* reviewed the case law and held that the appropriate approach to causation is set out in *Athey v. Leonati*, [1996] 3 S.C.R. 458 where it is stated that:

> 1. Causation is established where the plaintiff proves to the civil standard on a balance of probabilities that the defendant caused or contributed to the injury.
> 2. The general, but not conclusive, test for causation is the "but for" test, which requires the plaintiff to show that the injury would not have occurred but for the negligence of the defendant.
> 3. The "but for" test is unworkable in some circumstances, so the courts have recognized that causation is established where the defendant's negligence "materially contributed" to the occurrence of the injury.
> 4. In *Snell v. Farrell*, *supra*, this Court recently confirmed that the plaintiff must prove that the defendant's tortious conduct caused or contributed to the plaintiff's injury. The causation test is not to be applied too rigidly. Causation need not be determined by scientific precision; as Lord Salmon stated in *Alphacell Ltd. v. Woodward*, [1972] 2 All E.R. 475, at p. 490, and as was quoted by Sopinka J. at p. 328, it is "essentially a practical question of fact which can best be answered by ordinary common sense". Although the burden of proof remains with the plaintiff, in some circumstances an inference of causation may be drawn from the evidence without positive scientific proof.

In addition, the trial judge in *Goodman* relied on the Ontario Court of Appeal decision in *Fisher v. Atack* (2008), 62 C.C.L.T. (3d) 1 (ON C.A.) where the Court stated that whatever test for causation is applied, scientific precision is not required nor is it necessary to provide an expert capable of offering a firm opinion that supports the plaintiff's theory of causation in a medical malpractice case. Rather, as stated in *Fisher* at para. 54, "the trial judge is entitled to consider all the facts and circumstances established by the evidence at trial, and, where appropriate, to draw an inference of causation through the application of reason and common sense. This has been termed the 'robust and pragmatic approach'." However, at para. 58 the Court states "just as the robust and pragmatic approach cannot be used as a substitute for evidence, it cannot be used as a substitute for reviewing and making findings about relevant evidence."

The Appellants submit:

> In *Goodman*, the court also dealt with the argument that research data on the effects of the steroid treatment on cerebral palsy should be ignored because it failed to reach statistical significance, stating that the argument:
>
> > rests on the flawed premise that legal causation requires the same standard of proof as medical/scientific causation. This is of course not the case; the two standards are in fact quite different. The law is clear that scientific certainty is not required to prove causation to the legal standard of proof on a balance of probabilities (See: *Snell v. Farrell*, [1990] 2 S.C.R. 311, at para. 34).

They say that “the trial judge went on to say she agreed with the plaintiffs' submission that they cannot be denied recovery because science has not advanced far enough to answer the question to a degree of scientific precision.”

The Director argues that in determining whether the project “will cause” serious harm to human health, the Tribunal need not engage in the elaborate causation analysis proposed by the Appellants. The Director submits that a “causation analysis is appropriate in circumstances where the alleged harm or injury is a matter of fact and record, and the issue for determination is the uncertain source or reason for that harm.” However, the Director argues that a causation analysis involving the “but for” test is not appropriate or applicable in the circumstances of the present case because the alleged harm has not yet occurred. The Director submits that “the issue in the present case is not causation, but simply whether a very high likelihood exists that alleged harm will occur, in the circumstances given.”

Suncor takes a similar approach as the Director and contests the Appellants’ reliance on cases that address past events but do not address the present context of future events. Suncor submits that the contexts for hearings regarding past events and future events are legally different and are subject to different standards. It submits that the case law relied on by the Appellants in regards to this issue is irrelevant. Further, Suncor contests the Appellants’ reliance on case law that involves different statutory regimes such as the *EBR* leave to appeal process or the *Insurance Act* and damages cases from civil litigation.

“Serious Harm”

The Appellants note that the term “serious harm” was first introduced into the *EPA* with the enactment of sections 142.1 and 145.2.1, and consequently, there are no decisions interpreting this term in the *EPA* environmental law context.

However, they note that the courts have considered the term “serious” in other contexts. In *Meyer v. Bright* (1993), 15 O.R. (3d) 129 (C.A.), the Ontario Court of Appeal interpreted the word “serious” in relation to “permanent serious disfigurement or permanent serious impairment of a bodily function” found in section 266(1) the *Insurance Act*, R.S.O. 1990, c. I.8.

The Appellants submit that the following excerpts of this decision are relevant:

> [12] It is worth emphasizing here that when it created those statutory exceptions the legislature did not choose to express itself in difficult or technical terms. It used words which are common and which are in everyday use. It does not seem to us to be desirable to seek hidden meanings for such common and ordinary words as "serious" and "important".
>
> …
>
> [26] It would be inappropriate for us to attempt to define the word "important" because it is a word which is commonly used. The definitions of the word found in dictionaries are largely composed of synonyms. We do not think that it is appropriate for us to select one or more of those synonyms and hold that they

> express the intent of the legislature when it chose to use the word "important". If the legislature had intended to use a synonym for the word "important" to express its legislative intention it would have done so.
>
> The issue which the courts will have to determine in each case is whether the bodily function which has been impaired is an important one to the particular injured person. It is an issue of fact to be determined according to the evidence in each case.
>
> …
>
> [29] As with the word "important", dictionary definitions of the word "serious" contain synonyms. For the same reasons that we would not choose a synonym for the word "important", we do not choose a synonym for the word "serious" as being the meaning which the legislature intended when it used the word "serious". "Serious" is a word which by its very nature imports a sense of degree and probably imports a range. The courts must avoid qualifying the word "serious". If the legislature had wanted to do so it could have said very serious to indicate that it was only those impairments which were at the upper end of the range which would permit an injured person to sue for damages.
>
> …
>
> [34] It is simply not possible to provide an absolute formula which will guide the court in all cases in determining what is "serious". This issue will have to be resolved on a case-to-case basis.
>
> …
>
> [36] It is impossible for this court to lay down general guidelines of the concept of seriousness in all cases. Each case must be decided upon its own facts.
>
> We are reluctant indeed to use examples lest in other cases they may be seen as precedents.
>
> …
>
> The issue which the courts will have to determine in each case is whether the permanent impairment of an important bodily function is serious to the particular injured person. It is an issue of fact to be determined according to the evidence in each case.

The Appellants submit that:

> The purpose of the relevant provisions of the *EPA* and the concepts of “serious impairment” vs. “serious harm” are clearly different. However, in terms of an approach to analysis, the *Meyer* decision makes it clear that where the Legislature has chosen to use “common and ordinary words,” resort to dictionary definitions and synonyms is not appropriate. The issue is one that should be decided on the facts of each case.

The Appellants submit that in the environmental law context, the concept of “serious,” as contrasted with “minimal or trivial,” was considered in *Ontario v. Canadian Pacific Ltd.*, [1995] 2 S.C.R. 1031, in which the Supreme Court of Canada distinguished between different types of effects when considering an “adverse effect”:

> It is apparent from these other enumerated impacts that the release of a contaminant which poses only a trivial or minimal threat to the environment is not prohibited by s. 13(1). Instead, the potential impact of a contaminant must have some significance in order for s. 13(1) to be breached. The contaminant must have the potential to cause injury or damage to property or to plant or animal life (s. 13(1)(b)), cause harm or material discomfort (s. 13(1)(c)), adversely affect health (s. 13(1)(d)), impair safety (s. 13(1)(e)), render property or plant or animal life unfit for use by man (s. 13(1)(f)), cause loss of enjoyment of normal use of property (s. 13(1)(g)), or interfere with the normal conduct of business (s. 13(1)(h)). The choice of terms in s. 13(1) leads me to conclude that polluting conduct is only prohibited if it has the potential to impair a use of the natural environment in a manner which is more than trivial. Therefore, a citizen may not be convicted under s. 13(1)(a) *EPA* for releasing a contaminant which could have only a minimal impact on a "use" of the natural environment.

The Appellants further state that in *R. v. Dow Chemical Canada Inc.* (2000), 47 O.R. (3d) 577 (C.A.), the Court of Appeal found that the discharge of chlorine, a potentially deadly gas, from an industrial plant into the open air was “serious” even though it did not appear to reach the perimeter of the site, caused no off-site impacts and was unnoticed by all except one employee. The release of the gas was sufficient to disable, disorient, and traumatize this employee and he suffered significant physical injury in attempting to escape the area where the gas had been released. The Court found that the effect of the discharge on the employee was “very serious”.

The Director submits that the term “serious harm” has a different meaning than the term “adverse effect” used elsewhere in the *EPA*. The Director references *Sullivan on the Construction of Statutes*, 5th ed. (LexisNexis, 2008) for the principle that “given the presumption of consistent expression, it is possible to infer from the use of different words or a different form of expression that a different meaning was intended.” The Director states that this principle was relied on by the Supreme Court of Canada in *Frank v. The Queen* [1978] 1 S.C.R. 95. Further, the Tribunal followed this principle in *Safety-Kleen Canada Inc. v. Ontario (Ministry of Environment),* [2006] O.E.R.T.D. No. 14 and stated at paras 27-28:

> Therefore, it is necessary to refer to generally applicable principles of statutory interpretation. In Statutory Interpretation (Toronto: Irwin Law, 1997), Professor Ruth Sullivan outlines the principle that, **within a statutory enactment, the same words should carry the same meaning, while different words should be understood to carry different meanings**. Sullivan writes in Chapter 4:
>
> > As Sopinka J. wrote in R. v. Zeolkowski, [1989] 1 S.C.R. 1378 at 1387, "[g]iving the same words the same meaning throughout a statute is a basic principle of statutory interpretation. "**In light of this principle, and the legislature's preference for uniform expression, it follows that different words appearing in the same statute should be given a different meaning. …”**
>
> Thus, in O.Reg. 347, if the legislature had intended to mean utilize as fuel, it would have used the same word, "utilize", a second time. **Instead, it used**

> **different words, "treatment" and "processing". Therefore, it intended to mean something different from "utilize".** Therefore, "treatment or processing" means dealing with waste-derived fuel in some way other than burning it as fuel. (emphasis added)

The Director argues that because the Legislature chose to use a different term than “adverse effect” the Legislature intended a different standard to apply in the context of REA appeals. The Director notes that the term “adverse effect” is defined in s. 1 of the *EPA* as follows:

> “adverse effect” means one or more of,
>
> (a) impairment of the quality of the natural environment for any use that can be made of it,
>
> (b) injury or damage to property or to plant or animal life,
>
> (c) harm or material discomfort to any person,
>
> (d) an adverse effect on the health of any person,
>
> (e) impairment of the safety of any person,
>
> (f) rendering any property or plant or animal life unfit for human use,
>
> (g) loss of enjoyment of normal use of property, and
>
> (h) interference with the normal conduct of business;

With respect to the use of the modifier “serious”, the Director notes how this term has been used in other contexts. In *Black’s Law Dictionary*, 7th ed. (West, 1990), “serious” is defined as:

> “**serious**”, adj. **1.** (Of conduct, opinions, etc.) weighty; important <serious violation of rules>. **2.** (Of an injury, illness, accident, etc.) **dangerous; potentially resulting in death or other severe consequences** <serious bodily harm> (emphasis added)

The term “serious harm” is defined in the *Corrections and Conditional Release Act*, S.C. 1992, c. 20, s. 99 as meaning “severe physical injury or severe psychological damage”. Similarly, the *Ontario Natural Health Products Regulations*, S.O.R./2003-196, s. 1(1) define the term “serious adverse reaction” as follows:

> **“serious adverse reaction**" means a **noxious** and unintended response to a natural health product that occurs at any dose and that **requires in-patient hospitalization or a prolongation of existing hospitalization, that causes congenital malformation, that results in persistent or significant disability or incapacity, that is life threatening or that results in death.** (emphasis added)

The Director also notes judicial interpretations of the word “serious” in other contexts. Like the Appellants, the Director also refers to the *Meyer* decision. The Director notes that the Court of Appeal, in considering what can be classified as serious impairment, stated at para. 34:

> It is simply not possible to provide an absolute formula which will guide the court in all cases in determining what is "serious". This issue will have

> to be resolved on a case-to-case basis. However, **generally speaking, a serious impairment is one which causes substantial interference with the ability of the injured person to perform his or her usual daily activities or to continue his or her regular employment.** (emphasis added)

and also at para 63:

> When the legislature qualified "permanent impairment" by the word "serious" it obviously intended that injured persons must endure some permanent impairment without being able to sue.

The Director notes that in the criminal law context in *R. v. McCraw* [1991] 3 S.C.R. 72, the Supreme Court referred to the dictionary definition of serious and interpreted “serious bodily harm” for the purposes of the provision in question as being “any hurt or injury, whether physical or psychological, that interferes in a substantial way with the physical or psychological integrity, health or well-being of the complainant.” The Court states that: “it requires greater harm than the mere "bodily harm" described in s. 267; that is hurt or injury that interferes with the health or comfort of the complainant and that is more than merely transient or trifling in nature.”

The Director submits that:

> the above cases suggest that “serious harm” in the REA context must imply an effect more ‘serious’, substantial, grave or severe in degree and potential consequences than ‘mere’ adverse effects defined as “harm or material discomfort”, “adverse effect on health”, or “impairment of safety” otherwise defined in the *EPA*. It must be more than a complaint of mild or moderate harm, discomfort, annoyance, or nuisance.

The Director argues that because the environmental considerations, which are informed by the definition of environment in the *EAA*, include aspects of both the natural and man-made environment, “serious harm to human health” must mean something “more severe than the adverse effects to human health elsewhere defined and described in the *EPA*.”

The Appellants submit that the Tribunal should not rely on the criminal cases raised by the Director because criminal courts have different considerations than this Tribunal. Instead, the Appellants state that the Tribunal should give weight to the environmental cases under the *EPA* which they have cited.

Suncor refers to the *Operation Dismantle* case, where the Supreme Court states that when predicting future harm, the harm must be grave. Suncor submits that the meaning of “serious harm to human health” should be considered within the scheme of the *EPA*. Suncor submits that the term “serious harm” is new to the *EPA*, which has previously addressed harm to human health through the use of the term “adverse effect.” Suncor submits that “the EPA definition of “adverse effect” is relevant to defining the scope of the phrase, “serious harm to human health”, within Part XIII of the *EPA*. In particular, Suncor submits that the term “adverse effect” provides a global legislative context for impacts under the *EPA*. As such, this term provides useful

guidance on the narrower impacts which are the exclusive focus of an REA appeal." Suncor notes that the definition of "adverse effect" in the *EPA* includes a health effect. However, the REA reference to "serious harm to human health" is more limited because it does not include the range of effects on humans that "adverse effect" does and it requires "serious" harm instead of any adverse effect. Suncor submits that "the range of effects on humans within the definition of "adverse effect" provides a limit on what may be considered in a REA appeal: if a discharge of a contaminant is not an "adverse effect", it is equally not "serious harm to human health" within the context of an REA appeal." Specifically, Suncor submits that in the past 40 years of the *EPA*, adverse effect has not included "annoyance", so it is a problem to now say that the more onerous definition of "serious harm" would include annoyance.

The Parties made submissions with respect to the interpretation of "serious harm to human health" in section 145.2.1(2)(a) as compared to "serious and irreversible harm to plant life, animal life or the natural environment" in section 145.2.1(2)(b), given that clause (a) must be read in context. The Appellants note that the word "irreversible" was included in section 145.2.1(2)(a) in an earlier draft of the legislation, but that this term was removed before it was passed. This indicates that the Legislature does not intend that for the test to be met in clause (a), harm must be irreversible. The Appellants submitted that, based on the principle of statutory interpretation that different words mean different things, the meaning of "serious and irreversible" in clause (b) is different than "serious" in clause (a). They stated that, to meet the test in clause (a), the harm needs to be serious, but it may or may not be reversible.

The Director notes that an injury can be both serious and irreversible or serious and reversible. The Director submits that in the case of clause (a) of the test, it is the gravity of the harm that is at issue, and that reversibility, as found in clause (b), is a separate thing. The Director states that it does not mean that something is less serious if it is reversible, and harm that is irreversible is not necessarily serious. The Director submits that for this particular case, which relies on clause (a) of the test, the reversibility of the harm does not matter. Suncor submits that "serious and irreversible" is a more stringent test than "serious." Suncor endorses the Director's submissions on the meaning of serious and irreversible.

<u>"Human Health"</u>

The Appellants note that the WHO, in the preamble to its Constitution, defines "health" as:

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

The Appellants note that this definition was expressly adopted by the Supreme Court of Canada in *R. v. Morgentaler*, [1988] 1 S.C.R. 30. The Appellants submit that the Supreme Court made it evident that the term health is to be given a broad and liberal interpretation, which includes physical, mental and social well-being.

Findings on the Statutory Test

Though the Appellants chose to analyze each element of the statutory test separately, the Tribunal finds that there are limitations on the utility of such an approach. The task of this Tribunal, in adjudicating this first proceeding under section 145.2.1 of the *EPA*, is not to find synonyms or analogies for every word in the provision, which is not particularly ambiguous. Rather, the provision should be read as a whole. Having said that, the Tribunal is prepared to offer the following guidance on its approach to interpreting some aspects of each component of the test where appropriate. These comments will assist in explaining how the Tribunal interprets and applies the test as a whole.

"Will Cause"

With regard to the "will cause" arguments of the Parties, the Tribunal finds that there are some aspects of the case law cited by the Parties which are applicable here. For example, there is a distinction between medical (or scientific) causation and legal causation. The Tribunal is to determine whether specified harms will be caused according to the applicable legal standard, which is a balance of probabilities. That standard is not the exact same standard used by scientists, statisticians or medical experts. The Tribunal will take its direction on determining whether the Appellants have proven that harm will be caused according to the legal concepts of proof and causation. In doing so, it will assess the scientific evidence and consider which approaches to causation and proof were used in that evidence.

The Tribunal is aware that "causation" in many areas of scientific and legal inquiry is a complex issue. In epidemiology, for example, an outcome may be associated with an exposure without there being a causal link. Also, outcomes can be generated by multiple causes (as is the case with several of the effects spoken to during this Hearing). It can also be the case that two exposures acting independently will have no serious effect, but together they will (as in cumulative and synergistic effects). Further, there can be situations where a specific effect is already present but its incidence increases with a new exposure. As well, sometimes a causal link can be established, even if the specific mechanism responsible for that link has not been identified with certainty within a suite of plausible pathways.

It is the Tribunal's task to determine if the Project will cause the specified harm. In this case, the nature of the evidence has not necessitated specific findings on all aspects of the "will cause" submissions of the Parties. For this case, the Tribunal has examined the evidence about projected effects with a view to determining whether such effects will be caused by the Project. It should be noted that some effects, such as stress-related impacts that are allegedly caused by wind turbines, are also present in the general population due to the presence of other stressors. For those effects that already exist in the receiving population, the Tribunal needs to examine the evidence to determine whether an increase in the rate or magnitude of such effects will be caused by the Project. The Tribunal finds that it can consider what the Parties call "direct" and "indirect" effects. Regardless of whether an alleged harm is considered direct (e.g.,

a passer-by being injured by a falling turbine blade or a person losing hearing) or indirect (e.g., a person being exposed to noise and then exhibiting stress and developing other related symptoms), the Tribunal will consider whether they "will" be caused by the Project.

"Serious"

With regard to the word "serious", the Parties to this case put forward extensive argument. As per *Rizzo*, the words in a statute are to be read in their entire context. Therefore, even though this Hearing was confined to evidence about harm to human health, the Tribunal must interpret section 145.2.1(2)(a) in a manner that respects the wording of section 145.2.1(2)(b). For example, it should be noted that clause (a) refers only to "serious" harm, while clause (b) refers to "serious and irreversible" harm. One of the dangers of interpreting clause (a) in isolation is that it could result in a conclusion that may subsequently generate difficulties in cases involving clause (b). The potential for this type of unintended consequence arose in this Hearing where one of the Director's witnesses posited that "serious would be something of a serious functional impairment, a physiological impairment or tissue damage, and likely not to be reversible". Ms. Rotter, in her closing submissions, however, used several examples to acknowledge that there are situations where harm is serious and irreversible (e.g., loss of limb), serious and reversible (e.g., a long lasting infection), and irreversible but not serious (e.g., the loss of a toenail).

Even though this Hearing is confined to clause (a) matters, the Tribunal cannot ignore the fact that there are material similarities and differences between the two clauses. Indeed, the Tribunal heard evidence that the phrase "serious and irreversible" was initially in both clauses (a) and (b) of the bill that enacted section 145.2.1(2). As the bill proceeded through the Legislature, the word "irreversible" was dropped from clause (a). It would, therefore, be wrong for the Tribunal to read clause (a) in isolation from clause (b) and reach a conclusion that serious harm is something akin to irreversible harm, a proposition with which the Parties apparently agree. The Tribunal prefers an approach which gives meaning and a role to both terms.

Looking at living organisms, for example, there obviously can be harm that is both serious and irreversible, as noted by Ms. Rotter. For humans and other organisms, this can include mortality as well as other serious long-term conditions and diseases. From a medical perspective, the section 145.2.1(2) test is therefore expansive enough to cover both mortality and morbidity as serious matters.

There can also be harm that is serious but reversible. Curable serious conditions and diseases would fall into this category, which is only relevant to clause (a). For the sake of argument, there can even be harm that is irreversible but not serious. As noted by Ms. Rotter, the loss of a toenail would not likely satisfy clause (a) or (b).

The Tribunal notes that the above interpretations use living organisms as examples (whether humans in clause (a) or other animals or plants in clause (b)). When it comes to the harm to the "natural environment" phrase in clause (b), the words "serious and irreversible" would not be

confined to medical conditions, disease, injury or mortality (which affect human health or animal/plant life) as those concepts do not have direct application to the natural environment as a whole. Therefore, an appropriate interpretation of the words serious and irreversible needs to be readily applicable to the natural environment and not just organisms.

All of the above analysis leads the Tribunal to the conclusion that the concept of serious harm has to be one that has relevance to humans as well as plant life, animal life and the natural environment (including abiotic components). Where there will be serious harm to humans or serious and irreversible harm to animal life, plant life or the natural environment, the test will be satisfied. Therefore, the Tribunal has decided to eschew an approach of finding a synonym for "serious" or creating a list of medical conditions that are serious. The word needs to be given an appropriate breadth of applicability for it to have relevance throughout clauses (a) and (b). In this regard, the Tribunal agrees that a flexible approach is needed, as in *Meyer v. Bright* (1993), 15 O.R. (3d) 129 (C.A.).

