

# WCO | WIND CONCERNS ONTARIO

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June 16, 2016

Mr. Jim Virtue  
Senior Program Support Coordinator  
Ministry of the Environment and Climate Change  
Operations Division, Environmental Approvals Access and Service Integration Branch  
35 St. Clair Avenue West, Floor 1  
Toronto ON M4V 1P5

**Re: Comments on Compliance Testing Protocol, EBR Registry Number: 012-7445**

Dear Mr. Virtue:

The following document provides the comments from Wind Concerns Ontario on the Compliance Testing Protocol, based on a review by technical experts assisting us. Wind Concerns Ontario (WCO) is a citizens' advocacy coalition of grassroots community organizations and individuals that formed in response to the development of large industrial-scale wind turbine projects across rural Ontario. Our members and activities provide a unique experience and information that is useful for the Ministry of the Environment and Climate Change as it establishes testing protocols for the wind turbine noise emissions going forward.

From the perspective of WCO, the growing scientific research on wind turbine noise emissions and the escalating number of unresolved complaints confirm that the proposed changes to the old protocol amount to minor tweaking and are insufficient to address the problems faced by people living among the existing wind turbine projects. **A complete rethink of the testing process is required.**

The technical review/comment document is structured so that general comments are followed by specific recommendations for changes in the process.

This is of critical importance to Ontario. In the words of Dr. Hazel Lynn, the Grey-Bruce Medical Officer of Health who has lengthy experience with health complaints related to wind turbines and is a peer-reviewed published author on the subject, 'you can no longer pretend that these people do not exist'. This comment applies to the MOECC as it considers changes to the noise testing protocol as the existing as many people living among wind turbines believe that the existing protocol is not designed to meaningfully address their concerns. It is critical to address this perception in this round of revisions.

We hope you find our perspective valuable. We would be more than pleased to meet with you directly to discuss these issues.

Sincerely,

Jane Wilson, President  
Wind Concerns Ontario  
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CC. Diane Saxe, Environmental Commissioner

## WIND CONCERNS ONTARIO

### Comments on Compliance Testing Protocol

#### EXECUTIVE SUMMARY

The Ministry of the Environment and Climate Change has proposed a set of changes to its regulations governing industrial-scale or utility-scale wind turbine noise emissions.

This is a contentious area as part of the objection many communities in Ontario have to the wind power projects (which they have no say in the siting of, under the Green Energy Act) is the effect of the noise emissions. The concerns about the adverse health effects of wind turbine noise emissions have been presented at numerous appeals of wind power approvals, and research has progressed to the point where it is acknowledged that there is an association between the noise and health problems (Lynn and Arra, Krogh, and others).

Yet the Ontario government does not seem prepared to deal with citizen complaints. As a team of academics wrote in a peer-reviewed article published this year, although “epidemiologic evidence is incomplete and uncertain” Ontario’s “public policy takes an ‘innocent until proven guilty’ view ... rather than a more precautionary approach.” (Fast et al, Lessons learned from Ontario wind energy disputes, January 2016.)

Wind Concerns Ontario has prepared a summary of recommendations for the proposed changes, but our core recommendation is that the whole regulatory process needs to be revised, based on new scientific evidence and a changing environment in wind power development. The changes proposed are simply “tweaks” to an existing and flawed protocol.

Wind Concerns Ontario also suggests that there should be a change in the attitude of the Ontario government toward managing complaints: they should be seen as a learning opportunity, not something to be dismissed.

#### **Key recommendations:**

*Expand noise testing to do actual testing* at locations where complaints have originated, duplicating conditions as far as possible. Reliance on wind power developers’ predicted modelling is not adequate or appropriate.

*Expand the focus from the narrow reliance on audible noise:* the majority of complaints are connected to low-frequency noise, and are described by residents as a “sensation” rather than, or in addition to, a “noise.” The revised protocol should address the full scope of complaints.

*Timelines for testing* to ensure compliance are not adequate; compliance testing should be reported on within six months of a project start date.

*The MOECC needs an enforcement strategy:* currently there is no review of actual measurements. The MOECC needs to commission third-party testing where the number of resident complaints indicates follow-up is needed.

*Measure cyclical noise:* the current protocol is for “steady state” noise conditions but are not appropriate for cyclical or impulsive noise sources.

*Seasonality of noise testing:* resident complaints about noise emissions are more frequent in winter than in summer, but the MOECC protocol states testing does not take place December through February. Steps must be taken to carry out measurement related to timing of noise complaints.

*Wind companies’ testing:* there is no review by the MOECC of noise testing done by the power developers and no validation of whether data is being omitted.

*The current protocol does not address sleep disturbance* and other reported health effects; it is not acceptable to ignore these citizen complaints.

If the Government of Ontario wants to make good on its claim to be a leader in renewable energy, it needs to follow up on, resolve, and report to the public on the issues associated with wind turbine noise.

## A. Context for the Testing Protocol

To properly evaluate the current testing protocol, an assessment of its effectiveness in dealing with the existing conditions is required, together with recognition of the fact that, for utility-scale wind turbines, the situation is changing.