Accordingly, interpretation of the word "serious" must be conducted through a case-by-case assessment of what is serious according to all relevant factors. It may be that, as more issues of potential harm are brought before the Tribunal and the case law develops, there will be more certainty about what the Tribunal is likely to term serious. At this early stage, it is appropriate to simply point out that the term "serious" should not be narrowly defined in a manner that may suit harm to human health but not the other subjects in clause (b). Clause (a) specifically, could encompass any harm to human health that is serious, regardless of whether it is irreversible.

To move from the abstract to the concrete, it is appropriate to assess the specific health conditions mentioned throughout this Hearing to determine if they are "serious" within the meaning of clause (a). Most of the Tribunal's analysis in this regard will be set out further below in the context of the evidence. At this point, however, it would be useful to settle some of the nomenclature to be used in this Decision with regard to the word "serious" and its relation to the word "annoyance".

In this case, there is apparent agreement that many of the medical conditions discussed by the witnesses are serious (the debate on those is, therefore, confined to whether they will result from the Project). It is, therefore, largely unnecessary to engage in an abstract discussion of the boundaries of "serious" in this case. There are several types of harm alleged by the Appellants that are clearly serious. The question is whether the Project will cause these types of harm, not whether they are serious. This is not to say that there is complete agreement on the appropriate categorization of the alleged harms raised by the Appellants. In fact, there is disagreement on the interplay between the concept of "annoyance" and "serious harm to human health". The Tribunal now turns to that important point, which was the source of significant disagreement among the Parties and some witnesses. The question to be answered is whether "annoyance" *per se* should be considered a serious health effect. While this appears to be an important legal point, it really is not. It is simply a case of being clear in the use of language.

It is important for the Tribunal to clarify how it will use the word “annoyance” in this Decision. As will be shown below, the key health effects of concern to the Appellants are to be assessed by the Tribunal whether one uses a broad definition of annoyance so as to capture those effects or a narrow definition. In the latter scenario, which is used here, the effects will still be assessed but they will be assessed in their own right, rather than as a species of annoyance. In any event, the serious health effects in question will be assessed according to whether they will be caused by the Project.

At points during the Hearing, the Tribunal heard evidence that annoyance itself can constitute serious harm while at other points annoyance was used as a term to connote a state of being that either falls short of serious harm or is a precursor to serious medical conditions that are recognized in the literature such as those associated with stress. In many ways, the differences in opinion boil down to different uses of the word “annoyance”. Like many words in the English language, the word “annoyance” can mean different things to different people and can mean different things in different contexts. Rather than descending into a semantic discussion of the meaning of annoyance, the Tribunal chooses to look at that term in the specific context of noise emissions.

In this case, the Appellants are not arguing that annoyance in its most narrow sense (e.g., being bothered or “annoyed” by having to wait in line) is a serious health effect. A broader view of annoyance, such that it includes stress related symptoms and other medically-recognized conditions that can clearly be considered serious, is what lies at the heart of the Appellants’ concerns stemming from annoyance. For the purposes of this Decision, the Tribunal has adopted a nomenclature whereby “annoyance” is not itself the medical effect of concern but rather one of the causes of the effects of concern, many of which can rise to the “serious” level. This approach fits with the fact the Tribunal heard evidence that annoyance is not found in the International Classification of Diseases.

The Tribunal recognizes that this approach differs from how some authors and witnesses have used the word “annoyance”, but this is understandable given the flexibility of the English language (for example, Dr. McMurtry stated that annoyance is an effect associated with stress, distress, sleep disturbance, etc.). Depending on how it is used, “annoyance” can mean anything from a very mild bother to a serious mental or psychological state. The Tribunal’s approach is simply a convenient way of sorting through the language used during the Hearing so as to focus on serious health effects, which is what is asked in the statute. This approach does not serve to exclude from consideration any of the specific health effects raised by the Appellants. What it is meant to do is provide some boundaries to the word “annoyance” by the Tribunal so that its use will be clear in this Decision. It should be noted that all of the individual health effects that can be included in a broader definition of annoyance than the one used herein will still be assessed in this Decision. The objective is for the Tribunal to determine if there will be serious harm to human health, regardless of the witnesses’ differences as to

whether one ought to label “annoyance” as the harm itself or something that is associated with, is a cause of, or is a precursor to more specific types of harm.

“Human Health”

With regard to the final portion of the statutory test, “human health” is another term that can be the subject of different interpretations. Though one witness expressed reservations with the WHO’s definition of health, the Tribunal finds that it is the most appropriate definition that was provided. The WHO’s broad approach to human health best fits with the statutory scheme, including the direction provided by the *Legislation Act, 2006* and will be used by the Tribunal in this Decision.

Cumulative Impacts of all Effects

Finally, it can be expected that appellants will raise multiple concerns regarding human health. From the statutory test, it appears that the test asks for a “global answer” to the question about serious harm. For example, if an appellant lists five types of harm that will potentially result from a project and the probability of each of them on its own falls below the “balance of probabilities” standard, it is important for the Tribunal to be provided evidence about the probability that at least one of them (regardless of which one) will occur. One could have a hypothetical situation where five completely different serious health effects each has a likelihood of 45% of occurring with a given exposure. Taken together, the likelihood that at least one of them will occur would still be greater than 50%. In such a case, the situation, viewed cumulatively, would satisfy the statutory test because it would be more probable than not that at least one serious health effect would occur. It is, therefore, important for the Tribunal to look at the totality of the evidence before reaching an informed conclusion on whether the legal test has been satisfied.

When it comes to the environment and human health, it is often the case that there are many different risks present. One can select one or two specific risks and state that the chances of one of them occurring at a particular site are relatively low. However, it is important to note that the cumulative chance of at least one risk being realized is much higher than the individual chance that any one particular risk will be.

Overall Approach to the Test

To summarize, the Tribunal’s overall approach to the statutory test is guided by *Rizzo*. The Tribunal will interpret and apply the wording of section 145.2.1(2) according to that approach. In many ways, the Tribunal finds that, despite the extensive submissions from the Parties, the wording is not particular ambiguous. As well, the nature of the evidence leads the Tribunal to approach the totality of the evidence according to the entire wording of the test rather than attempting to artificially subdivide evidence according to the components of the test.

Submissions on General Issues Related to the Qualification of Expert Witnesses:

The following section summarizes the Parties' general submissions (both at the beginning and end of the Hearing) on the qualification of expert witnesses as well as the approach that the Tribunal took in hearing expert evidence at the Hearing.

Introductory Submissions

The Appellants raise the question of qualification of expert witnesses by stating that the focus of the Hearing would be on impacts on human health, such as sleep disturbance, annoyance, stress or psychological distress, inner ear symptoms, headaches, excessive tiredness and loss of quality of life. The Appellants also indicated that they would be relying on the material facts and the evidence provided by the Presenter, Mr. Palmer, in relation to turbine failure and ice throw.

The Appellants asked the Tribunal to qualify ten witnesses to provide expert opinion evidence in a variety of disciplines:

- Dr. Robert McMurtry, an orthopaedic surgeon with a long history in the area of public health;
- Dr. Michael Nissenbaum, a specialist in diagnostic imaging and co-author of the first controlled epidemiological study (the "Study") looking at the relationship between industrial wind turbines and people and their health outcomes when living in proximity to industrial wind turbines;
- Dr. Jeff Aramini, an epidemiologist who would be speaking to the statistical aspect of the Study;
- Dr. Jeff Wilson, an epidemiologist, who would be presenting evidence respecting a peer review that he conducted of the Study;
- Dr. Carl Phillips, a specialist in public policy with extensive experience in epidemiology and related health sciences, who would be presenting an evaluation of the available scientific evidence;
- Dr. Christopher Hanning, a leading medical sleep specialist in the United Kingdom, who would be speaking to the question of sleep disorders as they relate to industrial wind turbines;
- Dr. Arline Bronzaft, a psychologist who has conducted landmark research into the effect of noise on learning, who would be speaking to the link between exposure to noise and adverse effects on mental and physical health and well being;
- Dr. Robert Thorne, an acoustician and Dr. Daniel Shepherd, a psychoacoustician, who would be testifying as a panel regarding their experience with numerous wind projects in Australia and New Zealand; and,

- Richard James, who has extensive experience in industrial noise and industrial wind turbine noise.

The Appellants submit that their case is based on science. While that science is an emerging one, the Appellants indicate that it has evolved to the point where experts from Canada, United States, United Kingdom, Australia and New Zealand, would be coming before the Tribunal to say that, in their professional opinion the Kent Breeze Wind Project, as approved, will cause serious harm to human health. The Appellants argue that all of their witnesses should be permitted to provide expert opinion evidence.

Suncor indicates that its independent experts, who had reviewed the information provided by the Appellants and their witnesses, would testify that engaging in the project will not cause serious harm to human health. Suncor indicates that it intended to call several expert witnesses. Suncor submits that nine of the Appellants' ten witnesses are associated with the organization called SWV, either as members of the Board of Directors or as scientific advisors. Suncor argues that the Tribunal would need to consider whether the Appellants' witnesses could be qualified as experts who are required to be impartial, objective experts and not advocates.

Like Suncor, the Director indicates that he intended to call several expert witnesses. The Director argues that the experts that the Appellants had rallied from around the world and Ontario were essentially advocates. The Director states that nine of the ten belong to an advocacy group specifically put together to oppose wind turbines. The Director suggests that the Tribunal was hearing this appeal, not because the specific project is causing harm to residents around it but because this is the first project. Counsel for the Director submits that the Appellants' expert evidence, as it is characterized, consists largely of hearsay and unconfirmed assertions and speculations, "and a lot of it is fear mongering and kind of rabble-rousing."

The Director states that he would show that the Appellants' witnesses have an anti-wind turbine agenda that they are trying to further with this appeal, as they were trying to further it in the recent judicial review in *Hanna v. Ontario (Attorney General)*, 2011 ONSC 609. The Director states that Drs. Hanning, Nissenbaum and McMurtry provided affidavits in support of the judicial review applicant who sought a declaration of invalidity with respect to certain sections of O. Reg. 359/09, made under the *EPA*. The Director states that he would be presenting detailed technical evidence about how and why the project will not cause any harm or affect anyone's health.

The Director's Submissions

The Director argues that at least nine of the Appellants' ten witnesses ought not to be qualified as experts who can give opinion evidence. The Director points out that, according to the Tribunal's Practice Direction for Technical and Opinion Evidence (the "Practice Direction"), experts are required to give objective scientific opinions on technical matters to assist the Tribunal. They are not supposed to give opinions that actually decide the very question that the

Tribunal is to decide. The Director points out that the Appellants had stated that all of their experts would give evidence to show that proceeding with the Project will cause harm to human health. However, he argues this is exactly the question the Tribunal is asked to answer under the *EPA*. The Director submits that, if the experts were proposing to answer that question, this is improper. The Director refers to the Practice Direction, which states, at section 7: "…Expert witnesses must present evidence in an unbiased manner and not act as an advocate." The Director submits that the Appellants' experts were not complying with that provision.

The Director states that the language used by the SWV takes it as a given that risk and adverse health effects will arise from exposure to wind farms or that there is a causal relationship between health effects and exposure. He states that, according to material on its website, SWV purports to promote "the development of authoritative wind turbine guidelines to protect the health and safety of communities" with a "mission" to "mitigate the risk of both psychological and physiological adverse health effects" from wind farms. He indicates that the SWV says that "currently there are no authoritative guidelines for the siting of turbines" and discounts all the existing guidelines, studies, and regulations in Ontario and elsewhere that contradict the SWV's position.

The Director submits that the SWV is a serious advocacy group and that, based on this predetermined stand and lack of independence with respect to the issues here, none of the proposed witnesses should be admitted as experts, given that nine of the Appellants' ten experts are associated with the SWV as directors or scientific advisors. The Director states that Drs. McMurtry, Hanning, Nissenbaum and Mr. James are also listed as Corporate Directors under the *Canada Corporations Act*. The Director argued that all of the witnesses are adopting a uniform "party line" according to the SWV's approach. As a result, the Director submits, none of them can be objective and provide the Tribunal with objective scientific advice. The Director argues that their evidence should be given no weight.

Further, the Director argues, in the Appellants' witness statements, they all refer to each other's work with approval and discount any contrary opinions. For example, Drs. Hanning, Nissenbaum and Aramini worked together on the Study and cross-reference and cite with approval each other's work, while discounting everyone else's.

The Director also indicates that Dr. Nissenbaum testified in the case of *McKinnon v. Martin* involving a wind farm, in which the Saskatchewan Court of Queen's Bench declined to qualify him as an expert in an injunction application because "he has assumed the role of an advocate", "makes bold, unsupported statements on issues critical to the injunction", and lacked the requisite objective approach to the issues.

The Director also refers to Mr. James, an engineering witness for the Appellants, who indicated that he has been involved in many hearings and testified in opposition to wind projects across the United States.

The Director also submits that it appears that many of the Appellants' witnesses involved themselves in this issue for personal partisan reasons. The Director argues that Drs. Hanning, McMurtry and Nissenbaum conceded that they only became involved and acquired expertise in the issue of noise and wind farms when they thought wind farms would be located near their residences. For example, at page 2, paragraph (e) of Dr. Hanning's witness statement, he talks about the village in England where he lives being "threatened with a wind farm", prompting him to become involved with a group opposing the development.

The Director states that Dr. McMurtry concedes that he became involved because there were proposals to put up wind farms in Prince Edward County where he was planning to build his retirement home. The Director points out that Dr. McMurtry is a Director for the Alliance to Protect Prince Edward County which believes that "[a]ny installation of industrial scale wind turbine complexes in Prince Edward County will be detrimental to its unique character" and is generally opposed to the development of wind turbines. The Director submits that Dr. McMurtry's evidence shows that he is personally and politically, although not professionally, "involved in the movement to prevent the development of wind turbines". To this end, the Director submits, Dr. McMurtry has made submissions about the legislative scheme; attended meetings and rallies opposing wind turbines; and met with government officials "to attempt to influence the development of legislation relating to wind turbines". The Director states that in his testimony in this matter, Dr. McMurtry referred to himself as an advocate and admitted that he is not "perfectly neutral" because he is "trying to draw the government's attention to the fact that there are concerns".

The Director argues that Dr. Nissenbaum became concerned because of wind farms in Maine near where he lives and that Dr. Aramini, an epidemiologist, became involved after attending a public information session on wind turbines, in Fergus, where he lives (approximately two and a half kilometres from a proposed wind turbine project) and that he subsequently joined an opposition group. The Director also states that Dr. Phillips, a consultant with a Ph.D. in public policy, wrote a blog in July 2010 criticizing wind turbines and also testified before the Wisconsin Public Services Commission in July 2010 on the adverse health effects from wind turbines. The Director argues that the work done by Drs. Nissenbaum and Aramini was not funded neutrally but was "done to prove a thesis they had".

In addition, the Director argues that the Appellants' witnesses lacked the specialized knowledge required of an expert, which the Director addressed as each expert's credentials were presented throughout the Hearing and in final submissions.

The Director submits that Dr. McMurtry purported to give opinion evidence on harm to human health from wind turbines, noise characteristics of wind turbines and measurement of that noise, compliance monitoring and other technical matters such as visual impact, "research gaps" and the Director's consideration of the SEV. He also provides commentary on the technical literature reviews published by the Respondents' witnesses. The Director submits that, although Dr. McMurtry is a well-respected orthopaedic surgeon and an accomplished

professional, he has no credentials, expertise or professional experience nor has he conducted any original research, in any of the areas he addressed in his evidence. The Director submits that Dr. McMurtry's medical experience does not "encompass questions of risk to human health in psychological, neurological, optical or audiological domains". The Director argues that Dr. McMurtry's 3700 hours of self-acquired knowledge on wind turbine issues was not acquired in the course of his duty as a neutral expert. This is in contrast to Dr. Colby, who created a literature review as part of his duties as Acting Medical Officer of Health. The Director argued that Dr. Colby is recognized as an expert, not an advocate.

The Director further argues that Dr. McMurtry's area of expertise, as proposed by the Appellants, "as a physician and surgeon with experience in delivery of health care, health care policies and health policy", is not relevant to the subject matter of this Hearing, namely environmental impacts, about which Dr. McMurtry has no professional expertise. The Director states that the issues are not about health care (delivery or policies) or health policy.

The Director refers to *Bryson v. Canada (Attorney General)* (2009), 45 C.E.L.R. (3d) 107 (N.B.Q.B.), in which the Court rejected the opinion evidence of a witness who conducted research and attached to her affidavits copies of various articles and papers prepared by other authors but had no specific expertise in the relevant fields of epidemiology, toxicology, immunology and endocrinology. The Director suggests that Dr. McMurtry's situation fit those facts.

The Director also refers to *Western Forest Products Inc. v. Sunshine Coast (Regional District)* (2007), 93 Admin. L.R. (4th) 163 (B.C. Sup. Ct.), in which the Court found that it was unreasonable to prefer the opinion evidence of a non-expert over that of a qualified expert, which was not contradicted by any other expert evidence.

The Director also refers to sections 5 and 9 of the Practice Direction (see Appendix B) and to the consolidated recommendations of the Goudge Inquiry into Paediatric Forensic Pathology in Ontario. Regarding the role of courts, at Chapter 18, Commissioner Stephen T. Goudge recommends:

> 129. When a witness is put forward to give scientific evidence, the court should clearly define the subject area of the witness's expertise and vigorously confine the witness's testimony to it.
>
> 130. A concern about the reliability of evidence is a fundamental component of the law of evidence. Threshold reliability plays an important role in determining whether the proposed expert evidence is admissible under the *Mohan* test. Reliability can be an important consideration in determining whether the proposed expert evidence is relevant and necessary; whether it is excluded under any exclusionary rule, including the rule that requires evidence to be excluded if its prejudicial effect exceeds its probative value; and whether the expert is properly qualified. Trial judges should be vigilant in exercising their gatekeeping role with respect to the admissibility of such evidence. In particular, they should

> ensure that expert scientific evidence that doesn't satisfy standards of threshold reliability be excluded, whether or not the science is classified as novel.
>
> 131. In determining the threshold reliability of expert scientific evidence, the trial judge should assess the reliability of the proposed witness, the field of science, and the opinion offered in the particular case. In doing so, the trial judge should have regard to the tools and questions that are most germane to the task in the particular case.

The Director also refers to the case law on the issue of expert witnesses. The decision in *The* "*Ikarian Reefer",* [1993] 2 Lloyd's Rep. 68 (Eng. Comm. Ct.) lists several duties with which experts must comply. The key duties, according to the Director, are: 1) "Expert evidence presented to the court should be, and should be seen to be, the independent product of the expert uninfluenced as to form or content by the exigencies of litigation", 2) "An expert witness should provide independent assistance to the court by way of objective, unbiased opinion in relation to matters within his expertise", and 3) "An expert witness should state the facts or assumption upon which his opinion is based. He should not omit to consider material facts which could detract from his concluded opinion."

The Director states that the leading case in Canada is *R. v. Mohan,* [1994] 2 S.C.R. 9. At para. 17, the Court states:

> Admission of expert evidence depends on the application of the following criteria: (a) relevance; (b) necessity in assisting the trier of fact; (c) the absence of any exclusionary rule; (d) a properly qualified expert.

The Court went to on to explain these criteria beginning at para. 19.

The Director also relies on *Fellowes, McNeil v. Kansa General International Insurance Co.* (1998), 40 O.R. (3d) 456 (Gen. Div.), which refers to both *Mohan* and *The "Ikarian Reefer"*. The judge stated:

> An expert must have a minimum requirement of independence.
>
> Experts must not be permitted to become advocates. To do so would change or tamper with the essence of the role of the expert, which was developed to assist the court in matters which require a special knowledge or expertise beyond the knowledge of the court.
>
> …
>
> Finally, an expert's report "cannot be advocacy dressed up as expert opinion". (citation omitted)

The Director also notes the following paragraph from *R. v. Montague* (2007), 74 W.C.B. (2d) 62 (ON Sup. Ct.):

> While most experts tendered to the Court today are not truly independent there comes a point where the expert is recognized as being an advocate of a position to such an extent that his impartiality cannot be relied upon. The place of such a person is at the counsel table, not the witness box.

The Director also relies on *Alfano (Trustee of) v. Piersanti* (2009), 176 A.C.W.S. (3d) 152 (ON Sup. Ct.) at paras. 6-7:

> The court expects objectivity on the part of the expert. In other words, he or she cannot "buy into" the theory of one side of the case to the exclusion of the other side. To do so, poses the danger that could taint the court's understanding of the issues that must be decided with impartiality and fairness to both sides. The fundamental principle in cases involving qualifications of experts is that the expert, although retained by the clients, assists the court. If it becomes apparent that an expert has adhered to and promoted the theory of the case being advocated by either Plaintiffs or Defendants, he or she becomes less reliable and is not an expert in the way that the role has been defined in the recent and well known jurisprudence.
>
> Before I leave the topic of the proper role of an expert, I refer to Farley J's decision in *Bank of Montreal v. Citak*, 104 A.C.W.S. (3d) 100. At paragraph [5] in his reasons for judgment, he said the following:
>
> > Experts must be neutral and objective, to the extent that they are not, they are not properly qualified to give expert opinions (citations deleted). To the extent that Mr. Hill has merely used the views of Mr. Citak as to the state of affairs and based his opinion on these views, Mr. Hill is building on a foundation of sand, not rock.

The Director submits that the Court determined that it was entitled to exercise a gatekeeper role and dispense with the evidence without listening to it. The Director submits that there are two lines of cases. One line holds that a decision-maker can admit the evidence of an expert and decide what weight to give to it at the end of the day, while the other indicates that if evidence is tainted or does not have the requisite impartiality and objectivity, the Court should act as a gatekeeper and decline to hear it up front. The Director states that a discussion of the two lines of cases is set out in the case of *United City Properties Ltd. v. Tong*, 2010 BCSC 111, which states at paras. 48 and 58:

> Casey Hill et al., *McWilliams' Canadian Criminal Evidence*, looseleaf (Aurora, Ontario: Canada Law Book, 2009) at section 12:30:20:50 presents a strong case for considering bias as a precondition to admissibility. McWilliams suggests a restrictive, but contextual, approach. The argument is based on the importance of impartiality in light of the rationale for allowing expert evidence, at p. 12-58:

> The importance of impartial expert opinion testimony cannot be overemphasized. The expert's evidence is permitted in the limited circumstances of a necessary exception to an exclusionary rule. Partial or biased evidence amounts to an abuse of the exceptional indulgence or opportunity to provide opinion testimony. This is so having especial regard to the limited effectiveness of cross-examination of an expert witness and ... the contours of the hearsay exception relating to an expert's reliance in formulating an opinion on facts, data or material not otherwise proven by admissible evidence at trial.

…

In *R. v. J.-L.J.*, 2000 SCC 51, [2000] 2 S.C.R. 600, the Supreme Court of Canada dealt specifically with the trial judge's gatekeeper function vis-à-vis experts in the context of novel scientific evidence. Justice Binnie, for the Court, reiterated the statements from Mohan quoted above, and remarked on the trial judge's role as gatekeeper at para. 28:

> In the course of *Mohan* and other judgments, the Court has emphasized that the trial judge should take seriously the role of "gatekeeper". The admissibility of the expert evidence should be scrutinized at the time it is proffered, and not allowed too easy an entry on the basis that all of the frailties could go at the end of the day to weight rather than admissibility.

The Director submits that the approach of listening to the evidence and weighing it should be rejected as being inconsistent with the gate keeping function envisaged by the Supreme Court in *Mohan*. The Director submits that the Tribunal should be reluctant to admit all the evidence and assign weight later. Rather, there is a serious and important gate keeping function to be exercised up front.

The Director submits that all those associated with the SVW adhere to the same views and have the same advocacy goal of promoting their agenda. Therefore, the Director submits, none of them should be qualified as an expert. The Director submits that they come to the Tribunal not for reasons of concern about the specific project, but in order to further that agenda. The Director argues that it is not appropriate for them to be qualified as expert witnesses, that their evidence should not be given any weight and that any opinion evidence offered by the Appellants' experts, and in particular Drs. McMurtry, Nissenbaum, Hanning and Phillips, should not be accepted "in preference to opinion evidence from the acknowledged and properly qualified experts of the Respondents".

The Director submits that the qualification issue is not a question of credibility, which relates to whether someone can be believed. It is a question of the weight that can be placed on opinion evidence. The Director submits that no weight should be given to the Appellants' witnesses' opinions because they are not properly qualified. The Director agrees that there is some risk

from wind turbines: “We don’t want any of them two or three feet away from our houses and nobody’s talking about that kind of risk here.” The Director submits, however, that there is no risk at the setbacks approved in this case.

Suncor’s Submissions

Suncor supports the general position put forward by the Director. Suncor agrees with the case law and the overarching need to ensure, as the Practice Direction states expressly, that experts are to be objective and unbiased. Suncor agrees with the Director that the gate keeping function of a decision maker is crucial.

Suncor submits that the “Appellants’ case involves a radical departure from the principles and rules applied by courts and tribunals to the admissibility of expert evidence”, which, it states, are well-established and have received attention and reinforcement as a result of the recent Goudge public inquiry and civil justice reforms. Suncor says these are reflected in changes to the Rules of Civil Procedure and tribunal rules, including those of the Tribunal.

Suncor says that the accepted principles have the following components. It argues that expert evidence is an exception to the normal rules of evidence that exclude opinion evidence and must be constrained at the outset through the “gatekeeper function”, rather than being allowed liberally with subsequent decisions being made about its weight. In support of this principle, Suncor refers to *Mohan* and sections 4, 8 and 9 of the Practice Direction (See Appendix B). Suncor submits that an example of a failure of justice arising from a court’s admission of opinion evidence without careful scrutiny of its impartiality and reliability was recently the subject of the Goudge Inquiry Report which examined the issue of the reliability of forensic pathology evidence. Suncor submits that the Goudge Inquiry Report provides that once experts are qualified, care should be taken to ensure that they stay within the bounds of their expertise.

Suncor argues that, if an opinion has no verified basis or acceptance “within the community of knowing individuals”, particularly where it is claimed that it is science-based, it is not acceptable expert opinion. Suncor states that section 5 of the Practice Direction provides the context for that assertion, but it is *Mohan* that explicitly addresses the issue of expert evidence that seeks to advance a novel scientific theory or technique:

> [E]xpert evidence which advances a novel scientific theory or technique is subjected to special scrutiny to determine whether it meets a basic threshold of reliability and whether it is essential in the sense that the trier of fact will be unable to come to a satisfactory conclusion without the assistance of the expert. The closer the evidence approaches an opinion on an ultimate issue, the stricter the application of this principle.

On the issue of the requirement that expert opinion be unbiased and distinct from advocacy, Suncor refers to section 9(e) of the Practice Direction and to recent amendments to the Rules of Civil Procedure (sections 4.1.01(1) and (2)).

Based on these principles, Suncor submits, the Appellants' case depends "substantially, if not entirely, on inadmissible opinion evidence". In its submissions, Suncor points out the following examples.

Suncor states that several witnesses gave no opinion on matters for which they were qualified as experts, instead giving opinion evidence on matters outside that expertise, including: Dr. McMurtry (expert in surgery and health policy but gave evidence on wind turbine noise, epidemiological studies and the adequacy of MOE noise standards and measurement and monitoring techniques); Dr. Nissenbaum (expert in diagnostic imaging with knowledge of medical physics, internal medicine and primary care but gave evidence on epidemiology, i.e., the statistical validity of a study based on responses to a questionnaire); and Dr. Hanning (qualified as a medical doctor with experience in sleep medicine and sleep physiology but agreed that he had no training in acoustics or psychology and did not clinically examine any individuals living near wind farms, but gave evidence on the health impacts of exceeding certain noise levels and certain setbacks).

Suncor submits that two witnesses gave opinion evidence on topics for which they have no identifiable expertise: Dr. Thorne was qualified as an expert in environmental health, with knowledge of acoustics and psychoacoustics; despite admitting in cross-examination that he is not an epidemiologist and was not working with one, his opinion was that up to 5 to 10% of exposed households will have their health seriously harmed by noise causing sleep disturbance, anxiety and stress; Dr. Phillips, introduced as an expert in public health, with knowledge of epidemiology and related health sciences, has no degree in epidemiology, yet said that there is enough scientific evidence to conclude that serious health effects occur for some people living near wind turbines (in cross-examination he admitted that he could produce no evidence that quantified complaints from wind turbine noise).

Suncor argues that several witnesses gave opinion evidence based on "unpublished and/or inaccessible documents that are at odds with existing science on noise levels and human health, and that fails to meet the required "strict" standard of scrutiny on reliability". Suncor argues that Mr. James, an acoustician, gave contradictory opinion evidence on several points and unsubstantiated opinion on others, such as in relation to his criterion of 35d BA as a standard, the requirement that 3 dBA be added to all modeled sound levels, wind shear adjustment, whether the ISO standard contained a limit on height of noise sources that was not met by the Hatch report, and whether the CMOH Report of represents a complete review of information on infrasound and low frequency noise.

Suncor submits that Dr. Bronzaft, introduced as an expert in environmental psychology with knowledge of noise and its effects on humans, admitted that she has no special training as a clinician in psychology and agreed that she has not conducted any research into wind turbine noise or noise in rural settings, nor was she familiar with the WHO Night Noise Guidelines.

Suncor states that Dr. Shepherd, introduced as an expert in psychoacoustics, with knowledge of human health and qualify of life, agreed that he was neither an engineer, epidemiologist nor a

clinical physician or treatment provider; however, he claimed that there will be serious health effects where noise is below 40 dBA, based on unpublished data from a survey but agreed on cross-examination that his presentation of the data did not conclude that there will be serious harm to human health below 40 dBA.

Suncor argues that Mr. Palmer was not retained by any Party but came forward as Presenter, then, at the request of the Appellants, sought to be qualified as an expert.

Finally, Suncor states that several of the Appellants' witnesses do not appear to be unbiased and impartial, such as members of the SWV, Mr. James and Drs. Nissenbaum, Hanning and McMurtry, members of other organizations opposing wind turbines, Drs. Aramini and McMurtry and one who has engaged in general advocacy opposing wind turbines, Dr. McMurtry.

The Appellants' Submissions

The Appellants concede that there is no disagreement amongst the Parties in terms of the relevant case law. *Mohan* is the test given by the Supreme Court of Canada and it is consistently applied by courts and tribunals. The Appellants note that much of the case law raised by the Director was raised by the respondent in the *Hanna* case. The Appellants state that they were concerned that this matter proceed as expeditiously as possible and made several submissions to allow the Tribunal to resolve the global issue of expert witness qualification.

With respect to the Director's objection that the mission statement of the SWV assumes a risk of adverse health effects from wind turbines, the Appellants submit that there is an uncontested fact before the Tribunal that there is such a risk, as is evidenced by the fact that a regulation establishes a setback distance of 550 m. The Appellants argue that this constitutes a direct acknowledgment by the Government of Ontario and by all experts in this proceeding who say it must be complied with, that there is a risk of adverse health effects if people are placed too close to wind turbines. The implication is that there is nothing wrong with the SWV assuming that such risks exist, when it appears that the Government of Ontario acknowledged that there were risks in establishing a mandatory setback distance. The Appellants submit that the difference lies in the degree of the risk, which is the question before the Tribunal, and not whether there is any risk at all. The Appellants question whether the Director correctly identified the risk and whether harm to humans will ensue.

Viewed in that light, the Appellants submit, association with the SWV is not an automatic disqualifier in that the Director's argument does not meet any legal, practical or ethical test of how an expert should be regarded. If it did, then, in the Appellants' submission, almost every expert being called by Suncor or the Director would also have to be disqualified because many of them have a connection to the CanWEA, which is an advocacy organization that advocates on behalf of the wind industry. However, the Appellants state, they are not seeking to disqualify the witnesses for Suncor and the Director on that basis. The Appellants submit that any specific

questions regarding qualification should be dealt with on an individual basis, together with any other issues relating to credibility.

With respect to the issue in *McKinnon v. Martin*, the Appellants distinguish the situation in that case with the one here. The Appellants indicate that caution is in order since the Tribunal does not have the affidavit from the *McKinnon v. Martin* case before it. The Appellants also state that the reference to Dr. Nissenbaum's work in the Mars Hill area in the Saskatchewan case was to a pilot study rather than the newer study before this Tribunal. The Appellants submit that making a decision about Dr. Nissenbaum's qualifications on the basis of the information provided, before he had an opportunity to provide an explanation, would put the Tribunal in a poor position to decide on his credibility.

The Appellants argue that there would be challenges by all three Parties to many of the witnesses but that they should be dealt with when the witnesses are called. For example, the Appellants submit that experts to be called by the other Parties have collaborated in the same way that Drs. Nissenbaum, Hanning and Aramini have worked on a paper together. Drs. Leventhall, McCunney and Colby have all collaborated on a paper.

The Appellants suggest that, with regard to the issues raised by the Director about the Appellants' witnesses, many, if not all of those things could be said regarding the witnesses for the Director and Suncor. The Appellants submit that the Hearing ought to move forward in the normal course.

The Appellants submit that the record demonstrates that the experts called by the Appellants have studied or gained extensive experience in the areas on which they testified and that many of the Respondents' witnesses rely on similar qualifications, such as Dr. Colby, who is an infectious disease specialist who has no professional training respecting wind turbines but has acquired knowledge through other means. The Appellants submit that since the Respondents rely on such witnesses, they ought not to question the expert status of the Appellants' witness who are in similar circumstances.

The Appellants submit that many of those called by them also have specific and direct experience with science on wind turbines and human health and direct experience with wind turbine projects and people living near them in many parts of the world.

The Appellants disagree with the Respondents' claim that the Appellants requested that the Tribunal not address expert evidence as a gatekeeper, but rather admit it and address its weight following final submissions. The Appellants' position is that the Tribunal performed the gatekeeper function in the case of every witness called by the Appellants. The respondents challenged qualifications and the Tribunal issued oral rulings. Thus, the normal practice was followed.

With respect to the Respondents' claim that the Appellants requested that the Tribunal admit as expert evidence a variety of opinions with no relationship to the basis of claimed expertise, the Appellants respond that that their experts were properly qualified to give the evidence they

presented; their qualifications were reviewed by the Tribunal and they were permitted to testify. The Appellants submit that the time to take objection to specific evidence was at the time the witnesses were present; this approach reduces hearing time, avoids issues raised by *Browne v. Dunn* (1894), 6 R. 67 (H.L.) and forms part of procedural fairness. Where this approach was taken, the Parties may make submissions going to weight.

With respect to the Respondents' claim that the Appellants requested that the Tribunal admit as expert opinion a variety of unpublished opinions with no scientific foundation and at odds with current science, the Appellants say that the science relied on by the Respondents either does not address the indirect effects of wind turbines (e.g., the AWEA/CanWEA Report or the CMOH Report) or acknowledges them, such as the Pedersen et al. studies. The Appellants submit that their experts also relied on this science and the Appellants rely on statements made by the Respondents' witnesses, such as Dr. Leventhall, Dr. Colby and Mr. Howe. Thus, the Appellants submit, the Respondents' position is at odds with their evidence.

With respect to the issues raised about Mr. Palmer, the Appellants state that Mr. Palmer chose independently to participate in the hearing. They said that the courts have accepted witnesses as experts where they were parties to a hearing. Further, there is nothing unusual in a party relying on evidence presented by a witness for another party, which the Appellants do in this case. The Appellants refer to *Wynberg et. al. v. HMQ* (June 2, 2003) (Ont. S.C.J.) [unreported] at para. 3, per Kiteley J.:

> For the purposes of this ruling, and in view of the assumed description of the scope of their expertise, I accept that both of these witnesses have the "acquired special or peculiar knowledge through study or experience." Accepting that there is a threshold level of reliability, I see no basis for holding that each of them fails to meet that threshold simply because they are parties. Their evidence as experts is not inadmissible on that basis.
>
> I therefore overrule the objection and find that the issue of the party status of Thibodeau and Laredo is a question of weight, not admissibility.

With respect to the Respondents' claims that the Appellants requested that the Tribunal admit as expert evidence opinions of individuals who were not unbiased and independent, but advocates opposed to wind energy, the Appellants submit that "membership in an organization or generalized allegations is not the test". The Appellants submit that the Tribunal must consider the evidence regarding each witness and determine the weight to be given their testimony based on the facts; this is the normal approach.

With respect to the seven criteria respecting opinion evidence from the Goudge Inquiry Report put forward by Suncor, the Appellants state that the criteria assist the decision maker in analyzing expert evidence as part of its gatekeeping function. The Appellants submit that the Tribunal had performed this function and would continue to do so as it assessed all of the evidence presented by the Appellants, Respondents and Presenter.

Relying on *R. v. Deacon* (2006), 146 C.R.R. (2d) 140 (ON S.C.J.) and *R. v. Karaibrahimovic* (2002), 2 Alta. L.R. (4th) 213 (C.A.), the Appellants argue that this approach does not include consideration of findings made by courts in previous hearings, such as in *McKinnon* v. *Martin* regarding Dr. Nissenbaum. *R. v. Karaibrahimovic* states:

> 7. … Cross-examination of a witness about whether the witness's testimony in previous proceedings was rejected or disbelieved is irrelevant and ought not to be permitted….
>
> 8. Sound policy reasons exist for not using a present trial as an opportunity to assess, or reassess, a witness's evidence in another, unrelated trial. The most obvious problem is that what happened in the first trial, including the reasoning of the trier of fact in that trial, would not be known to the trier of fact in the second….
>
> 11. …The rationale for the collateral evidence rule, that is to avoid mini-trials within trials on collateral issues, applies with equal force to cross-examining experts about the treatment of their testimony in prior cases.

The Appellants argue that this approach also does not include criticism of witnesses for considering the same test that the Tribunal will be applying, such as in the case of Dr. Hanning providing evidence respecting the test of "serious harm" that applies in this proceeding, when he had not addressed this test in others. The Appellants state that a primary purpose of expert evidence is to assist the Tribunal and that many experts called by both the Respondents and the Appellants gave evidence regarding serious harm. The Appellants submit that it is proper for the Tribunal to receive this evidence and weigh it, on the understanding that the Tribunal alone has the jurisdiction to decide the issue.

The Tribunal's Approach to the Qualification of Witnesses at the Hearing:

During the course of the Hearing, the Tribunal made specific rulings on the qualification of each proposed expert, as set out in the transcript of proceedings. In some cases, there were no objections. In other cases, the Tribunal considered the objections but nonetheless determined that the witness could provide opinion evidence in a given area of expertise. In some cases, the Tribunal considered the objections, allowed the opinion evidence to be put forth but pointed out that questions about the scope of a witness's evidence vis-à-vis the area in which the expert was qualified and the weight of that witness's opinion evidence would be considered by the Tribunal in light of any further submissions made by Counsel. The Tribunal's rulings on the admissibility of the proposed opinion evidence were made in the context of the relevant case law provided by Counsel as well as the *SPPA* which provides considerable flexibility on evidentiary matters. Section 15 of the *SPPA* states:

> 15 (1)Subject to subsections (2) and (3), a tribunal may admit as evidence at a hearing, whether or not given or proven under oath or affirmation or admissible as evidence in a court,

> (a) any oral testimony; and
>
> (b) any document or other thing,
>
> relevant to the subject-matter of the proceeding and may act on such evidence, but the tribunal may exclude anything unduly repetitious.
>
> (2) Nothing is admissible in evidence at a hearing,
>
> (a) that would be inadmissible in a court by reason of any privilege under the law of evidence; or
>
> (b) that is inadmissible by the statute under which the proceeding arises or any other statute.
>
> (3) Nothing in subsection (1) overrides the provisions of any Act expressly limiting the extent to or purposes for which any oral testimony, documents or things may be admitted or used in evidence in any proceeding.

In one case, with respect to the Presenter, Mr. Palmer, the Tribunal reserved its ruling on qualification because the Parties had reached a practical agreement (given time constraints present in the Hearing) that his evidence would be admitted and that his expertise would be challenged on a later date. The issue respecting Mr. Palmer's qualification is discussed later in these reasons.

Much of the opposition to the qualification of most of the Appellants' expert witnesses focused on their affiliation with the SWV, and in particular the fact that the SWV assumes that wind turbines can generate adverse effects. Based on the limited information provided during the Hearing, the Tribunal did not find that affiliation with the SWV compromised the objectivity of the Appellants' witnesses. As noted by the Appellants, the Director freely admitted that it would not be appropriate to construct a large turbine right next to a residence. Thus, the fact that the SWV appears to assume that, generally speaking, there are adverse effects from turbines does not seem to differ from the Director's position that some kind of setback is needed. The difference of opinion in this Hearing was really about how great a setback is needed. The Director and Suncor did not seek to promote a view that it was appropriate to have no setback at all. Given that, it follows that it would not be appropriate to disqualify expert witnesses on the simple basis that they are affiliated with the SWV, which assumes that there are some adverse effects.

Another aspect of the SWV's views was also the focus of some of the challenges to the qualification of the Appellants' witnesses, namely the SWV's view that there are no "authoritative" guidelines regarding wind turbines. Again, the differences of opinion on this issue did not constitute an adequate basis to disqualify witnesses associated with the SWV. The Tribunal heard evidence that the Province of Ontario and other jurisdictions do have guidelines, standards, and/or regulations regarding wind turbines. These documents are authoritative in at least one sense of that word, in that they were issued by regulatory authorities. However, the SWV appears to be using the word in another sense. Whatever the reason for the SWV's

statement on the lack of authoritative guidelines, it was not of such significance that it would lead to the disqualification of witnesses.

On the basis of the evidence, an affiliation with the SWV did not appear to be grounds for a conclusion that the witnesses lacked objectivity. However, this was not the only factual basis for the Director's and Suncor's concerns about objectivity. The Director and Suncor pointed out that some of the Appellants' witnesses were the subject of heightened concerns about objectivity because of their involvement in local anti-wind turbine organizations. These are valid concerns in light of *Mohan* and the Practice Direction (especially section 9).

Given the novelty of the issues being raised in this proceeding and the relatively small number of individuals who have been involved in the recent research on health effects from turbines, the Tribunal found that it was appropriate to hear from these witnesses (especially given two of the most contested witnesses co-authored the Nissenbaum Study that was at the heart of the present appeals). Nevertheless, the Tribunal has kept in mind the relative objectivity of the various witnesses in reaching its conclusions on the evidence. The Tribunal notes that the Appellants did not respond in kind to the objections of Suncor and the Director by objecting to the qualification of the responding witnesses. The Appellants appropriately noted at the outset of the Hearing that some of the objections by Suncor and the Director could also apply to some of the Respondents' own witnesses. Based on the limited questioning in this area during the Hearing, the Tribunal acknowledges that the Appellants did have a valid point in this regard. Some of the witnesses put forward by the Respondents had some affiliation with pro-turbine organizations such as CanWEA and/or ventured into advocacy at some points in their testimony. In sum, there were issues of concern across several witnesses for all three Parties, but none of those concerns rose to a level where the Tribunal decided to disallow the expert evidence.

As noted in the Practice Direction: "Evidence that is influenced by the special interests of a Party may be received and considered, but the Tribunal may give this evidence little or no weight." In other proceedings, especially those that are without some of the time constraints present in this one or those involving areas of expertise for which more neutral experts are available, the Tribunal may determine that evidence that is unduly influenced by a Party's interests should be excluded. In this particular case, the Tribunal decided to hear evidence from witnesses that did not have the same degree of impartiality that other witnesses who appear before the Tribunal have, but this should not be taken as standard practice. While the Tribunal ruled, during the course of the Hearing, that each of the Parties' proposed expert witnesses could provide opinion evidence, the Tribunal wishes to draw attention below to some of the lessons learned in this Hearing given that it was the first Tribunal Hearing subject to the new legislated timeline.

Despite the flexibility provided by section 15 of the *SPPA*, the Tribunal is supportive of the recommendations of the Goudge Inquiry and the case law on expert witnesses, which was relied upon by the Director. Indeed, many of the observations found in the case law and in

Commissioner Goudge's report are consistent with the Tribunal's existing Rules and Practice Direction.

The Tribunal wishes to point out some of Commissioner Goudge's other recommendations which form part of the context within which the Tribunal decides whether to admit expert evidence. For example, Commissioner Goudge also recommended in Chapter 18:

> 133 Judges should consider whether there are parts of the proposed expert evidence that are sufficiently reliable to be admitted and others that are not or which must be modified to be admitted.
>
> 136 a) A code of conduct for experts giving evidence in criminal proceedings should be created.
>
> b) It should be incorporated into the criminal justice system. This may best be done through the introduction of practice directions and amendments to pretrial conference forms.
>
> c) The code should provide that experts have a duty to assist the court on matters within their expertise and that this duty overrides any obligation to the person from whom they received instructions or payment.
>
> d) Experts should be required to certify that they understand this duty as part of their reports and agree to be bound by the obligations contained in the code of conduct before giving evidence.
>
> 139 It will often be in the best interests of all concerned for expert witnesses to meet before trial to discuss and clarify their difference. In appropriate cases, judges, particularly pretrial judges, can encourage and facilitate such meetings between willing experts, without requiring that they take place.

In 2010, the Tribunal added a requirement in its Rules regarding an "Acknowledgement of Expert's Duty" form modeled after the form used in the civil courts. This approach is consistent with recommendation #136 of the Goudge Inquiry. With respect to recommendations #133 and #139, the Tribunal is supportive of these approaches in its standard hearings, where more time is available.

The timelines associated with appeals of *REAs* pose a challenge, however, to the Tribunal's ability to proceed in a manner that is completely consistent with recommendations #133 and #139. This Hearing provides an example of that challenge. Here, witnesses from several countries were brought together by the Parties on relatively short notice. Within the timelines associated with these types of appeals, the Parties worked diligently in producing witness statements and disclosing underlying data and reports. Even then, some witness statements were not available until partway through the Hearing.

The Parties all agreed to a detailed schedule of witnesses, assigning each one to a particular day in the Hearing calendar. In order to accommodate both the legislated timeline and the

breadth of experts and evidence, the Tribunal accepted regular in-person testimony, written testimony, testimony by videoconference and testimony by audio conference. For this case, given the number of experts involved, the Tribunal could not readily schedule numerous meetings among witnesses nor carefully parse each witness statement to determine which paragraphs should be excised or be modified to better fit within a given expert's field of expertise. In this Hearing, it was actually more appropriate and efficient to hear contested evidence (especially since much of it was provided in advance in written form and a significant portion of the actual Hearing time was reserved for cross-examination) and then determine weight later than to regularly adjourn so as to allow witnesses to meet and for witness statements to be amended.

The Tribunal is fully aware that there were disadvantages to this approach. For example, it is clear that some witnesses occasionally strayed beyond the limits of their expertise and provided evidence that was beyond their true area of specialty. It is also clear that some witnesses gave their opinion on the ultimate question to be decided by the Tribunal rather than focusing solely on the evidence that the Tribunal should weigh in reaching its own conclusion on the ultimate question. Nevertheless, the Tribunal has been diligent in separating the wheat from the chaff in reaching the conclusions in this Decision. If a witness jumped to a conclusion on whether serious harm would stem from the project without providing an adequate basis for that general conclusion, then the Tribunal has considered that in reaching its own conclusions on the ultimate question.

In other cases, some aspects of the testimony appeared to be less than objective and strayed somewhat towards advocacy. The Tribunal adds that such issues arose with respect to witnesses from all Parties. In many ways, it was probably unrealistic to expect that a stable of completely impartial witnesses could be called upon to testify on such novel questions as those that were raised in this proceeding. At present, there are studies and reports emanating from various sources that are actively involved in the debate about wind turbines. As compared to other fields of expertise, there are comparatively few sources of information. This is to be expected in a nascent situation such as this, especially where there is a tight timeline associated with the Hearing.

The Tribunal's generous approach to the admission of expert evidence in this Hearing should not be taken as an invitation for future Parties to ignore the Tribunal's Practice Direction or the relevant case law such as *Mohan.* The Tribunal is rarely faced with a case where so many experts in emerging areas of inquiry must be heard in such a short time. These appeals of Suncor's renewable energy approval had a relatively unique set of attributes. There is a regulated timeline, with which the Tribunal must comply. There is a legal test that calls for expert evidence. There is the potential, at least in this case, for novel opinions to be offered by experts in emerging fields. When all of those factors are looked at in totality, it became challenging for the Tribunal to obtain the expert assistance it needed to answer questions raised

by the Appellants in the limited timeframe afforded without relaxing its gatekeeping role somewhat.

In hindsight, now that the evidence has all been heard, it is clear that some of the evidence heard during this Hearing was not useful to the Tribunal for a number of reasons. The Tribunal, using the latitude afforded by section 15 of the *SPPA,* determined that it was best to have all of the views of the Parties fully aired and tested in this Hearing given the novelty of the issues raised and the delays that would have ensued had the Tribunal taken an active role in parsing witness statements and requiring adjournments for the purposes of expert meetings. However, where more time is available to schedule a Hearing, or where the list of expert witnesses is more limited, the Tribunal will expect much better adherence to the dictates of the Practice Direction.

This Hearing was acknowledged to be an expedited novel case involving emerging areas on scientific inquiry and the Tribunal felt that the best approach was to err on the side of allowing contested evidence to be put forth by the Parties so that the Tribunal had a “full picture”. Without there being available a stable of more impartial witnesses for many of the lines of evidence heard in this Hearing, the practical alternative would likely have been to hear no evidence at all on some key issues. This “partial picture” approach would not have served the Parties or the Tribunal well in this particular case.

It is hoped that the legitimate debates surrounding the effects of turbines will spawn further independent research to the point that some of the challenges posed in this Hearing will be reduced over time. This Hearing was far from ideal in the sense that the level of objectivity and impartiality that the Tribunal prefers and that case law calls for was not always present. However, when dealing with issues as novel as those that arose in this Hearing, it may be unrealistic to expect the ideal to be readily available.

Opinion Evidence and the Role of a Presenter

At the Hearing held on March 2, 2011, prior to giving his presentation, the Presenter, Mr. Palmer, stated that he wished to present factual evidence to the Tribunal. He indicated that he holds an engineering degree from the University of Toronto, has been a licensed professional engineer since 1973 and holds a Professional Engineers of Ontario Certificate of Authorization to serve the public in the areas of public safety. He stated that he served as the nuclear safety manager at the Bruce A Generating Station and was part of the team who performed the risk assessment for the restart of Units 3 and 4. He also conducted performance assurance evaluations at different nuclear stations in Canada, namely Darlington, Pickering and Bruce. He stated that he has given presentations on sound assessment for wind turbines at conferences in France in 2007, Denmark in 2009, and will make a presentation in Italy in 2011. He indicated that he is a senior member of the Institute of Electrical and Electronics Engineers and a member of the Canadian Acoustical Association.

Shortly after Mr. Palmer began his testimony, the Appellants suggested that Mr. Palmer could potentially be qualified as an expert in certain areas. Mr. Palmer stated that he wanted to provide "factual evidence" (as he understood the meaning of that phrase). However, from a legal standpoint, it was arguable that at least some of what he wished to present was opinion evidence. The Appellants requested that Mr. Palmer be allowed to give his presentation and that prior to cross-examination, the Parties would indicate whether any of them is asking that the Tribunal recognize him as an expert. If so, the Parties could ask him questions about his qualifications during the cross-examination portion. On being questioned by the Tribunal on the nature of his intended evidence, Mr. Palmer eventually clarified that he wished to provide expert evidence.

The Director submitted that Mr. Palmer should not be recognized as an expert witness. Although he is qualified as a professional engineer, he has no professional expertise with respect to wind turbines. Therefore, the Director submitted that Mr. Palmer is not in a position to offer credible opinions with respect to public health and safety issues in connection with wind turbines. The Director proposed that his presentation be viewed as merely that of a concerned citizen, not an expert. Finally, the Director submitted that Mr. Palmer is a known wind turbine activist with strong tries to Wind Concerns Ontario ("WCO"). He has made numerous representations to various government bodies and agencies regarding wind turbines. The Director submitted that his presentation should be taken as that of an advocate. If he were to have testified as an expert, the Director submitted he should have been called by the Appellants.

Suncor initially objected to the procedure proposed by the Appellants, on the grounds that it would undermine the Tribunal's Rules with respect to expert evidence, disclosure and timing. Suncor argued that Mr. Palmer expected to be qualified as an expert, but that his approach was not the proper way to do it. Suncor submitted that he was granted status as a Presenter and he stated at the beginning of his presentation that he intended to provide facts to the Tribunal. However, he went on to say that he would provide his view on risk assessments and was therefore attempting to qualify himself as an expert in risk and noise assessment and wind turbines. Suncor pointed out that Mr. Palmer had not filled out a Form 5, Acknowledgment of Expert's Duty, which is required by the Tribunal's Rules. Suncor stated that it objected to the matter going any further.

Following a brief break in the Hearing on March 2, 2011 and after conferring with Mr. Palmer, the Parties agreed that Mr. Palmer's testimony could be presented, followed by that of the witness called by Suncor with respect to the issues raised by Mr. Palmer and to deal with the issue of qualification at the next Hearing date (March 4, 2011). The Parties requested that Mr. Palmer provide a more complete resume, as well as a completed Form 5 prior to the next Hearing date. The Tribunal found this approach to be satisfactory so that the Hearing schedule would not be disrupted by the timing of Mr. Palmer's decision on the nature of his intended evidence (i.e., whether it was purely factual evidence or whether it contained opinion evidence).

The Form 5 filed by Mr. Palmer indicated that he sought to provide expert opinion evidence as a Professional Engineer and holder of a Certificate of Authorization in the professional activity areas of operations, public safety, risk assessment and environmental assessment related to the electrical power generating system. He sought to give expert opinion evidence on evaluating operation of electrical generating systems, including wind turbines and the nuclear generating system, advising and reporting to the Tribunal information specific to the safeguarding of life, health, property and the public welfare requiring the application of engineering principles of risk assessment, evaluation of operating experience and monitoring of acoustical information.

Suncor submitted that a Presenter should not be eligible to be qualified as an expert under the Tribunal's Rules, which are silent on this issue. Suncor pointed out that the role of a Presenter is set out in Rules 70 and 71. Rule 70 states that a Presenter may be a witness, may be questioned by the Parties, provide the Tribunal with a written statement and upon request, receive a copy of documents. Suncor submitted that Rule 70 does not state that a Presenter may be an expert or opinion or technical witness. Suncor further pointed out that the Tribunal's Practice Direction for Technical and Opinion Evidence states that its purpose is to assist parties, their representatives and their witnesses who will give scientific, technical and opinion evidence to prepare for the Hearing and present evidence to the Tribunal, not to assist presenters to be expert witnesses.

Suncor submitted that, if Mr. Palmer were being tendered as an expert witness for a Party, which he is not, the issues to look at include independence, objectivity and expertise. Suncor argued that Mr. Palmer does not have the expertise necessary to be qualified as an expert with respect to risk assessment or the assessment of noise from wind turbines. Suncor stated that Mr. Palmer admitted that he has no formal training in acoustics and has never published any peer-reviewed journal article dealing with acoustics or risk assessment. His only experience with risk assessments relates to training staff to perform risk assessments on the Bruce A and Candu nuclear systems. Suncor noted that Mr. Palmer admitted that he has never been retained to prepare a risk or noise assessment for a wind turbine.

Suncor submitted that in his testimony, Mr. Palmer demonstrated a lack of familiarity with some of the results presented by Dr. Heraud. Suncor submitted that Mr. Palmer's presentation did not take into account all the relevant facts and data and that he did not bring to the Tribunal the benefit of all the data and proper calculations. Suncor further submitted that Mr. Palmer was not familiar with the renewable energy approval and made his calculations based on an outdated map.

With respect to his independence and objectivity, Suncor pointed out that Mr. Palmer testified that he is an "advocate for the truth", but that nowhere in his written submission was it mentioned that he lives 6 km from a 110 wind turbine wind farm, 54 of which he can see from his property. Suncor also stated that Mr. Palmer failed to fully disclose in his written submission how his evidence was treated in at least one of five Ontario Municipal Board ("OMB") hearings

in which he was involved. Suncor also stated that Mr. Palmer's written submission failed to reveal that he was a researcher for WCO.

Suncor submitted that Mr. Palmer does not have the required independence and objectivity to be qualified as an expert before the Tribunal, nor does he have the expertise required. Suncor argued that Mr. Palmer has had the opportunity to present his materials, which is what he sought to do when he first sought status from the Tribunal in January. Suncor submitted that it was not until Mr. Gillespie's "motion" on March 2, 2011 that the idea emerged that Mr. Palmer could be qualified as an expert, and not merely a concerned citizen. Suncor's position is that the motion (if that is what Mr. Gillespie's interjection was) should be denied. Suncor indicated that Mr. Palmer's presentation is before the Tribunal and that the Tribunal may accord it the appropriate weight, but not the weight of an expert witness.

The Director indicated that originally, he did not object to Mr. Palmer being given Presenter status as a concerned member of the public, although the Director lodged an objection to Mr. Palmer being accorded expert witness status. The Director continued to stand by that objection. The Director submitted that Mr. Palmer's evidence is not relevant to the Hearing and he cannot be said to be unbiased. Further, he said, Mr. Palmer has no formal training in noise or acoustics, other than a course at a conference taught by Dr. Leventhall. The Director pointed out that Mr. Palmer has never had a regulatory body in Ontario accept or approve a noise assessment or report he has prepared, nor has he been retained to provide professional engineering services respecting noise, acoustics or risk assessment for wind turbines.

The Director submitted that much of Mr. Palmer's presentation attempted to give an opinion on noise and risk assessment regarding wind turbines but that he does not have the requisite expertise to provide such an opinion. The Director also submitted that Mr. Palmer has not demonstrated that he is unbiased. The Director stated that Mr. Palmer is a member of Wind Concerns Ontario, an activist group opposed to wind turbine development in Ontario. The Director also stated that Mr. Palmer has had the status of an appellant who tried to prevent the development of wind turbines in the Kincardine area in an OMB hearing.

The Director stated that, with respect to whether a Presenter could ever be qualified as an expert witness, there could be an appropriate circumstance in the future where a Presenter has specific and unique professional experience and qualifications relevant to a hearing and where none of the parties has brought forward any experts with that expertise. The Director stated that this is not the circumstance here, where, for example, on the subject of noise, the Appellants have called Drs. Thorne and Shepherd and the Director and Suncor also intended to tender expert witnesses in the relevant areas. Therefore, the Director argued, Mr. Palmer's evidence is not needed for the Tribunal to make a fully informed decision. The Director submitted that Mr. Palmer has not presented facts, but an interpretation of facts which is an opinion that only an expert can provide. The Director argued that Mr. Palmer does not have the expertise to do so in an unbiased way.

The Appellants addressed the issue of a Presenter as an expert. In their submission, nothing in Rules 70 and 71 precludes this. They submitted that the word “witness” is often used interchangeably to refer to people with lay or factual information as well as expert information, so that the word encompasses both concepts.

The Appellants submitted that Mr. Palmer fits fully within the ambit of the roles and responsibilities set out in Rules 70 and 71. Even that were not the case, Rule 1 states that the purposes of the Rules are to provide “a fair, open accessible and understandable process”. The Appellants argued that permitting Mr. Palmer to give expert evidence falls within those purposes. Further, Rules 4 and 5 deal with interpreting the Rules to secure the just, most expeditious and cost effective determination and departing from the Rules or waiving them. The Appellants submitted that the Tribunal has the ability to give effect to the purpose of the Rules by permitting Mr. Palmer to testify.

The Appellants disagreed with Suncor that the Appellants made a “motion” for Mr. Palmer to be permitted to testify as an expert. They stated that Mr. Gillespie spoke on this issue as an officer of the court and as a matter of procedure, pointing out to the Tribunal and to Mr. Palmer, who is not trained as a lawyer, that there may be an issue to be addressed before the evidentiary portion of his presentation began. They stated that their position is consistent with the approach taken throughout the proceeding that the process should express the purposes of the Rules and be inclusive, not exclusionary.

Finally, the Appellants pointed out that they have indicated from the outset that Mr. Palmer’s submissions would be different from the evidence provided by the Appellants and that is why there was no safety or risk assessment expert called by the Appellants. His evidence is different from that of Mr. James or Dr. Thorne, dealing with different measurements taken at different times in different ways in different places. The Appellants stated that they have worked to ensure that there is no duplication of evidence.

The Appellants stated that they support in principle Mr. Palmer’s inclusion in this proceeding as a Presenter and his request to be identified as an expert, leaving him to make whatever submissions he feels are appropriate.

Suncor submitted that the Appellants chose not to call a witness on the issues of ice throw and blade failure that they included in their Notices of Appeal and have stated that they rely on Mr. Palmer’s presentation in support of that ground of appeal. Suncor, therefore, took issue with Mr. Gillespie’s characterization of his interjection on the nature of Mr. Palmer’s evidence.

Mr. Palmer stated that he wrote to the Tribunal in December indicating that he believed that he was in a unique position to be able to help the Tribunal in making a difficult decision. He stated that when he appeared before the Tribunal at the Preliminary Hearing, he told the Tribunal that it was his intent to give factual evidence. Mr. Palmer explained that, in his mind, which is not a legal mind but an engineering mind, he was differentiating between factual evidence, where he could say a pathway derives an end result, from an opinion based on personal tastes and likes.

On that basis, he stated that he wished to present factual evidence. He explained that he held that understanding honestly.

He further explained that holding himself out as an expert created conflict with his personal beliefs about acting humbly. He indicated that in the course of the discussion about expert evidence, he understood the persuasive nature of expert opinion and also that he ought to use his talents to help people. On that basis, he presented material to the Tribunal to assist it, putting things in an understandable format. Mr. Palmer disagreed that he is not an expert in risk assessment, commenting that there is operating today 1600 MW of nuclear generation based on his sign-off.

Mr. Palmer stated that the expertise he has tried to bring to the Tribunal is to look at the material that has been presented and comment on whether it makes sense, much as he did when he provided input into the risk assessment of nuclear facilities. He submitted that he has shown that the input does not match the output with respect to the expert evidence he examined. He also stated that the expertise he brought to the Tribunal was that for which he was often selected to train others, namely his ability to put material into a form that could be understood with respect to the issues of blade stress, wind shear and sound frequency. He eventually understood that he could only provide this assistance as an expert.

Mr. Palmer stated that he responded on cross-examination that he had never been paid to do this work; he explained that he has done it independently because he believed the work needed to be done and that he could provide input into it. As to his qualification and capability to do that work, Mr. Palmer asked the Tribunal to read the written material he filed with the Tribunal in order to assess his qualifications. He submits that the proof is in the work that he produced.

Mr. Palmer submitted that he has a unique background in doing risk assessment and in looking at electrical generating systems; in the course of that, he has background in recognizing where there are common threads to disasters. He explained that he audited an acoustics course, so that he has similar qualifications to any Canadian acoustical engineer. He admitted that he does not have detailed experience in using the Monte Carlo analysis (which was used by Dr. Heraud), since a different technique is used in his industry. Finally, Mr. Palmer stated that he tried to add value to the Tribunal in a professional and honest manner.

Findings on Opinion Evidence and the Role of a Presenter

Suncor argues that the Tribunal's Rules of Practice and, in particular, Rules 70 and 71, and its Practice Direction for Technical and Opinion Evidence, do not provide for a Presenter to give expert opinion evidence before the Tribunal.

The Director admits that there could be an appropriate circumstance in the future for qualification of a Presenter as an expert witness where he or she has specific and unique professional experience and qualifications relevant to a hearing and where none of the parties has brought forward any experts with that expertise.

The Appellants argue that nothing in Rules 70 and 71 precludes a Presenter from being an expert witness. They submit that the word "witness" encompasses those with lay or factual information as well as expert information. They also argue that the Tribunal's powers under Rules 4 and 5 to liberally interpret the Rules and waive or depart from them could be employed in this regard so as to give effect to the purposes of the Rules to provide a fair, open, accessible and understandable process. In other words, they argue for an inclusive approach.

The Tribunal agrees with the Appellants and the Director. The words of Rules 70 and 71 do not expressly preclude a Presenter from being an expert witness. The Tribunal also agrees with the submission of the Director that, in the absence of expert evidence from the parties, a Presenter might fill that gap.

The Tribunal recognizes that the Practice Direction addresses the more typical situation of an expert witness called by a Party. However, most of its provisions could be applied equally to the situation of a Presenter giving expert evidence, including the compliance provisions in section 15 of the Practice Direction, with the exception of section 15(f). Moreover, the Tribunal notes that the prohibition in Rule 71(e) against a Presenter making oral and written submissions (as opposed to evidence) to the Tribunal at the commencement and end of a hearing (i.e., advocating a position) accords with the requirement in the Practice Direction that an expert witness must never assume the role of an advocate.

In conclusion, the Tribunal is of the opinion that its proceedings ought to be inclusive and accord with the requirement of the *SPPA* that the Act and a tribunal's rules must be liberally construed to secure the just, most expeditious and cost-effective determination of every proceeding on its merits. In appropriate circumstances, a Presenter may be qualified to give expert evidence.

For the following reasons, the question of whether it is appropriate to qualify Mr. Palmer as an expert witness in this particular proceeding is essentially moot and does not need to be decided. As noted above, as proposed by the Parties, the Tribunal heard Mr. Palmer's full evidence and then received submissions on his qualifications later. The Tribunal has also heard from expert witnesses who testified in the fields raised by Mr. Palmer. It is quite clear that, even if the Tribunal were to accord Mr. Palmer's evidence full status as expert evidence, there is no question that the Tribunal heard much more detailed and convincing evidence on the issues raised by Mr. Palmer from the other relevant witnesses. As set out below, the Tribunal has been able to reach clear conclusions on the issues raised by Mr. Palmer without having to decide whether his evidence should be considered expert evidence. In sum, even if the Tribunal were to treat Mr. Palmer's evidence as expert evidence, the best that can be said of it is that Mr. Palmer provided evidence of some "risks" of harm that fall well below the statutory test applicable to this proceeding. For example, Mr. Palmer pointed out several risks associated with workers or members of the public being harmed by various sorts of accidents involving turbines. There is no doubt that these risks are present and that, looking at the wind turbine industry in totality, some of these risks are periodically actualized. However, the various harms,

collectively or individually, do not occur commonly enough such that it is expected that they "will" occur at this particular facility consisting of eight turbines.

As set out below, Mr. Palmer raised valid concerns about public safety and occupational safety that should be considered in wind turbine and health and safety regulations. They are not concerns that lead to a conclusion that this project "will" harm human health, however. The Tribunal wishes to add that this conclusion is not meant to be taken as a criticism of Mr. Palmer. Mr. Palmer is very qualified in the many areas in which he has worked over his long career and came to the Hearing with a genuine belief that he would be able to add value to the proceeding by providing evidence in an easy-to-understand manner. Presumably, at the time he became interested in this proceeding, he did not know who else would be testifying on the issues he sought to raise. In the end, the Tribunal has determined that the Parties' specific experts qualified in the areas touched on by Mr. Palmer provided the most complete and accurate evidence in this Hearing. This should come as no surprise given the fact that the expert witnesses in question have more direct and extensive experience in the relevant fields.

Discussion, Analysis and Findings on Main Issues Regarding Factual and Opinion Evidence:

The Central issue is whether engaging in the Project in accordance with the REA will cause serious harm to human health. The following sub-issues were addressed by the Parties:

Issue #1(a): Will the project as approved cause serious harm to human health of non-participants?

Overview of Parties' Positions

The Appellants' position is that the REA for the Kent Breeze Project should be revoked because the project as approved will cause serious harm to human health. The Appellants submit that considered in its entirety there is compelling evidence that supports this position. The Appellants submit that although the precise mechanism for the health effects is not known, there are a number of plausible pathways including audible noise, amplitude modulation, low frequency noise, infrasound, visual impact, and shadow flicker. The Appellants submit that there is uncontradicted evidence that some people living near the Kent Breeze Project will be annoyed by the wind turbines. They submit that annoyance is an adverse health effect which can lead to serious harm to health. The Appellants submit that the serious harm that will result from exposure to the wind turbines at Kent Breeze will be indirect health effects such as sleep disturbance, headache, tinnitus, ear pressure, dizziness, vertigo, nausea, visual blurring, tachycardia, irritability, problems with concentration and memory, and panic episodes.

The Director's position is that the Kent Breeze Project operating in accordance with the REA will not cause serious harm to human health and the Appellants have failed to prove otherwise. The Director submits that the evidence raised by the Appellants is partial and unreliable and should not be given weight by the Tribunal. The Director acknowledges that the evidence could support

a conclusion that sound from wind turbines may be annoying to a small percentage of exposed people and that this annoyance may cause stress in a few highly sensitive and susceptible individuals. However, it is the Director's position that this annoyance is caused more by the individual's attitude toward the sound than to the actual sound level alone. The Director submits that the Appellants have not established that the annoyance and stress which some susceptible individuals may experience will cause serious harm to human health. The Director submits that annoyance and stress are not equivalent to serious harm to human health.

Suncor also takes the position that the Appellants have failed to establish that engaging in the Kent Breeze Project in accordance with the REA will cause serious harm to human health. Suncor submits that the Kent Breeze Project presents no risk of direct health effects to residents, as the noise levels generated by the Kent Breeze turbines will be below the levels which are known to cause direct health effects. Suncor submits that the published, scientific peer-reviewed evidence demonstrates that at the noise levels approved for Kent Breeze indirect effects are minor. Suncor further submits that this literature does not support a conclusion that the Kent Breeze Project will cause serious harm to human health.

Submissions on Tower collapse, blade failure/throw, ice fall/throw

In their Notices of Appeal the Appellants identified concerns related to "ice throw/fall and turbine failure." The Appellants did not call evidence on these matters and initially relied on Mr. Palmer's evidence, which is summarized in the "Summary of Evidence" section above. In closing submissions, the Appellants state that, at the time that the appeals were filed, the assessments by Dr. Heraud and Dr. Holley had not yet been conducted. The Appellants take no issue with the conclusions of these witnesses and provide no other submissions on these matters.

Suncor submits that the expert evidence of Dr. Heraud establishes "that there is no significant risk of ice being thrown on the public at the project, that the project will not present any significant safety risk to the public from ice being thrown or dropped by the wind turbine, and that the project will not present any significant risk for the safety of the public due to blade throw or tower collapse." Suncor relies on the evidence of Dr. Holley to conclude that the ice throw setback distances at Kent Breeze are appropriate and will not result in serious harm to human health. Suncor notes that the Appellants take no issue with the expert evidence on these matters and submits that Mr. Palmer's presentation demonstrates a lack of expertise and understanding of these matters, such that it should not be relied upon by the Tribunal. Suncor submits that ice throw/fall, blade throw/fall, or tower failure/collapse at Kent Breeze will not cause serious harm to human health.

The Director submits that Mr. Palmer has not demonstrated that the Kent Breeze Project will cause serious harm to human health due to ice throw and turbine failure. The Director submits that "Mr. Palmer lacks the specific professional credentials that would allow him to challenge the technical and scientific evidence put forward by Suncor demonstrating that there is no

significant risk of either of these events occurring at the Kent Breeze site." The Director submits that the deaths from wind turbine accidents referred to by Mr. Palmer can mostly be described as industrial accidents involving workers in maintenance or operational capacities. The Director submits that these accidents do not support the conclusion that serious harm to human health will result from the Kent Breeze Project. The Director relies on the evidence of Dr. Heraud and Dr. Holley to conclude that there is no risk of serious harm to human health from ice throw or turbine failure at the Kent Breeze Project.

Findings on Tower collapse, blade failure/throw, ice fall/throw

Regardless of whether Mr. Palmer's evidence is considered to be expert opinion evidence or not (a finding in that regard is unnecessary, as noted above), the best evidence in the areas of tower collapse, blade failure/throw, and ice fall/throw came from Dr. Heraud and Dr. Holley, who have considerable expertise in the areas touched upon by Mr. Palmer. Mr. Palmer did provide evidence of some "risks" of harm associated with accidents or structural hazards involving turbines, which is a point that is generally acknowledged (as in the CMOH Report). The Tribunal finds that these risks are present if one looks at the wind turbine industry in total, as Mr. Palmer did. However, Dr. Heraud's statistical analysis of the expected rate of such accidents demonstrates that the risks are very low at a given site. The risks, collectively or individually, do not occur commonly enough to lead to the conclusion that serious harm to human health from such risks "will" occur at this Project, which involves eight turbines.

Submissions on Shadow flicker

The Appellants submit that shadow flicker is one of the plausible mechanisms by which exposure to IWT's can cause serious harm to health. The Appellants submit that wind turbine shadow flicker has the potential to induce photosensitive epileptic seizures. However, they acknowledge that the risk is low with large modern turbine models and proper planning. The Appellants submit that the evidence of Dr. McMurtry and Dr. Mundt indicates that "detailed shadow flicker modeling during the design stage of a wind turbine project is considered a best engineering practice to ensure human protection from shadow flicker health impacts." The Appellants note that O.Reg. 359/09 does not address shadow flicker and although the Project Consultation Report states that a shadow flicker assessment will be undertaken, there is no evidence that a detailed assessment was conducted for the Kent Breeze Project. The Appellants also submit that shadow flicker may cause annoyance and stress.

The Director and Suncor both submit that the evidence shows that shadow flicker will not be an issue at the Kent Breeze Project because the maximum frequency of the Kent Breeze turbines will be well below the flicker frequencies (above 3 Hz) that are known to induce photosensitive epileptic seizures. Suncor relies on the evidence of Dr. Ollson and the Director relies on the CMOH Report and the Consultation Report prepared by Suncor. The Director notes that the Consultation Report prepared by Suncor provides for mitigation measures to deal with flicker

nuisances should unexpected situations arise. The Director and Suncor submit that the Appellants have not provided any evidence that the Kent Breeze Project will result in shadow flicker that causes serious harm to human health.

Findings on Shadow flicker

Shadow flicker as a mechanism causing serious harm to health was not a primary focus for the Appellants. Some evidence was presented to explain that wind turbine shadow flicker could cause a number of human health issues, including photosensitive epileptic seizures. However, little, if any, evidence was given with respect whether shadow flicker at the Kent Breeze Project will cause serious harm to human health.

The Appellants state that detailed evidence cannot be given because a detailed assessment has not been done for the project. Despite the lack of a specific study, the Appellants have not provided any basis to suggest there is any specific reason why shadow flicker is a concern at the Kent Breeze Project. The Appellants acknowledge that there is a relatively low risk with proper planning and depending on the type of wind turbine that is installed. There is no evidence that there are particular factors or a convergence of factors to suggest that shadow flicker will cause serious harm to human health at the Kent Breeze Project.

Submissions on Noise

The Appellants submit that noise from wind turbines is unique from other sources of industrial noise. They submit that wind turbine noise possesses unique characteristics, including amplitude modulation, lack of night-time abatement, low frequency noise, infrasound and tonality. The Appellants state that expert witnesses called by the Appellants and the Respondents acknowledge that it is these unique characteristics that contribute to the annoyance and/or stress and/or sleep disturbance and/or other related adverse health effects experienced by people living near wind farms. The Appellants submit that in order to protect humans from adverse effects the following standards are required: a 5 dB penalty for amplitude modulation and a 5 dB penalty for tonal noise and lower guideline limits for noise with low frequency components. The Appellants submit that there is no evidence that the effect of these unique characteristics was considered in issuing the REA. The Appellants submit that as there has been a failure to consider these characteristics and apply the appropriate penalties, uncertainties and corrections, the noise modeling performed for the REA does not reflect the "worst case scenario."

The Appellants note that it was acknowledged by all witnesses except Dr. Ollson that the WHO 2009 Night Noise Guidelines for Europe were developed based on research related to road, rail and air transportation noise and not wind turbine noise. The Appellants submit that "given the unique characteristics of IWT noise, it appears clear that an examination beyond that offered in the 2009 Guidelines of the specific impacts of IWT noise on human health is required."

The Appellants submit that there is no evidence that human health will be protected at the sound pressure levels approved in the REA. Rather, the Appellants submit that "the best available evidence on IWTs suggests that at the allowable noise limits permitted for this Project serious adverse health effects will occur." The Appellants submit that this is strengthened by the fact that in developing the 2008 Noise Guidelines for Wind Farms and O.Reg. 359/09, the MOE relied only on acoustical engineers and did not consult anyone with a medical or health background.

The Director submits that the Appellants have not shown that sound from wind turbines is unique or that it has any particular qualities that will cause serious harm to human health. The Director submits that the evidence shows that the noise assessment for Kent Breeze was performed according to the MOE's Noise Guidelines and O.Reg. 359/09 and was based on a worst case scenario. The Director submits that the additional penalties, uncertainties and corrections raised by the Appellants are not required or necessary for the noise modeling of the Kent Breeze Project. The Director submits that the Project is designed and approved to operate at a maximum level of 40 dBA, which is consistent with the recommendations of the WHO Night Noise Guidelines and the Appellants have provided no convincing evidence that the Project will exceed these limits.

Suncor submits that the Kent Breeze Project as approved will not exceed a sound level of 40 dBA at the receptors. Suncor states that the predicted noise levels are based on conservative modeling and reflect the worst case scenario. Suncor submits that any additions or corrections to the predicted noise levels raised by the Appellants are not required by the MOE Noise Guidelines, the ISO 9613-2 standard or industry practice.

Submissions on Direct Health Effects

The Appellants do not contest the Respondents' evidence that sound from wind turbines does not pose a "direct" health risk to humans, such as hearing loss, at the receptor distances proposed for the Kent Breeze Project. What the Appellants take issue with, however, is the lack of consideration of the "indirect" effects of wind turbine noise on human health, including annoyance, stress, and sleep disturbance. The Appellants state that the two major reports relied on by the Respondents (the CMOH Report and the AWEA/CanWEA Report) are limited to consideration of direct effects only.

The Director submits that the Appellants have not presented any direct evidence of harm to human health caused by exposure to wind turbines. The Director relies on the CMOH Report and its conclusion that the available scientific evidence does not establish a direct causal link between exposure to wind turbine noise and adverse health effects.

Suncor submits that "the peer-reviewed scientific evidence is clear that the audible noise from wind turbines is of too low an energy level to cause any harm to human tissue or any direct adverse physiological effects." In particular, Suncor submits that there is uncontradicted evidence that for noise levels to cause direct effects, they must be higher than 55 dBA. Suncor

states that the REA limits noise levels at receptors to 40 dBA, and therefore, there is no evidence that anyone is at risk of direct health effects from the Kent Breeze Project.

Findings on Direct Health Effects

All Parties are in agreement that direct impacts such as hearing loss will not be caused by the Project. The Tribunal finds that the evidence does not show that engaging in the Project will cause serious harm to human health with respect to direct impacts such as hearing loss.

Submissions on Indirect Health Effects

The Appellants submit that the WHO definition of health is widely accepted and clearly requires that "indirect" effects be considered. They state that the indirect pathway for noise effects on human health includes annoyance, stress and sleep disturbance. The Appellants submit that they are not required to prove which precise mechanism causes the harm to human health from exposure to wind turbines and that demonstrating cause and effect is sufficient. The Appellants refer to the example of cigarettes and smoking where legislators did not require that the precise mechanism that causes cancer be determined, whether it be the tar or the nicotine or the smoke, before taking action to protect human health. The Appellants submit that "there is a large body of evidence that supports the conclusion that exposure to IWTs causes indirect effects that harm human health."

The Appellants state that based on the Appellants' and Respondents' evidence, it has been acknowledged that annoyance is a health effect and that IWT noise is more annoying than other sources of noise at comparable sound levels. The Appellants state that the symptoms associated with noise annoyance include insomnia, headache, pressure in the ears or head, dizziness, nausea, eye strain, fatigue, distraction, nose bleeds, feeling vibration, muscle spasms, palpitations, skin burning, stress and tension. The Appellants state that although the Respondents' experts have not accepted these symptoms as a specific "wind turbine syndrome" as described by Dr. Pierpont, they have accepted them as the symptoms of noise annoyance generally. The Appellants submit that these symptoms of annoyance and stress are serious harm to human health. They state that "the serious nature of annoyance in relation to IWT exposure at the Project is the prolonged nature of the exposure, in the home environment, to a particularly annoying type of noise even at the approved sound levels."

The Appellants submit that the evidence from the Appellants and the Respondents establishes that a percentage of the population exposed to the Kent Breeze Project will be annoyed by the wind turbines. The Appellants submit that, based on the Pedersen et. al. studies, the numbers of people expected to be annoyed by wind turbines at the sound levels predicted for Kent Breeze is not trivial, minor or small. The Appellants submit that the evidence demonstrates that exposure to both noise and visual impacts of wind turbines can cause annoyance.

The Appellants submit that the evidence of the Appellants and the Respondents indicates that some people report sleep disturbance from exposure to IWTs at sound pressure levels and/or

setback distances to which people will be exposed at the Kent Breeze Project. The Appellants state that there is evidence that exposure to both low frequency noise and amplitude modulation causes sleep disturbance. The Appellants submit that the evidence shows that exposure to wind turbines can also cause adverse impacts to mental health and reduced quality of life.

The Appellants submit that there is a large amount of evidence that supports a finding of legal causation, including case reports, case crossover data, and population-based studies. They argue that when all of the available information is considered in its entirety, it provides compelling evidence of a causal link between wind turbine exposure and health effects. The Appellants submit that the Nissenbaum Study is part of this compelling evidence. The Appellants submit that this Study is directly relevant to the matters before the Tribunal because it looks at mental health and sleep effects related to distance from wind turbines at the same distances approved for Kent Breeze.

They state that the Study assists in establishing causation because its results meet the criteria for judging causation. Specifically, they refer to the following results which were observed in the Study: time sequence of effects where the symptoms worsened following the operation of the wind turbines; associations between distance to IWTs and health outcomes which were both statistically significant and clinically relevant; and a consistent dose-response relationship at two unique wind farm sites.

The Appellants refer to the opinions of Dr. Aramini and Dr. Wilson that the Study provides evidence of a causal relationship between IWT distance exposure and adverse health effects. The Appellants note that the exposure distances in the Study are similar to those at the Kent Breeze Project.

Further, the Appellants submit that the Study's findings of abnormal mental health scores, abnormal sleep quality scores and abnormal daytime sleepiness scores in those living close to the wind turbines constitute serious harm to health. In addition, the Appellants state that Dr. Aramini's model applying the Study results to the Kent Breeze Project found that the predicted number of residents at risk for diagnosed depression is well above the known proportion at risk in the general population. They state that this is further evidence that serious harm will be caused at the Kent Breeze Project.

The Appellants note that the Study's authors do not disagree with the Respondents' witnesses about the potential sources of bias in the Study. However, they say the important consideration is whether these sources of bias can explain the observed results. The Appellants rely on Dr. Aramini's and Dr. Wilson's evidence that an analysis of the data indicates that it is unlikely that the observed dose-response relationships can be explained by bias alone. The Appellants note that there is a point of contention whether the application of the Bonferroni correction to the Study results is appropriate. However, they submit, even if it were applied, important findings would still be considered statistically significant.

The Appellants submit that the evidence of Dr. Phillips and the WHO 2009 Night Noise Guidelines demonstrate that it is appropriate to rely on self-reported evidence of serious health effects from wind turbines. The Appellants submit that "adverse event reporting is a cornerstone of identifying new health risks." The Appellants state that such evidence has been presented in the Nissenbaum Study, the Pedersen et. al. studies and Dr. McMurtry's evidence on the self-report based case studies of residents living near wind turbines in Ontario and globally. The Appellants submit that several of the case studies also provide case-crossover data which provides additional convincing evidence of causation.

The Appellants submit that, because wind turbines are a new source of community noise, the available evidence is not yet fully contained in the peer-reviewed literature. The Appellants submit that non-peer-reviewed reports should not be automatically dismissed because, irrespective of peer-review, the foundation data remains the same and "such a dismissal of evidence would also be contrary to the adverse event reporting systems relied on by pharmaceutical regulators... and contrary to basic principles of public health..."

The Appellants submit that the literature reviews conducted by their witnesses were more comprehensive than the literature reviews conducted and relied on by the Respondents' witnesses. The Appellants state the Respondents' reviews did not include many of the numerous available case reports and were confined solely to health effects occurring through a direct pathway.

The Appellants state that "the evidence of adverse health effects from wind farms is consistent across different study types, countries, topography and turbines." The Appellants submit that this consistency and the sheer volume of adverse event reports make the evidence of adverse health effects more compelling. The Appellants state that this evidence includes case reports by Dr. Harry, Dr. Phipps, Dr. Thorne, Dr. Pierpont, the Windvoice Survey, Dr. McMurtry's personal interviews, submissions to an Ontario Standing Committee from residents near the Ripley Wind Farm, the Pedersen et. al. studies, the Nissenbaum Study, and Dr. Shepherd's research. The Appellants submit that "the evidence when considered as a whole demonstrates consistent observations of health effects in relation to exposure to IWTs in terms of modeled sound pressure levels and distance. These effects are occurring at setback distances and modeled sound pressure levels to which residents living near the Project will be exposed." The Appellants submit that because the science is not settled regarding the precise mechanisms and pathways contributing to the observed serious health effects, it is necessary to rely on the best health evidence available to predict future harm. The Appellants submit that this includes relying on a limited number of studies and/or studies that are not formally peer reviewed.

The Appellants submit that they "have provided large amounts of evidence of serious health effects that is directly relevant and applicable to the Project. There are numerous examples of the application of IWT/health evidence to the specific circumstances of the Project. Furthermore, specific receptors that will be subject to impacts have been clearly identified." This evidence includes the predictions of the Appellants' experts that were specific to the Kent Breeze Project

and their experts' opinions that the Kent Breeze Project will cause serious harm to human health. Further, the Appellants state that "the Respondents have provided no evidence to suggest that the Project will be significantly different in its characteristics to the wide variety of wind farms where serious health effects have been studied and reported, at the same distances and noise exposures approved for the Project, so as to negate the risk of serious harm to health." The Appellants acknowledge that information on the attitudes of the Kent Breeze residents to wind turbines has not been presented to the Tribunal because the evidence indicates that attitudes towards wind turbines are likely to change after residents are exposed to the operating turbines and therefore, such information would not be helpful to this Hearing. Moreover, the Appellants state that information from other jurisdictions is applicable due to the nature of noise assessment and regulation. The Appellants note that the MOE Noise Guidelines set general noise limits that do not depend on the specific turbines used or the topography of the land or the attitudes of the nearby residents. The Appellants state that sound levels are sound levels regardless of what jurisdiction they are measured in.

The Director submits that the Appellants have not proven that the Kent Breeze Project, as approved, will cause serious harm to human health, regardless of whether it is judged on a higher than normal or a balance of probabilities standard of proof. The Director denies the Appellants' assertion that witnesses called on behalf of the Director and Suncor acknowledged that the Project will cause health impacts. The Director submits that "the evidence and expert opinions submitted by the Director and Suncor clearly and reliably demonstrate that the sound predicted to be emitted from Kent Breeze is well within limits that are protective of human health, and will not cause harm."

The Director submits that the evidence of Dr. Leventhall, Dr. Colby and Mr. Howe demonstrates that the "existing assessments and measurements of the infrasound and low frequency sound emitted from wind turbines heretofore have conclusively demonstrated that the levels are very far below anything considered to be a risk to human health." The Director states that there is strong evidence that the levels of infrasound generated by modern wind turbines are well below the threshold for human hearing at the setback distances in Ontario and consequently, infrasound from wind turbines at the Kent Breeze Project will have no effect on human health. The Director submits that the work on infrasound by Dr. Salt "does not show that infrasound at the levels emitted by wind turbines is harmful to the human inner ear, has any other harmful health effect" or, as stated in the article "will be perceived or disturb function in any way". The Director submits that the Appellants have failed to establish that infrasound and low frequency noise from wind turbines will cause serious harm to human health.

The Director submits that "the Appellants have not led any reliable or relevant evidence that shows that the Kent Breeze site, as approved, will annoy people to such an extent that their health will be seriously harmed." The Director states that the evidence shows that "the majority of the annoyance provoked by sound stems from an individual's subjective attitude and feelings about the sound." The Director notes that the Pedersen et. al. studies suggest that at the sound

levels predicted for the Kent Breeze site, at worst, a small percentage of people will be very annoyed. However, the Director submits that this does not mean that this small percentage of people will suffer serious harm to their health or even an adverse health effect. The Director submits that the evidence of Dr. Leventhall, Dr. Colby and Dr. McCunney indicates that a very small number of people could become annoyed by the wind turbines at the Kent Breeze site. The Director submits: "However, there is no evidence that any annoyance that may be experienced due to the noise levels approved for the site, or from any other factors associated with the site, will result in serious harm to human health." The Director submits that annoyance does not equal serious harm to human health, or even an adverse health effect, but that it is a constant in life that everyone suffers from at one point or another. The Director states that it is unreasonable and unrealistic to require a total lack of audibility from industrial noise sources.

The Director submits that the Appellants have not provided "any evidence that the noise predicted to be produced by the Kent Breeze wind turbines will disturb sleep to such a serious degree that it will cause serious harm to human health." The Director states that the evidence of Dr. Hanning established that it was plausible, but not proven, that arousals that disturb sleep are due to noise from wind turbines. The Director notes that the WHO 2009 Night Noise Guidelines recommend that effects on sleep and health are not expected to occur below 40 dB. The Director submits that since the Kent Breeze Project as approved will operate within the 40 dB limit, there will be no effects on sleep.

The Director submits that the Appellants have not provided any evidence of causation with respect to the past instances of alleged harm. The Director submits that causation in these past instances has not been proven and is speculative, at best. Further, the Director states that even if it could be proven that the alleged harm in these past cases was caused by wind turbines, this does not prove that the same harm will be caused at the Kent Breeze Project. The Director states that the types of harm raised by the Appellants can arise from a variety of situations and "the cause of any single instance of harm can generally only be analyzed in retrospect."

The Director submits that "[the Study] does not provide any information specific to or relevant to conditions at the Kent Breeze wind farm project. Based on data in the Study, it is impossible to predict or determine whether any serious harm to human health will be caused by the Kent Breeze Project resulting from sound, and what the possible mechanism for such harm would be." The Director submits that the results of the Study, properly interpreted, do not prove that exposure to wind turbines causes health problems, in part because a self-reporting questionnaire style study cannot establish causation. The Director notes that the Study examines only distance to the nearest wind turbine and does not include any actual measurements of sound levels in the Study area, thereby making it impossible to draw any meaningful conclusions about the effects of sound on the Study participants. The Director states that "similarly, it is impossible to hypothesize about sound levels and their effects at the Kent Breeze Project based only on the setback information provided in the Study."

The Director submits that the Study methodology was so flawed that no valid conclusions can be drawn from its results. The Director cites the lack of epidemiological expertise in the design and data collection of the Study, the presence of bias in the sampling measures and the survey materials, the lack of blinding of participants, the use of non-validated questionnaires, and the reliance exclusively on self-reported symptoms as some of the major flaws of the Study. The Director submits that the Study may suffer from recall bias, sampling bias, selection bias, suggestibility bias, and interview bias. The Director also submits that the Study's statistical analysis was flawed because the authors utilized greater statistical significance levels than what is conventional, thereby increasing the possibility of Type I errors and they did not apply the Bonferroni correction for multiple analyses, which would make most of their results not statistically significant. The Director also submits that the Study should not be relied upon because of concerns about the expertise and impartiality of its authors.

The Director submits that "the review [of the Study] conducted by Dr. Wilson does not constitute appropriate peer review and is not the type of peer-review that would be expected to be conducted by a qualified academic or epidemiologist reviewing the Study that the authors hoped to publish in a peer-reviewed journal." The Director submits that Dr. Wilson's review is non-critical, flawed, and does not refer to generally accepted criteria for evaluating epidemiological studies. The Director submits that, therefore, Dr. Wilson's review should not add to the Study's credibility, authority or weight.

The Director submits that the Windvoice Survey was fatally flawed because it "relies on self-reported symptoms that have not been clinically verified and could be the result of psychological suggestibility." The Director states that the results of the survey have no probative value due to the biased survey materials and recruitment procedures. The Director notes that the Appellants' witness, Dr. Aramini, acknowledged that there is no causal association being tested in the Survey.

The Director submits that the literature reports by the Appellants' experts "do not present direct evidence of harm. At best these reports can be described as compilations of unsubstantiated and often dubious hearsay evidence, speculation and theory that should not be relied upon by the Tribunal in making its determination." In contrast, the Director submits that the CMOH Report should be relied on by the Tribunal as a review and synopsis of the existing scientific evidence on the potential health impact of wind turbines using rigorous scientific criteria. The Director states that the Report concludes that "the scientific evidence that is available to date does not demonstrate a direct causal link between the exposure to noise from wind turbines and adverse health effects."

Suncor submits that the evidence before the Tribunal indicates that some people exposed to some wind turbines may experience indirect health effects of annoyance or sleep disturbance, which if left unchecked, may lead to more serious health effects. However, Suncor notes that this evidence is based on turbine locations outside of Canada and turbine technologies other than what will be used at the Kent Breeze Project. Further, Suncor notes that the evidence

establishes that these indirect effects are subjective and are caused by a combination of noise, visual impact, lack of economic benefit and negative attitude towards wind turbines. In addition, Suncor submits that there is uncontradicted published, peer-reviewed scientific evidence that where noise levels did not exceed 40 dBA, the indirect effects were minor. Suncor notes that the REA requires that noise levels do not exceed 40 dBA at receptors and that the company report and address any complaints of adverse effects, such that they will not go unchecked. Suncor submits that the Appellants "have not provided the Tribunal with any evidence regarding the visual impact, attitude or economic benefit that will be experienced by any persons living within 2 km of Kent Breeze. As such, the Tribunal has no evidence upon which to predict what level of harm if any, any of those persons may experience." Suncor submits that, therefore, the evidence is insufficient to establish that engaging in the Kent Breeze Project in accordance with the REA will cause serious harm to human health.

Suncor submits that the evidence of Dr. Colby and the AWEA/CanWEA Report establishes that annoyance is not an adverse health effect. However, Suncor acknowledges that "in some cases, protracted annoyance can result in escalated health effects, starting with stress, and leading to sleep disturbance, and if, chronic and untreated, adverse health effects." Suncor submits that there is no evidence to demonstrate that these indirect effects equate to serious harm, only that they may lead to serious effects if left unchecked. Suncor submits that serious harm will not be caused at the Kent Breeze Project because the REA contains conditions to prevent reports of any alleged effects from going unchecked. Suncor further states that the Appellants' experts do not specifically equate the adverse effects they claim are caused by wind turbine noise with serious harm to human health.

Suncor submits that the Appellants have not provided any reliable evidence to support their claim that the Kent Breeze Project will cause sleep disturbance at levels that constitute serious harm to human health. Suncor submits that the evidence of Dr. Hanning regarding sleep disturbance and adverse effects from wind turbine noise should not be relied upon. Suncor criticizes Dr. Hanning's report because it is not based on any research that he has personally conducted and because it was amended from an earlier version solely on the basis of the Nissenbaum Study to suggest that lower levels of wind turbine noise cause more serious harm than what he previously suggested.

Suncor submits that the evidence shows that exposure to infrasound and/or low frequency sound from wind turbines will not cause serious harm to human health. In support of this submission, Suncor relies on the evidence of Dr. Leventhall that infrasound only leads to health issues where it is above 90 dBA and that infrasound levels from wind turbines are well below this. Suncor also relies on the evidence of the Respondents' other experts, as well as the CMOH Report and the AWEA/CanWEA Report to conclude that infrasound and low frequency sound from wind turbines have no associated adverse health effects. Suncor submits that the work of Dr. Salt, which was referenced by the Appellants' witnesses, does not conclude that infrasound causes serious harm to human health.

Suncor acknowledges that there are unpublished, non-peer-reviewed surveys and self reports where some people living near wind turbines have complained of adverse health effects. However, Suncor submits that this information does not prove that the Kent Breeze Project will cause serious harm to human health. Suncor submits that the Nissenbaum Study did not conclude that wind turbines cause serious harm to human health and furthermore, there are reasons to question the Study's findings. First, the Study is based on a survey that was not designed by an epidemiologist, includes non-validated questions and contains many potential sources of bias. Second, the Study only measures distance from the wind turbine and not actual noise levels. Third, the Study has not been published or peer-reviewed and the evidence of Dr. Baines, Dr. Speechley, Dr. Mundt and Dr. Ollson was that the Study would not be published in its current form. Fourth, even despite the flaws of the Study, it merely concludes that there is evidence to support a causal association between wind turbines and adverse health effects. Suncor submits that this is insufficient to prove that wind turbines will cause serious harm to human health at the Kent Breeze Project.

Suncor submits that the model produced by Dr. Aramini applying the Study results to Kent Breeze should not be relied on by the Tribunal, as there was no evidence that the assumptions on which the model relies are true. Similarly, Suncor submits that the Windvoice Survey does not prove that serious harm to human health will be caused by wind turbines because the evidence obtained from this type of study is not the most reliable and cannot lead to conclusions about causation.

Suncor submits that the literature reviews of the Appellants' witnesses rely on case reports and grey literature which cannot support causal conclusions regarding the effect of wind turbines on human health. Suncor submits that unpublished self-reports were also considered in the literature reviews conducted by the Respondents' experts, though these types of reports were given less weight than peer-reviewed, published articles. Suncor states that the evidence of Dr. Mundt and Dr. McCunney indicates that case reports and case series may be useful for generating hypotheses but they do not have value in drawing causal inferences.

Suncor submits that the Appellants' evidence may support a conclusion of retrospective indirect causation, but without any evidence of the condition of the residents at the Kent Breeze Project, it is insufficient to prove prospective causation on either a balance of probabilities or a higher standard of proof. Suncor states that the Appellants have provided no evidence of any of the Kent Breeze residents' susceptibility to the claimed adverse effects. Further, Suncor submits that the evidence "clearly indicates that none of the adverse health effects can be specifically linked to wind turbines, but rather are common symptoms attributable to a number of different environmental exposures." Suncor states that the residents of Kent Breeze may actually be less susceptible to effects from wind turbines based on the evidence of Dr. Colby regarding the lack of health complaints made about the numerous wind turbines currently operating in Chatham-Kent.

Findings on Indirect Health Effects

Throughout the Hearing, the Parties presented extensive evidence on what was often referred to as "indirect" health impacts of wind turbines. Some of the evidence pertaining to health impacts is well founded in the scientific and medical literature while others (e.g., VAD) are still being studied and debated.

One of the initial issues is whether "indirect" health impacts are included in the test for serious harm under section 145.2.1(2) of the *EPA*. The Tribunal has found above that "serious harm to human health" includes both direct impacts (e.g., a passer-by being injured by a falling turbine blade or a person losing hearing) or indirect impacts (e.g., a person being exposed to noise and then exhibiting stress and developing other related symptoms). This approach is consistent with both the WHO definition of health and Canadian jurisprudence on the topic.

None of the Parties took the view that all indirect health impacts are outside the scope of the phrase "serious harm to human health." Indeed, Suncor acknowledges that in some cases, protracted annoyance can result in adverse health effects. Hence, the issue in this matter is not whether indirect health impacts can be considered, but whether those impacts will be caused here at a level that meets the "serious harm to human health" threshold. There is no reason to doubt, for example, Dr. Hanning's evidence that inadequate sleep can lead to a long list of diseases, conditions and accidents or Dr. Bronzaft's evidence about noise-related disorders. Also, as Dr. Ollson has noted: "Regardless of whether the perceived impacts by affected individuals are physiological or psychological in nature, they are a serious matter and are considered as adverse health effects." The Tribunal accepts that indirect effects are a complex matter and that there is no reason to ignore serious effects that have a psychological component. The Tribunal is mindful of the complex array of factors that have a role to play in perception studies such as those conducted by Pedersen. To the degree that perception can lead to a number of psychological responses, it is something that needs to be addressed in one forum or another (see, for example, Dr. Leventhall's evidence).

The Tribunal, earlier in this Decision, discussed the term "annoyance." It has chosen to use the word "annoyance" here as one of the causes of the effects of concern, many of which can rise to the "serious" level, as opposed to constituting a serious health effect itself. As noted above, regardless of this terminology, the Tribunal is focused on the specific health effects raised by the Appellants irrespective of whether one labels them "annoyance".

Submissions and Findings on Whether Cause and Effect is Sufficient

One of the issues raised in the proceeding is whether the Appellants have to prove which mechanism(s) caused an effect or whether cause and effect is sufficient. It would seem that, when reviewing the test in the *EPA*, the key issue is whether the wind turbines will cause serious harm to human health. The mechanisms of how that harm occurs seem secondary to

the finding of fact that the receptor will experience serious human health impacts resulting from a wind turbine operation.

For this reason, it is not necessary for the Tribunal to make a finding at this point in time as to whether noise from wind turbines is unique and different from other sources of industrial noise. It is apparent that the phrase “wind turbine syndrome” has been a launching pad for a robust debate internationally, nationally and locally as to whether wind turbine noise is any different than other sources of noise and whether it leads in any way to an indirect health outcome. There is no doubt that this debate will create the initiative for new and further studies on the topic which, in turn, will yield a better understanding of this issue in terms of amplitude modulation, low frequency noise, infra sound, audible sound, tonality, etc. For the purposes of this Decision, the Tribunal finds that the Appellants can attempt to satisfy the section 145.2.1(2) test even if there is uncertainty about the specific mechanism that causes the alleged health effects. As noted by Dr. Speechly (albeit in the context of the application of scientific findings, as opposed to the section 145.2.1(2) test itself), an understanding of the specific causal mechanism is not an absolute precondition to action. What needs to be shown here, given the wording of the legal test, is that the effect is being caused by the Project, even if the exact mechanism is unclear.

Evidence Presented and Findings on Ministry of the Environment Noise Guidelines

It is recognized that the current noise guidelines do not account for all turbine noise characteristics mentioned by the Appellants. However, there was considerable evidence presented at the Hearing as to how the MOE Noise Guidelines evolved and how they compare with other noise guidelines. From the evidence, it is fair to say that they represent the current regulatory application of the relevant science on the matter and are consistent with international approaches to the topic. In particular, the WHO Night Noise Guidelines reference that effects on sleep and health are not expected to occur below 40 dB. The Tribunal did hear from several witnesses that the 40 dB limit should be lowered. However, no proof of serious harm at levels approaching 40 dB was presented to the Tribunal.

This is not to say that the MOE Noise Guidelines should remain static. As the science continues to evolve with respect to wind turbines and noise, guidelines should be routinely reviewed and revised, if necessary. As mentioned already, the scientific issues pertaining to wind turbine noise are evolving. Therefore, the regulatory responses to that evolving science must keep pace. Doing so may assist in addressing some of the ongoing concerns regarding the effects of wind turbines. Persons who wish to propose a limit that is lower than 40 dB are entitled to make that case in the regulatory and policy contexts, where proof of harm is not necessarily a condition precedent to taking action. However, under section 145.2.1(2) arguments for a lower limit will only find success before the Tribunal if the case is also made that serious harm will occur at levels below 40 dB.

With respect to the Kent-Breeze Project, on the totality of evidence, there is insufficient evidence to suggest that there will be serious harm to human health if the MOE Noise Guidelines are followed. In other words, there is insufficient evidence to show that serious harm to human health will be caused by exposure to noise below 40 dB at the Kent Breeze Project.

Submissions and Findings on the Status of the Evidence

The Appellants presented a considerable amount of evidence that includes reference to expert opinions, case reports, the Windvoice Survey, Dr. McMurtry's personal interviews, submissions to the Standing Committee, the Pedersen et al. studies, the Nissenbaum Study and Dr. Aramini's application of the Nissenbaum Study results to the Project. They argue that, cumulatively, the totality of the evidence leads to the conclusion that serious harm to human health will occur if the Kent Breeze Project proceeds.

The Director and Suncor urge the Tribunal to either reject or give little value to much of the evidence of the Appellants because it is not peer reviewed or is flawed due to methodological and other weaknesses. In particular, they argue that indirect effects are subjective and could be caused by a combination of noise, visual impact, lack of economic benefit and negative attitude toward wind turbines. They also posit that any indirect effects from the Project do not rise to the "serious" level.

The Tribunal has already discussed above how it approached the issue of the qualification of the witnesses during the Hearing. Regardless of whether the evidence was admitted, however, there is still a question about the degree to which aspects of the evidence should be relied upon in making factual findings under section 145.2.1(2) of the *EPA.* The Parties placed emphasis on the relative weight that certain aspects of the evidence should be given.

The Tribunal recognizes that the science involved in determining the impact of sound from wind turbines continues to evolve and unfold. Hence, it is appropriate for the Tribunal to at least review and consider all evidence put before it and assign the appropriate weight to it. The mere fact that some evidence is not peer reviewed does not automatically disqualify it or prevent the Tribunal from relying on it.

Thus, the case reports, case cross over data and population based studies put forth by the Appellants provided the Tribunal with an understanding of some aspects of the current "state of the science". This data may also serve as an indicator of which issues may be the subject of further scientific research. It is also recognized that the peer-review process adds significant rigour to scientific inquiry (as noted by Dr. Ollson, for example) and that evidence resulting from that process can carry significantly more weight than non peer-reviewed research.

The evidence presented by the Appellants, in totality, establishes that there may be an association between exposure to noise from wind turbines and certain indirect health effects, but the evidence is not sufficient to establish a causal connection at the distances and/or noise

levels for this Project. The Tribunal finds that the evidence marshalled by the Appellants, such as the Nissenbaum Study and Dr. Aramini's application of it, is exploratory in nature, not confirmatory. The legal test, however, imposes a standard that requires more than exploratory evidence.

The Nissenbaum Study and Dr. Aramini's application of it, raise enough questions about the Study to suggest that its results do not meet the legal threshold that wind turbine noise will cause serious harm to human health at the 550 m setback at the Kent Breeze Project. These questions include issues pertaining to: study design, statistical analysis, causation analysis and the transferability of the findings, given the difference in wind turbine design and in the physical lay-out and topography between the study site and that at the Kent-Breeze Project.

Owing to the limitations of the Study, it would be inappropriate, therefore, to rely on the analysis by Dr. Aramini as proof that serious harm will be caused by the Project. This is because the limitations of the Nissenbaum Study apply equally to Dr. Aramini's subsequent application of it. Dr. Aramini has attempted to integrate some of the results of the Nissenbaum Study into a predictive model. This is an important start in the process of developing a more accurate picture of the effects at a given site for a proposed turbine installation. However, given the significant assumptions in the model, the uncertainties regarding the inputs, and the differences between the projects studied by Nissenbaum et al and this project, Dr. Aramini's model can only be described as a first step in the process of better predicting the likelihood of serious health effects. For the risks covered by Dr. Aramini's model, the Tribunal concludes that further research will be necessary before reliable quantification of future harm at a given site can be made. The Tribunal makes no assumptions as to how such research will develop and whether evidence about serious harm to health will become stronger or weaker over time. The point is simply that, at present, the available information is not sufficient to make accurate predictions. This is not to be taken as a criticism of any of the researchers in this area. It is obvious that new ground is being broken and that important questions are being raised. While the questions are being raised, they are not yet being answered conclusively one way or the other.

The heart of the Appellants' case is that there will be serious harm to human health at the non-participating receptor sites. The main ingredient of their case (ignoring for the moment issues such as turbine failure, shadow flicker, etc.) is that sound emissions (including audible sound, low frequency sound and infrasound) cause serious harm at certain levels and that the Project will emit sound at high enough levels that non-participating receptors will experience serious harm. However, the Appellants' position has not been proven according to the evidence that the Tribunal heard. The Tribunal points out, however, that this is not a situation in which the Appellants' non-peer reviewed science was conclusively negated by peer-reviewed science that has found no association between turbines and serious health effects. There is actually a lack of peer-reviewed science on both sides of this debate. It should also be noted that the Tribunal does not find the proposition that "one cannot prove a negative" to be an adequate excuse for the lack of peer-reviewed science. If numerous studies are undertaken to check for

associations between turbines and serious health effects, the Tribunal can look at all of the results to determine whether a particular legal test has been satisfied. Further peer-reviewed science on the association and causation questions would be a welcome development in the debate. More informed decisions will no doubt be possible if further study is undertaken.

Given the current level of science, the Tribunal finds that it is not necessary to make major findings regarding the weight that should be attached to each witness' testimony. The Tribunal recognizes that there were divergent views on the very question to be decided (i.e., "serious harm"). However, it is the Tribunal's role, not each witness' role, to answer that question. In that regard, the Tribunal was more interested in the pathways that led the witnesses to their conclusion, than their general opinions on the legal test. For the most part, the Tribunal has found the evidentiary gap among the Parties to be not nearly as wide as would appear. For example, as the evidence was put in, the Tribunal noted that unequivocal statements of harm or no harm became modified. There is no doubt that witnesses for all Parties began to recognize that the scientific issues raised in this appeal were not easily answered with a "yes" or "no". The Tribunal appreciated the frank comments from witnesses who admitted that a particular study was not "the" study, but just "a" study or that some aspects of the evidence raised questions rather than conclusively answered them. The Tribunal also appreciated the fact that some witnesses, in their oral testimony or supplementary statements, added qualifications to previously stark opinions, such that it was recognized that other witnesses had made important points. These developments give the Tribunal hope that the scientific debate can proceed in a reasonable manner from this point on.

In light of the above, the Tribunal has determined that only the following points on the weight of the evidence need to be made. Generally speaking, the Tribunal did not place a significant amount of weight on any witness' overall conclusion on the legal test. The Tribunal looked carefully at the chain of reasoning and less so at the end of the chain. The end of the chain is more apt to be influenced by the subjective views of individuals, especially in this proceeding where several witnesses have had considerable involvement in debates about turbines. This was another reason why the Tribunal decided to focus more on the inputs to the conclusions of the witnesses rather than just the conclusions.

Looking at the Appellants' evidence, the Tribunal found that strong statements about harm that will be caused were preceded by evidence that largely showed that harm "may" be caused. For example, with respect to the Nissenbaum Study and Dr. Aramini's application of it, there are enough uncertainties to lead the Tribunal to conclude that no proof of harm is present. Indeed, Dr. Aramini spoke about the results "supporting" a causal link, which is different than proof being present on a balance of probabilities standard. Similarly, with respect to the evidence led by Suncor and the Director, there were many instances where appropriate concessions were made in cross-examination or in reply evidence that showed that several witnesses were open to the need for further research in this area (e.g., Dr. McCunney with respect to psychological aspects of symptoms). Similarly, there were acknowledgments that annoyance can lead to harmful

effects (e.g., Dr. Leventhall and Dr. McCunney). As well, there were clarifications about the use of language, such as direct versus indirect effects, which led the Tribunal to conclude that some of the apparently broad conclusions regarding a lack of harm were geared more towards direct effects than indirect effects. This is the case for some passages in the CMOH Report (see, for example, Dr. Rachamin's evidence regarding issues such as direct effects, seriousness, and irreversibility) and the CanWEA/AWEA Report (see, for example, Dr. Leventhall's evidence regarding direct patho-physiological effects as opposed to other effects).

Not surprisingly, once the definitive statements on the legal test were peeled back, a healthy scientific debate was uncovered. Despite the strong differences of opinion on the "serious harm" question, the Tribunal did not find that there were significant questions about the weight of the various inputs. The witnesses, for the most part, provided clear evidence on the inputs. That evidence amounts to various strands of evidence in an emerging area of inquiry. Admittedly, some of the conclusions that the witnesses put forward may later be shown to be incorrect. However, with respect to indirect effects (the situation being different for ice throw, etc. as noted above), the Tribunal does not find that individualized findings about weight are needed for each witness' evidence. Rather, it is the nature of the evidence and the legal test that are key considerations. Thus, the Tribunal has not necessarily "preferred" the evidence of a witness called by Suncor or the Director over the evidence of a witness for the Appellants.

In many cases, the evidence (as opposed to the conclusions) was simply different, but not divergent. To use an example, the Appellants put forward a non peer-reviewed study that showed an association between distance from turbines and reports of effects. The Director and Suncor did not counter with a similar study that did not find an association (a point that was generally made by Dr. Shepherd). Rather, they provided expert evidence on some of the apparent weaknesses in the study and conclusions on why definitive causal correlations could not be found. They also provided evidence about what the existing peer-reviewed articles have studied (for example, perceived impacts, such as "annoyance", "high annoyance", etc.) and contrasted them with what the legal test asks for. This type of evidence added to the evidentiary picture presented to the Tribunal. In very few instances did the scientific evidence run in completely opposite directions. Indeed, the Tribunal heard evidence from Dr. Mundt that many of the applicable peer-reviewed articles are about the perception of noise from wind turbines and not necessarily health effects. This, in part, led to the significant debates about the applicability of words like "annoyance" in the perception of noise studies to the test used in this proceeding, which focuses on health. Obviously, the Tribunal would have preferred clear evidence from peer-reviewed studies that actually measured health effects and their relation to wind turbines, but research in that area is still quite limited.

While the above points are useful general statements about the nature of the evidence that was heard, there were instances where the Tribunal did need to sort through apparent inconsistencies. The Tribunal has already noted above that it preferred the Parties' evidence on ice throw, etc. over that of the Presenter. On noise issues, however, it was rare for the Tribunal

to have to choose one side or another. One example where it does need to do so is the question of the maximum sound levels. The Tribunal heard evidence that the Project may not comply with the 40 dB limit, owing to a lack of incorporation of uncertainties or tolerances (for example, relating to wind shear). The Tribunal also heard that the modeling used by Suncor and the calculations made by the Director showed what the maximum sound level emissions would be (i.e.,105.1 dBA emission at the source, which translates to approximately 40 dBA immission at the closest receptor) and that there was no need to add anything further to the maxima. The Tribunal has carefully reviewed that evidence and finds that Suncor and the Director have provided adequate explanations for their calculations of the maximum sound level, even in cases of high wind shear. The evidence leads the Tribunal to conclude that the calculations appear to be sound and that, it is therefore, unnecessary to determine if the Tribunal has the jurisdiction to examine the effects of the Project if it is shown to be out of compliance with the 40 dB limit. The Tribunal finds that the Appellants' evidence has not shown that the Project will be above the regulatory limit or that any upward adjustments to the maximum sound level emission or immission calculations are needed. Nevertheless, if the modeling does end up being inaccurate (recognizing the general point that pre-operation modeling has limitations as compared to accurate post-operation field measurements), then adjustments will have to be made to ensure ongoing compliance. The 40 dB limit is a real limit that Suncor must abide by regardless of its modeling exercises. This is one reason why the Tribunal hopes that there are advancements in the field of noise measurement. Such advances will allow compliance monitoring and enforcement activities to proceed more smoothly.

To summarize, the evidence in this Hearing on serious indirect harm was largely exploratory. The evidence on a lack of serious indirect harm was also limited (the evidence on a lack of serious direct harm is much stronger, however). The Tribunal is not giving significant weight to the latter and little to the former in reaching its conclusion. That is because the legal test itself tilts the balance in one direction. The onus is on one side (in this case, the Appellants). That side has provided evidence that the Tribunal finds to be exploratory in nature, even if given significant weight. Put another way (using the wording of Dr. Mundt), the present situation is closer to the hypothesis generating phase of scientific research than it is to the point where conclusions can be made on causation (with respect to the sound levels expected at the Project's receptors). Or, using the approach of Dr. Shepherd, it is clear that we are not yet at the third stage of research on a new condition where intensive research has been completed so as to determine causation. We are at a much earlier stage, where there have been adverse event reports and some exploratory studies, such as the Nissenbaum Study. It is, therefore, no surprise that the legal test, which requires proof of harm, has not been satisfied when the applicable scientific evidence is in such an early stage of development.

The Director admits that there is a need for significant setback in order for sound levels to decrease in magnitude with distance from the source. The implication of this is that it is recognized that turbines can cause serious harm if one lives too close to source of the sound. The real question is whether the noise levels that will be experienced at the non-participating

receptor sites will be high enough to cause serious harm and, as discussed below, in this Hearing it was not shown that they are. Noise levels are not high enough to cause serious harm. In that regard, the Tribunal hopes that this Hearing has served an important purpose in informing the debate about wind turbines.

Some may argue that time will tell that wind turbines are like cigarette smoking, because decades ago smoking was thought to be harmless. However, the Tribunal finds decades-old attitudes to cigarettes to be a poor analogy to wind turbines. This is because Ontario already recognizes that there are some risks with respect to wind turbines. That is why there are setbacks. The overall debate is not a simplistic one involving "yes" or "no" but really one about safe limits. The narrower debate in this proceeding is about whether the Appellants have satisfied the legal test for "serious harm".

In this proceeding, the Tribunal finds that there is insufficient evidence to establish that noise predicted to be produced at the Kent Breeze Project will cause indirect harm to such a serious degree that will cause serious harm to human health. However, as noted above, the science in this area is evolving and it is hoped that future studies will shed additional light as to possible impacts on human health.

Evidence Presented and Findings on Cumulative Impacts of all Effects

Though the Parties have addressed multiple concerns regarding harm to human health, the Tribunal notes that the statutory test appears to ask for a global answer to the question about serious harm, as discussed above in the findings on the statutory test.

In this case, the Tribunal has heard evidence of several different kinds of risks to human health. Based on the evidence, they can be put into several general categories. First, there are those, such as direct hearing loss, that the evidence in this Hearing shows will not be caused at all because the sound levels are too low to cause physical damage to the human ear. Second, there are those, such as physical injury or death from tower collapse, turbine failure or other accidents, which are caused at a very low rate across all turbine facilities. The chances of them occurring here at this site are extremely low. Third, there are those, such as chronic stress, sleep deprivation, etc., that are worthy of further study. However, the evidence at this Hearing has not shown, at this stage of research, that they will be caused here.

Based on the evidence received at this Hearing, it is not possible for the Tribunal to determine with a high degree of precision what the cumulative probability of at least one type of serious harm occurring would be. What the Tribunal can conclude is that the Appellants have not demonstrated that any one risk or any combination of one or more risks is likely to occur at a rate where it can be said on a balance of probabilities that at least one type of serious harm to human health will be caused.

Issue #1(b): Will the project as approved cause serious harm to human health of participants?

In this case, the Appellants focus most of their concerns on the effects of the Project on non-participating receptors. However, they do also argue that the one participating receptor will be the subject of serious harm. The evidence on this issue is very limited. The Tribunal is aware that the setback distance is shorter (332 m) and the maximum noise level is expected to be higher at this point (45.8 dBA).

It is interesting to note that the statutory test of serious harm is not subject to an exception for participating receptors. Therefore, it appears to be the case that the test can be satisfied if an appellant shows that serious harm will occur to a person who voluntarily absorbs that harm.

Findings under Issue #1(b)

In this case, the Tribunal does not know whether any person resides or will reside at this receptor. It is, therefore, unnecessary to determine if the above conclusions on the likelihood of serious harm to those subjected to 40 dBA noise levels would be materially different at 45.8 dBA. Recognizing that noise is not measured on a linear scale, the difference could very well be significant. However, the Tribunal heard evidence that attitude towards turbines (which could be different as between participants and non-participants) can affect the situation. For example, those who benefit from a project may not have the same reaction to the presence of a wind turbine as similarly situated persons who do not benefit. Nevertheless, without an adequate evidentiary basis regarding the use of the participating receptor site and whether it is to be regularly occupied, the Tribunal finds that the Appellants have failed to show that "serious harm to human health" will occur at the participating receptor.

In this case, the Appellants mounted a more general challenge to the setbacks in general and decided not to focus on specific individual receptors. In the future, where appellants allege harm to specific receptors (e.g., a participating receptor within the setback area; a non-participating receptor who has particular sensitivities to noise, etc.), they should call detailed evidence about the circumstances facing those receptors.

Issue #1(c): Will the project as approved cause serious harm to human health if the approval authority is unable to properly predict, measure or assess sound from the facilities including audible noise and/or low frequency noise and/or infrasound?

The Tribunal has addressed above the issues associated with the Appellants' arguments concerning the need for "corrections" or "adjustments" to the predicted noise levels. As noted above, the Tribunal has not found that those arguments meet the test of showing that serious harm will be caused.

The Appellants have also relied on an alleged "inability" to predict, measure and assess sound from the Project. The Tribunal heard evidence that there are challenges and uncertainties

associated with predicting, measuring and assessing sound (including audible noise, low frequency sounds and infrasound). The Tribunal also heard evidence that some of these issues can be addressed (e.g., the evidence of Mr. Howe and Mr. Najafi-Ashtiani). The Tribunal finds that some challenges and uncertainties remain despite continuing advances in this area. It is hoped that progress comes quickly, as compliance measurement will be an important aspect of the implementation of the new REA regime.

Findings under Issue #1(c)

In this case, however, the Appellants have not shown how these uncertainties will cause the harm specified in the statute. At best, one may conclude that the predictions of noise levels will not be completely accurate and that measurements and assessments will be hampered by the technology available and the very nature of sound and noise. However, it is a large leap to state that these challenges and uncertainties mean that the Project will cause serious harm. In this regard, the Appellants have simply provided evidence that rises to the point of raising concerns but not to the point of proving that serious harm will be caused.

The Appellants' additional arguments concerning the interface between the alleged inability to monitor noise level compliance and the SEV are dealt with under Issue 1(d) below.

Issue #1(d): Will the Project as approved cause serious harm to human health because the approval does not comply with the approval authority's Statement of Environmental Values?

The Tribunal has already discussed above the application of the precautionary principle in terms of statutory interpretation of the relevant sections of the *EPA*. However, the principle also arises in this issue because precaution is an important aspect of the SEV. This section of the Decision examines the Director's consideration of the SEV, including precaution, in the context of the REA for this project.

The Appellants submit that the protection of human health is one of the main purposes of the *EBR*. They refer to the purposes of the *EBR* set out in the Introduction to the SEV, in particular: "to protect the right to a healthful environment by means provided in this Act." The Appellants submit that "the SEV provides steps for the Minister (or Director in this case) to follow to ensure that the purposes of the *EBR* are met when decisions, such as the issuance of a REA, are made." The Appellants submit that "a significant portion of the SEV requires the Ministry (here the Director) to consider, among other matters, human health." In support of this claim, the Appellants refer to various parts of the SEV, including parts of Section 1: Introduction, Section 2: Ministry Vision, Mandate and Business, Section 3: Application of the SEV, Section 4: Integration with Other Considerations and Section 5: Monitoring Use of the SEV. The Appellants submit that a failure to meet those requirements to consider human health, demonstrates that the Director has not adequately turned his mind to considerations that have been determined to be necessary to achieve the *EBR*'s purpose of the protection of human health.

The Appellants submit that in issuing the REA, the Director failed to apply a precautionary approach as required by the SEV. The Appellants argue that this failure stems from the fact that the only material that the Director reviewed in relation to human health issues was the CMOH Report and this Report looked only at the direct health effects of wind turbines, ignoring the "myriad of indirect effects" that are known to occur. The Appellants submit that the failure to consider these indirect effects does not constitute proper consideration of human health and/or the precautionary principle as required by the SEV. In addition, the Appellants submit that the Director has not properly considered human health and/or the precautionary principle given that the REA was issued at a stage where there is no accepted approach to determine compliance and where it is known that wind turbine noise can cause adverse effects to human health and serious harm, if not properly regulated. The Appellants submit that "the non-compliance with the SEV, and specifically those parts of the SEV directed at the protection of human health, standing alone, provides sufficient evidence that, on a balance of probabilities, the Project as approved will cause serious harm to human health." Alternatively, the Appellants submit that the non-compliance with the SEV is strong evidence of harm to human health that must be taken into consideration when applying the section 145.2.1 test.

The Director points to the Tribunal's earlier Order on the applicability of the SEV in this case set out in *Erickson 2*. The Director notes that in allowing the SEV to be raised as an issue in the Hearing, the Tribunal stated that the Appellants must demonstrate a nexus between the SEV and the harm set out in the section 145.2.1 test. The Director submits that no such nexus has been shown by the Appellants. Rather, the Director submits that "it has been fully shown that consideration of the SEV was thorough and proper and there are no consequences of any lack of consideration that could or will result in human harm." The Director notes that the REA issued to Kent Breeze contains terms and conditions (including noise limits, setback requirements, monitoring and reporting obligations and maintenance procedures) that ensure the principles of the SEV are upheld. Specifically, the Director points to Conditions 25(e) and 26 to 28 which require the Approval Holder to record and report any complaints alleging adverse effects that are received. In addition, the Director argues that his reliance on the CMOH Report is evidence of how the precautionary principle was engaged and applied in his decision. The Director states that the Appellants' assertions that there are research gaps and scientific uncertainty about how to protect human health from exposure to wind turbines are not sufficient to meet the evidentiary burden required under section 145.2.1 of the *EPA*, nor do these assertions prove that the Director failed to consider the SEV or the precautionary principle.

The Director further states that, if the Appellants think the REA was not issued correctly or that an aspect of the SEV was not properly considered, the proper route for redress is a judicial review, not an appeal before this Tribunal because of the limited grounds available in a section 142.1 REA appeal. In response, the Appellants submitted that "the courts have made it clear that judicial review is a discretionary, equitable remedy that is the last place one looks to for relief." The Appellants further stated that "this is the Tribunal that has specialized expertise that

is tasked with adjudicating environmental issues in the province" and as such, it is the most appropriate body to hear this appeal.

Suncor submits that "(i)n law, there is no obligation on a decision-maker to make its decision in compliance with [the SEV]. Section 11 of the EBR requires only that the Minister ensure that the SEV is considered." Suncor states that its position is not that the SEV does not apply to the Director. Rather, it states that the *EBR*'s requirement for the Director to consider the SEV is not the same thing as a requirement to make a decision that is consistent with the SEV. Suncor submits that as long as the Director meets the requirement of considering the SEV, the legal standard does not oblige consistency with the SEV. Suncor submits that the evidence shows that the Director properly considered the SEV in issuing the REA. Suncor notes that the *EPA* requires the Director to ensure that no adverse effect would result from the project and this would include an adverse effect to human health. Further, Suncor states that the CMOH Report raised the issue of indirect effects in its review of the peer-reviewed literature on annoyance from wind turbines (i.e., the Pedersen et al. studies) and therefore, the Director would have been aware of the allegations of indirect health effects related to wind turbines when issuing the REA.

In reply, the Appellants refer to *Lafarge* where the Divisional Court held that the Minister is required to take every reasonable step to ensure the SEV is considered where required. Further, there is no exclusion for Directors making the same types of decisions. In their oral submissions, the Appellants submitted that this issue is *res judicata* because of the Tribunal's ruling in its previous Order that the issue of the SEV would remain on the issues list, demonstrating the applicability of the SEV to this Hearing. The Appellants state that the Director's assertion that they are relying on human health as the primary focus of the SEV is incorrect. Instead, the Appellants state that the SEV is to be read as a whole where each purpose or provision is part of the applicable statutory framework and must be given proper consideration.

Findings under Issue #1(d)

Under the *EBR,* the MOE's SEV plays an important role in informing environmental decision-making. Properly implemented, the SEV can assist in the process of making government decision-making more informed and environmentally sound. As noted before (*Erickson 2*), there are several aspects of the SEV that are relevant to decisions about renewable energy projects. Directors should consider the SEV carefully in making decisions, not only because the *EBR* requires it but because it will lead to better decisions. The principles of the SEV, including precaution, pollution prevention, environmental restoration, biodiversity protection, polluter pays, resource conservation, intergenerational equity, integration, sustainability, the right to a healthful environment, science-based decision-making, inherent value, transparency, continuous improvement, ecosystem approach and cumulative effects analysis are all sound approaches to improving the quality of decision-making.

As noted in the MOE's SEV, the *EBR* includes several key purposes:

> The [*EBR*] was proclaimed in February 1994. The founding principles of the *EBR* are stated in its Preamble:
>
> > The people of Ontario recognize the inherent value of the natural environment.
> >
> > The people of Ontario have a right to a healthful environment.
> >
> > The people of Ontario have as a common goal the protection, conservation and restoration of the natural environment for the benefit of present and future generations.
>
> While the government has the primary responsibility for achieving this goal, Ontarians should have the means to ensure that it is achieved in an effective, timely, open and fair manner. The purposes of the Act are:
>
> > To protect, conserve and where reasonable, restore the integrity of the environment;
> >
> > To provide sustainability of the environment by the means provided in the Act; and
> >
> > To protect the right to a healthful environment by the means provided in the Act.
>
> These purposes include the following:
>
> > The prevention, reduction and elimination of the use, generation and release of pollutants that are an unreasonable threat to the integrity of the environment.
> >
> > The protection and conservation of biological, ecological and genetic diversity.
> >
> > The protection and conservation of natural resources, including plant life, animal life and ecological systems.
> >
> > The encouragement of the wise management of our natural resources, including plant life, animal life and ecological systems.
> >
> > The identification, protection and conservation of ecologically sensitive areas or processes.
>
> To assist in fulfilling these purposes, the Act provides:
>
> > The means by which Ontarians may participate in the making of environmentally significant decisions by the Government of Ontario;

> Increased accountability of the Government of Ontario for its environmental decision-making;
>
> Increased access to the courts by residents of Ontario for the protection of the environment; and
>
> Enhanced protection for employees who take action in respect of environmental harm.

The SEV includes several other passages that are relevant to the Project, including:

> The Ministry of the Environment's vision is an Ontario with clean and safe air, land and water that contributes to healthy communities, ecological protection, and environmentally sustainable development for present and future generations.

The SEV goes on to list a number of important principles that should guide MOE decision-making:

- The Ministry adopts an ecosystem approach to environmental protection and resource management. This approach views the ecosystem as composed of air, land, water and living organisms, including humans, and the interactions among them.
- The Ministry considers the cumulative effects on the environment; the interdependence of air, land, water and living organisms; and the relationships among the environment, the economy and society.
- The Ministry considers the effects of its decisions on current and future generations, consistent with sustainable development principles.
- The Ministry uses a precautionary, science-based approach in its decision-making to protect human health and the environment.
- The Ministry's environmental protection strategy will place priority on preventing pollution and minimizing the creation of pollutants that can adversely affect the environment.
- The Ministry endeavours to have the perpetrator of pollution pay for the cost of clean up and rehabilitation consistent with the polluter pays principle.
- In the event that significant environmental harm is caused, the Ministry will work to ensure that the environment is rehabilitated to the extent feasible.
- Planning and management for environmental protection should strive for continuous improvement and effectiveness through adaptive management.
- The Ministry supports and promotes a range of tools that encourage environmental protection and sustainability (e.g. stewardship, outreach, education).

- The Ministry will encourage increased transparency, timely reporting and enhanced ongoing engagement with the public as part of environmental decision making.

One of the key issues of concern raised by the Appellants with respect to the SEV was the Director's application of the precautionary principle. The need to link the SEV to the section 145.2.1(2) test has already been emphasized by the Tribunal (*Erickson 2* at paras. 28-31):

> The SEV most often comes before the Tribunal in applications for leave to appeal under the *EBR*, where an applicant may argue that the SEV or another relevant policy was not considered or was not reasonably applied in the context of the test in section 41 of the *EBR*. In an appeal under section 142.1 of the *EPA*, however, there is no "leave to appeal" stage where the section 41 test from the *EBR* is used. Instead, the matter proceeds directly to an appeal hearing where the Tribunal is asked to focus on whether certain types of harm will result from the project.
>
> Does this mean that the SEV, which was developed under the *EBR*, is completely irrelevant to the "review" to be undertaken by the Tribunal under the *EPA*? If a section 142.1 appellant simply showed that the Director failed to carry out the duty imposed by the condition precedent found in section 11 of the *EBR* but did not also demonstrate the harm referred to in section 145.2.1(2) of the *EPA*, it appears that there would be no remedy available to the Tribunal to deal with the section 11 non-compliance. The Tribunal's powers in a section 142.1 appeal, unlike most other types of *EPA* appeals, flow exclusively from findings of harm (section 145.2.1(4)).
>
> However, in another sense, as outlined by Mr. Gillespie, the SEV can be relevant in a section 142.1 appeal where the Appellant argues that the Director's alleged improper consideration or application of the SEV led to the harms referred to in section 145.2.1(2) of the *EPA*. Here, Mr. Gillespie argues that the Director's SEV considerations were one link in the decision-making chain that led to a decision that will cause harm.
>
> There is no question that several aspects of the SEV relate directly to both arms of the section 145.2.1(2) test (though only the first arm is at play in these appeals). As such, the SEV can be raised by the Appellants and the Director can be questioned on how the SEV was considered in respect of human health matters. However, for the SEV to advance the Appellants' case, the Appellants will need to demonstrate a nexus between the SEV (and the consideration or lack of consideration thereof) and the harm listed in section 145.2.1.

The Tribunal has some concerns about how Suncor's application was assessed in light of the SEV's precautionary wording. The Director testified about the role of precaution in his decision-making process. Based on that testimony, the Tribunal has some concerns about the Director's understanding of the role and applicability of the principle. The impression left by some of the Director's comments is that more work should be done within the MOE on putting the precautionary principle into practice. Care should be taken in putting into place effective

precautionary measures rather than simply painting standard measures with a precautionary brush. For example, the Director pointed to Condition 10 as an example of precaution:

> 10. Prior to the construction or installation of the *Equipment* the *Company* shall:
>
> (1) submit one or more written reports to the *Director* verifying that the locations of the *Equipment* comply with Ontario Regulation 359/09 "Renewable Energy Approvals" under the *Act*; and
>
> (2) obtain written confirmation from the *Director* verifying that the *Director* is satisfied with the report(s) prepared under Condition No. 10(1).

The Director said that "...this condition is a classic example of ensuring the Statement of Environmental Values are followed; precautionary approach, sustainable development, planning and management is upheld." While Condition 10 is a useful component of the approval, it is hard to understand why that condition is an apt example of precautionary action by the Ministry. One would think that requiring the proponent to verify that the locations of the wind turbines comply with the setback distances prescribed in the regulation would be standard practice with or without regard to the precautionary principle.

With regard to the other aspects of the SEV, the Tribunal has already undertaken its analysis of the human health issues above. The Tribunal's findings are based on the evidence heard in this Hearing and not simply on how the Director assessed human health matters. In this case, that assessment included reference to the CMOH Report, which is largely focused on direct effects. Despite the apparent lack of a detailed review of possible indirect effects (as well as the Tribunal's concerns about precaution), the Appellants face the same issue here as they did with the ground of appeal relating to predicting, measuring and assessing sound. Again, it is a large leap to state that any deficiencies in how the SEV was considered mean that the Project will cause serious harm (especially where the Hearing itself constitutes an independent assessment of the serious harm test). In this regard, the Appellants have not proven that serious harm will be caused with reference to the approval's alleged non-compliance with the SEV. Rather, they have simply raised valid concerns about the process by which the application was assessed in light of the SEV. This is not enough to satisfy the section 145.2.1 test and provide jurisdiction to the Tribunal to make changes to the approval decision. As noted by the Director, the critical nexus is missing from the Appellants' case. To the extent that the Appellants have also addressed the alleged inability to monitor noise level compliance in relation to the SEV (in addition to Issue 1(c) above), the Tribunal reaches the same conclusion that the critical nexus to the section 145.2.1 test is missing.

Even though the Tribunal allowed the SEV issue to be raised by the Appellants in this case (see *Erickson 2*), now that the full evidence and submissions on the SEV has been heard, it has

become more apparent that it will be difficult for section 142.1 appellants to successfully use procedural arguments to satisfy the section 145.2.1(2) test. Section 145.2.1(2) is more direct in nature than the tests that may be applicable in other types of proceedings. Under the new REA provisions, it is clear that any argument about a procedural failing has to also prove that the harm listed in section 145.2.1(2) will result. If the chain of reasoning is not complete, then the argument will fail as noted in *Erickson 2* at para. 35:

> An analysis of section 145.2.1 demonstrates that a finding of a failure to properly consider or apply the SEV, on its own, is not sufficient to result in action by the Tribunal under section 145.2.1(4). A nexus still needs to be made to the types of harm listed.

Despite the Tribunal's concerns about the Director's apparent lack of consideration of indirect health effects and the need for further work on the MOE's practice of precaution, no direct consequences flow from those concerns here. As noted above, any Tribunal intervention is subject to the condition precedent found in section 145.2.1(2). In this case, because of the Tribunal's overall findings regarding harm, section 145.2.1(4) is not engaged and the Tribunal is, therefore, not to exercise its discretion by amending the approval according to the precautionary principle.

It is hoped that Ministry decision-makers will nonetheless continue to make progress in their efforts to further enhance the role of the SEV, including the precautionary principle, in their work. Precautionary measures should be taken to minimize the risk that renewable energy projects in some locations will simply sacrifice one value (e.g., an environmental amenity or public health) for another (e.g., reduction in the use of fossil fuels).

In this regard, precaution will not be the only applicable principle of environmental decision-making to be brought to bear. Attention to the ecosystem approach and cumulative effects, coupled with precaution and several other aspects of the SEV, will foster more sustainable, integrated and holistic approaches to decisions about other projects in other locations. For renewable energy projects to succeed in their promise of creating net environmental benefits relative to other, less sustainable and/or higher risk sources of energy, it will be important for decision-makers to "anticipate, prevent and attack the causes of environmental degradation" (using the words of the principle) by carefully assessing proposed renewable energy projects such that they do not themselves become significant sources of environmental degradation or public health risks. This case has served as a reminder that all types of energy projects (including renewable or "green" projects) can generate significant concerns and conflict. The precautionary principle's focus on "preventing" the causes of environmental degradation calls upon all of us to take significant steps to reduce energy demands and encourage conservation. In this way, the precautionary principle serves as a modern reminder of the old adage that "an ounce of prevention is worth a pound of cure".

Overall Conclusion:

The Tribunal has found that the Appellants have not met the legal test set out in section 145.2.1(2)(a) of the *EPA* and the appeals must, therefore, be dismissed. The Director's decision on the REA is, therefore, confirmed pursuant to section 145.2.1(5). While there are certainly legitimate concerns and uncertainties about the effects of wind turbines on human health, the Tribunal cannot conclude that engaging in the Kent Breeze Project as approved will cause serious harm to human health according to the evidence tendered in this Hearing. The Tribunal notes that the research in this area is at quite an early stage and that our collective understanding of the impacts of wind turbines on human health will likely progress as further research and analysis is undertaken.

While the Appellants were not successful in their appeals, the Tribunal notes that their involvement and that of the Respondents, has served to advance the state of the debate about wind turbines and human health. This case has successfully shown that the debate should not be simplified to one about whether wind turbines can cause harm to humans. The evidence presented to the Tribunal demonstrates that they can, if facilities are placed too close to residents. The debate has now evolved to one of degree. The question that should be asked is: What protections, such as permissible noise levels or setback distances, are appropriate to protect human health? In Ontario, recent regulations have provided guidance in that regard. In cases such as this, where the Appellants have not sought to demonstrate any type of unique harm associated with the design of this Project and have not attempted to demonstrate the sensitivity of a particular receptor, it was essentially up to the Appellants to prove that the Ontario standards are wrong in the context of the specific Project under appeal (leaving aside the related question about possible non-compliance with the standards). Just because the Appellants have not succeeded in their appeals, that is no excuse to close the book on further research. On the contrary, further research should help resolve some of the significant questions that the Appellants have raised.

The Tribunal wishes to commend the Parties and witnesses for their extraordinary efforts in completing this Hearing according in the expedited format required under the legislation and regulations. Despite the novelty of the legal issues and the nascent state of the scientific research, all those involved demonstrated a commitment to the efficient conduct of the proceeding. The Tribunal acknowledges that the constraints associated with hearings such as this can be challenging at times, but with the assistance of all of those involved those challenges were met.

Other Matters – July 18, 2011 Motion

On July 15, 2011, the Appellants brought a Motion to admit two documents as new evidence under Rule 234 of the Rules of Practice of the Tribunal and to adjourn the proceeding under section 59(2)(1)(ii) of O.Reg. 359/09 made under the *EPA* to consider the new evidence.

The Motion was heard by teleconference at 7:00 a.m. on July 18, 2011. Mr. Gillespie appeared for the Appellants. Ms. Huckins and Nicholas Adamson appeared for the Director. Mr. Engel and Mr. Headrick appeared for Suncor. The Director and Suncor filed written submissions on July 18, 2011.

Having heard and considered the submissions of the Parties, the Tribunal dismisses the Motion. Reasons for the Tribunal's dismissal of the Motion will follow.

Decision

The Appellants have not shown that engaging in the Project in accordance with the REA will cause serious harm to human health as required by section 145.2.1(2)(a) of the *EPA*. The Tribunal, therefore, dismisses the appeals and, under section 145.2.1(5) of the *EPA*, confirms the Director's decision.

Appeals Dismissed

Jerry V. DeMarco, Panel Chair

Paul Muldoon, Vice-Chair

Appendix A – Relevant Legislation
Appendix B – Tribunal's Practice Direction for Technical and Opinion Evidence
Appendix C – List of Acronyms used in the Decision
Appendix D – List of References cited in the Summary of Evidence

Appendix A - Relevant Legislation

Environmental Protection Act

Hearing re renewable energy approval

142.1 (1) This section applies to a person resident in Ontario who is not entitled under section 139 to require a hearing by the Tribunal in respect of a decision made by the Director under section 47.5.

Same

(2) A person mentioned in subsection (1) may, by written notice served upon the Director and the Tribunal within 15 days after a day prescribed by the regulations, require a hearing by the Tribunal in respect of a decision made by the Director under clause 47.5 (1) (a) or subsection 47.5 (2) or (3).

Grounds for hearing

(3) A person may require a hearing under subsection (2) only on the grounds that engaging in the renewable energy project in accordance with the renewable energy approval will cause,

(a) serious harm to human health; or

(b) serious and irreversible harm to plant life, animal life or the natural environment.

Contents of notice requiring hearing, s. 142.1 hearing

142.2 (1) An applicant for a hearing required under section 142.1 shall state in the notice requiring the hearing,

(a) a description of how engaging in the renewable energy project in accordance with the renewable energy approval will cause,

(i) serious harm to human health, or

(ii) serious and irreversible harm to plant life, animal life or the natural environment;

(b) the portion of the renewable energy approval in respect of which the hearing is required; and

(c) the relief sought.

Effect of contents of notice, s. 142.1 hearing

(2) Except with leave of the Tribunal, at a hearing by the Tribunal an applicant mentioned in subsection (1) is not entitled to appeal a portion of the renewable energy approval that is not stated in the applicant's notice requiring the hearing.

Leave by Tribunal, s. 142.1 hearing

(3) The Tribunal may grant the leave referred to in subsection (2) where the Tribunal is of the opinion that to do so is proper in the circumstances, and the Tribunal may give such directions as the Tribunal considers proper consequent upon the granting of the leave.

Parties to hearing

145. (1) The person requiring the hearing, the Director and any other person specified by the Tribunal are parties to the hearing.

Same, s. 142.1 hearing

(2) In the case of a hearing required under section 142.1, the holder of the renewable energy approval is a party to the hearing.

Powers of Tribunal

145.2 (1) Subject to sections 145.3 and 145.4, a hearing by the Tribunal under this Part shall be a new hearing and the Tribunal may confirm, alter or revoke the action of the Director that is the subject-matter of the hearing and may by order direct the Director to take such action as the Tribunal considers the Director should take in accordance with this Act and the regulations, and, for such purposes, the Tribunal may substitute its opinion for that of the Director.

Non-application of subs. (1)

(2) Subsection (1) does not apply in respect of a hearing required under section 142.1.

Hearing required under s. 142.1

145.2.1 (1) This section applies to a hearing required under section 142.1.

What Tribunal must consider

(2) The Tribunal shall review the decision of the Director and shall consider only whether engaging in the renewable energy project in accordance with the renewable energy approval will cause,

(a) serious harm to human health; or

(b) serious and irreversible harm to plant life, animal life or the natural environment.

Onus of proof

(3) The person who required the hearing has the onus of proving that engaging in the renewable energy project in accordance with the renewable energy approval will cause harm referred to in clause (2) (a) or (b).

Powers of Tribunal

(4) If the Tribunal determines that engaging in the renewable energy project in accordance with the renewable energy approval will cause harm referred to in clause (2) (a) or (b), the Tribunal may,

(a) revoke the decision of the Director;

(b) by order direct the Director to take such action as the Tribunal considers the Director should take in accordance with this Act and the regulations; or

(c) alter the decision of the Director, and, for that purpose, the Tribunal may substitute its opinion for that of the Director.

Same

(5) The Tribunal shall confirm the decision of the Director if the Tribunal determines that engaging in the renewable energy project in accordance with the renewable energy approval will not cause harm described in clause (2) (a) or (b).

Deemed confirmation of decision

(6) The decision of the Director shall be deemed to be confirmed by the Tribunal if the Tribunal has not disposed of the hearing in respect of the decision within the period of time prescribed by the regulations.

Consistency with policies

145.2.2 A decision or order of the Tribunal under this Part in respect of a renewable energy approval shall be consistent with any policies issued by the Minister under section 47.7 that are in effect on the date of the Director's decision.

Appendix B - Tribunal's Practice Direction for Technical and Opinion Evidence

Purpose

1. Technical staff, advisors, consultants and expert witnesses routinely give scientific and technical information and their professional opinions in reports and testimony on important issues that the Tribunal must resolve. The opinions given usually purport to be the independent professional judgment of the advisor or witness, based on his or her considerable experience and training. The Tribunal relies on the professional integrity and ethics of these witnesses.

2. The purpose of this Practice Direction is to assist Parties, their representatives, and their witnesses who will give scientific, technical, and opinion evidence to prepare for the Hearing and to present evidence to the Tribunal. The Tribunal seeks to ensure the reliability of scientific and technical evidence and opinion evidence provided to it. Comprehensive and reliable evidence will promote efficiency and fairness in the Tribunal's process, decrease cost and delay, and make the Hearing process less adversarial.

Technical and Scientific Evidence

3. Many witnesses, particularly government employees, appear before the Tribunal to give evidence of scientific and technical observations, tests, measurements, and estimates. While these witnesses are often not considered experts who interpret scientific and technical evidence and provide opinions, they collect, compile, and to some extent interpret, information that is essential to the Tribunal's understanding of the issues and often forms the basis for expert opinion evidence. In this Practice Direction, these witnesses are referred to as "technical witnesses" and the scientific and technical information they convey is referred to as "technical evidence".

Opinion Evidence

4. Generally, lay witnesses, including technical staff of companies and government agencies may only state facts, that is, observations made with their physical senses, or in the case of person with appropriate training, observations made with specialized equipment, for example, taking samples and analyzing them in a laboratory and recording the results. They may not give opinions about the significance of the results of such measurements for environmental quality or human health.

5. To give opinion evidence, a witness must have specialized education, training, or experience that qualified him or her to reliably interpret scientific or technical information or to express opinions about matters for which untrained or inexperienced person cannot provide reliable opinions. Such matters often include whether pollution has caused or is likely to cause significant harm to the environment. Such witnesses are often called "expert witnesses" or "opinion witnesses".

The Role of the Technical Witness

6. The Tribunal expects the witness giving technical or scientific evidence to remain within his or her area of competence. The witness should not attempt to interpret the meaning or significance of tests, observations and measurements unless qualified to do so. The witness should disclose in advance to the other Parties all measurements, tests, observations, and data relating to the issues about which he or she will give evidence, and disclose in examination-in-chief all information relevant to the issues before the Tribunal. Observations, tests, or measurements that do not appear to support the position of the Party for whom the witness is testifying should also be stated.

The Role of Expert or Opinion Witnesses

7. Opinion evidence from a properly qualified "expert" witness should be based on accurate facts, reliable estimates, and accepted or tested techniques or methods of investigation, measurement, and analysis. Expert witnesses must present evidence in an unbiased manner and not act as an advocate. The same obligations applicable to technical witnesses apply to expert or opinion witnesses.

The Role of the Tribunal

8. The decisions that the Tribunal must make involve the public interest and may have serious and far-reaching environmental consequences. These decisions must be based on a balanced record, composed of accurate and reliable technical information and professional opinions. All Parties and their representatives and witnesses have a responsibility to contribute to such a balanced record to assist the Tribunal to fulfill its duty. They are expected to make every effort to comply fully with this Practice Direction. The Tribunal expects that lawyers and other representatives will provide appropriate direction to witnesses to achieve this result.

9. (a) The Tribunal expects the opinion witness to provide it with assistance by way of qualified, relevant opinions and accurate information in relation to matters within his or her expertise. Objectivity and impartiality are necessary to assist the Tribunal in making its decision.
   (b) Evidence that is influenced by the special interests of a Party may be received and considered, but the Tribunal may give this evidence little or no weight.
   (c) The witness should express an opinion to the Tribunal only when the opinion is based on adequate knowledge and sound conviction. The witness should be reluctant to accept an assignment to provide evidence for use by the Tribunal if the terms of reference of the assignment do not allow the witness to carry out the investigations and obtain the information necessary to provide such an opinion. A witness who accepts an assignment under these circumstances should advise the Tribunal of the limitations that the terms of reference place on his or her ability to provide the information necessary to assist the Tribunal in making a sound decision.
   (d) Technical evidence and opinion evidence should be, and should be seen to be, the independent product of the witness uninfluenced by the interests of any Party and should, therefore, be fair, objective and non-partisan.
   (e) The witness must never assume the role of an advocate for a Party. Argument and advocacy should be left to counsel or agents presenting the Party's case. This does not preclude the vigorous advancement of strongly held scientific or

other professional opinions or prevent a duly qualified witness who is also a Party from advancing technical and opinion evidence.

(f) The witness has a duty to change his or her opinion where circumstances, such as the receipt of new information, require it. If at any time before the Tribunal issues its final decision, the witness changes his or her view on a material matter for any reason, particularly after having read the reports or listened to the evidence of witnesses for other Parties, the change in the information and/or opinion should be communicated to the other Parties and the Tribunal without delay. Where reports or documents prepared by the witness contain errors or information which has changed, this must be promptly identified. However, the witness must not change his or her opinion or change or withhold information to suit the position taken by any Party.

Preparing Reports

10. In preparing reports to be used by the witness' employer or client in determining the issues to be raised and the employer or client's position on those issues and for use as evidence, and in testifying before the Tribunal, the witness has the following disclosure duties:

(a) It is the responsibility of the witness to make fair and full disclosure.
(b) The witness should make it clear when a particular question or issue falls outside his or her expertise.
(c) To provide enough information on the assumptions made, procedures used, and conclusions drawn to allow comprehension of the report as it stands, and to permit fair and efficient cross-examination.
(d) When the witness is providing an opinion or giving evidence on an issue for which there are differences of professional or scientific opinion he or she has an obligation to make such differences clearly known to the Tribunal and all Parties. The witness should make reasonable efforts to be fully informed of those differences.
(e) The witness should state all the material facts and assumptions upon which his or her opinion is based. He or she should consider and acknowledge material facts which could detract from the opinion. Where the facts are in dispute, the Tribunal expects that the witness will give his or her view of the facts and the proof relied upon before giving the opinion.
(f) Where the opinion and evidence are based on information contained in other documents, detailed references should be provided in any report prepared by the expert, and copies of those documents made available on request before and during the Hearing.
(g) The witness is expected to disclose to the Tribunal and to the other Parties all significant information and opinions, and errors, shortcomings and limiting factors even if no one has asked for them.
(h) The witness should give direct answers to questions and should not be evasive while giving testimony. Any effort to avoid answering direct questions could adversely affect the weight assigned to the witness' evidence on the issue or the evidence as a whole.

Giving an Opinion

11. (a) When giving an opinion, the witness should provide a resume of the witness' qualifications and should state and explain the degree of certainty of the opinion or the level of probability that it is correct. The degree of uncertainty and the reasons for uncertainty should be candidly acknowledged. Uncertainties and assumptions inherent in measurement, estimates, projections and predictions should be clearly identified. The level of confidence or the sensitivity to error must be explained.

(b) Where there is a lack of consensus with respect to the use of a particular model or formula, the rationale for the chosen approach should be identified.

(c) If the witness' opinion is not properly researched because insufficient data are available, this shortcoming must be stated. Any limiting qualifications to the opinion should be identified. The Tribunal expects to be told when a lack of factual information or experience will increase the probability of inaccurate conclusions or predictions. The witness should avoid speculation where data are insufficient.

(d) Where an estimate falls within a range of reasonable possibilities, based on the same data, the variance within that range should be thoroughly disclosed. Where a prediction can lead to a range of potential impacts, that range should be fully described.

Plain Language

12. (a) In preparing reports and giving testimony, the witness should take into account that the Hearing process is a public process in which reports and testimony must be understood by participants and observers who may not have any significant technical knowledge. Therefore, the language and writing style should be simple and direct and scientific or technical terms and concepts should be explained in clear, simple language.

(b) Where specialized language is necessary to accurately convey information, the witness should use it rather than risk misleading or over-simplifying. However, the witness should avoid the use of scientific terms and jargon and unfamiliar acronyms, or at least fully explain those terms, so that the technical information and opinion can be easily understood.

Issue Resolution

13. (a) The Tribunal expects that the witness will attempt to adequately address, well in advance of the Hearing, the concerns raised by other Parties in an effort to resolve issues, shorten the Hearing, and save time and expense.

(b) The Tribunal may order the Parties' consultants (including independent consultants, technical or professional staff and advisors) to have one or more meetings and, where appropriate, communicate directly with each other outside of meetings in order to expedite the proceeding. The purposes of the meeting are to:

(i) exchange all relevant information and documentation related to facts or opinions in dispute;

(ii) discuss all facts or opinions in dispute with a view to reducing or eliminating areas of controversy;

(iii) arrange for a site visit if this may assist the consultants to obtain more complete information;
(iv) reach consensus on facts, issues and opinions which do not require a determination by the Tribunal;
(v) clarify differences of opinion and to consider whether further studies or information are required;
(vi) where applicable, develop conditions of approval acceptable to all Parties; and
(vii) explore any other means of resolving areas of dispute between the Parties.

Efficiency

14. (a) Reports, witness statements, and information should be produced in a timely fashion to all Parties.
(b) All reasonable requests for answers to written questions (often referred to as "interrogatories") must be answered promptly and thoroughly by the witness.
(c) Notwithstanding the requirements for full disclosure, the witness should make every effort to give succinct answers (while at the same time ensuring that they are direct and complete) to questions put to him or her in writing, in examination-in-chief, in cross-examination and in re-examination and by the Tribunal. Answers should be concise, responsive and focused on the most essential issues.
(d) During his or her testimony a witness should not be called upon to review the minutia of fundamental techniques, and to read correspondence and other reports line-by-line, unless it is clear that the purpose of such elaboration warrants this expenditure of time.

Compliance

15. If this Practice Direction is not complied with, the Tribunal may:

(a) decline to accept the opinions or evidence of an otherwise qualified witness;
(b) admit the evidence, but accord it little weight;
(c) adjourn the date of the Hearing until such time as this Practice Direction is complied with;
(d) note the conduct of the witness and subject the witness to adverse comment in its decision;
(e) report a breach of professional standards of conduct, an attempt to mislead, incompetence or negligence, extensive violation of this Practice Direction, or serious interference with the Tribunal's process to the professional association or licensing body responsible for compliance with standards of conduct; and/or
(f) order that costs be paid forthwith by the Party who retained or employed the witness.

Appendix C - List of Acronyms used in the Decision

ASHRAE	-	American Society of Heating, Refrigerating and Air- Conditioning Engineers
AWEA/CanWEA	-	American Wind Energy Association/ Canadian Wind Energy Association
CMOH	-	Chief Medical Officer of Health
dBA	-	A-Weighted Decibels
dB	-	Decibels
dBG	-	G-Weighted Decibels
dB Leq	-	Average Sound Level
EAA	-	*Environmental Assessment Act*
EBR	-	*Environmental Bill of Rights, 1993*
EEG	-	Electroencephalogram
EPA	-	*Environmental Protection Act*
ESS	-	Epworth Sleepiness Scale
GE	-	General Electric
GEA	-	*Green Energy Act, 2009*
GEGEA	-	*Green Energy Green Economy Act, 2009*
HGC	-	Howe Gastmeier Chapnik Limited
HRQOL	-	Health-Related Quality of Life
HVAC	-	Heating, Ventilation and Air Conditioning
IEC	-	International Electrotechnical Commission
ISO	-	International Standards Organization
IWT	-	Industrial Wind Turbine

m/s	-	Metres per second
MCS	-	Mental Component Score
MNR	-	Ministry of Natural Resources
MOE	-	Ministry of the Environment
MTC	-	Ministry of Tourism and Culture
MW	-	Megawatts
NHS	-	National Health Service (of the United Kingdom)
NRC	-	National Research Council
OEM	-	Original Equipment Manufacturer
OMB	-	Ontario Municipal Board
P-value	-	Measure of Statistical Significance
PSQI	-	Pittsburgh Sleep Quality Index
REA	-	Renewable Energy Approval
REAU	-	Renewable Energy Approvals Unit
SEV	-	Statement of Environmental Values
SF-36	-	Questionnaire measuring mental and physical health
SPPA	-	*Statutory Powers Procedure Act*
SWV	-	Society for Wind Vigilance
VAD	-	Vibroacoustic disease
WHO	-	World Health Organization
WCO	-	Wind Concerns Ontario

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