**Complaint Levels** - The MOECC is fully aware of the scope of the problems being caused by wind turbines as it has a structured process to track complaints about wind turbine noise. In 2015, the MOECC advised WCO that it had received 2,700 complaints about wind turbine noise to the end of 2014. Reports from WCO contacts in areas where new projects are starting operations suggest that this number will have grown considerably since that data was provided. No information has been made available, either at the local level or centrally, about steps that have been taken to address these complaints. In fact, the reports from local residents indicate the opposite. Even when tests indicate that the turbines are out of compliance, no changes in turbine emission levels are experienced. This suggests serious problems with the protocol.

**Independent Noise Monitoring Results** – In the absence of evidence of effective management in the MOECC's current noise testing protocol, municipalities, community groups and individuals have initiated their own testing. Results from this testing showing that the turbines are not operating in compliance with the REA approvals have been provided to the MOECC. Again, this has been met with no response. The protocol needs to be revised so that MOECC can show leadership in addressing these issues rather than letting its current, slow, cumbersome and narrowly-focused process continue. In the current environment other stakeholders are overtaking what in the past had been their leadership role in fighting threats to the environment. Changing technology is creating new approaches to assess wind turbine noise and rapidly reducing the costs of these activities. The MOECC needs to incorporate these new technologies in its process or it will fall further behind in assessing wind turbine noise.

**Changing Turbine Size** – The sound power rating of wind turbines being installed in Ontario has increased considerably since the Ontario standards were established. With the newer 3-megawatt (MW) wind turbines involved in the most recent projects, the health issues are surfacing sooner and the symptoms are more severe. This is creating new challenges in assessing wind turbine noise emissions. In this regard, WCO is closely monitoring the Township of West Lincoln project where 77 3-MW turbines are currently being installed in an area with a resident population of 1,900 homes within two kilometers. The REA approval for this power project assumed that these new larger turbines will have the same noise emissions as the smaller equipment, despite evidence, from both Ontario and elsewhere, to the contrary. Wind Concerns Ontario estimates that, using the most conservative figure possible from research, including the Health Canada noise study, the health of almost 400 people in this area will be affected.

**Abandoned Homes** – In every project, people who are exposed to wind turbine noise are forced to abandon their homes even though the existing protocol indicates that the projects are operating within the terms of their approval. Obviously there is a serious disconnect between the assessments by the MOECC and reality faced by people living among the turbines. Abandoning a major investment like a home that you cannot sell is not a decision taken casually – something *must* be seriously wrong even though problems are not officially dealt with by the current protocol. The scope of testing included in the protocol needs to be broadened substantially so that the MOECC can learn from these problem situations and identify the changes required in their policies.

## **B. New Research into Wind Turbines and Health**

Research into wind turbine noise is continuing and generating results that should be incorporated into the MOECC testing protocol. By expanding the scope of complaint testing procedures, the MOECC can confirm the extent to which these changes should be incorporated.

**Health Canada** – The federal government conducted a study of wind turbine noise from 2012 to 2014. The findings released in November 2014 reported two contradictory findings – first, there are no health effects linked to wind turbines and yes, there are health effects related to wind turbines. The design of this study was criticized by epidemiologists and health professionals before the project began. (The study was not designed to find a causal link; to now claim, as Health Canada does, that there is no causal link is disingenuous.) A review of the survey instrument design after the project revealed that the finding of “no problems” was based on questioning respondents about a narrowly-defined timeframe — in other words, participants were questioned about symptoms and events during a time when wind in Ontario is low and turbine noise emissions would be less. Responses to other questions that covered the whole year showed that problems existed. This second result was confirmed when physical samples from the people reporting complaints showed the physical indicators of stress.

Data specifically provided to Wind Concerns Ontario by Health Canada indicate that respondents to this study reported that wind turbine noise was worse than the road, rail and airport noise that formed the basis of the World Health Organization’s night-time noise standards. The study showed that problems begin at **35 dBA** which provides research data confirming that limiting testing to location exposed to 40 dBA noise will miss valid complaints. The study also found that annoyance with wind turbine noise emissions in Ontario was found 1-2 km from wind turbines with the percentage of “extremely annoyed” was 16.5% at 550metres to 1 km, and 25% at 550 metres. (Annoyance in this context is a medical term that denotes stress or distress.)

**Council of Canadian Academies** – This early 2015 review found that dBA measures were not appropriate for assessing the noise emissions from wind turbines. They also found there is sufficient evidence of a causal relationship between exposure to wind turbine noise and annoyance, which is a serious medical condition that can lead to a broad range of health effects. The Council also noted significant research gaps, and that vulnerable populations such as the elderly, children, and groups who are hypersensitive to noise (e.g., people with autism) had not been considered at all.

**Cape Bridgewater** – The Health Canada study was not designed to find a link between wind turbines and health issues, but this situation is being addressed by some actual studies of problems reported in specific wind projects. A study of the Cape Bridgewater Wind project in Australia, published in the Journal of the Acoustical Society of America (January 2016), is an example of these new studies. It was financed by a wind power producer whose goal aligned with the objectives of the MOECC in this protocol, as it was trying to understand ongoing community complaints about their project. To address these complaints, the study asked residents to track the specific times when their symptoms occurred, lessened and grew worse. Discussions with the residents indicated that the issue was not audible noise but rather the physical pulsing *sensations* in their bodies generally associated with low frequency noise and infrasound. The research design was adjusted in response to this feedback. The finding should be instructive for the MOECC in developing the noise testing protocol:

1. Testing of actual noise emissions indicated that noise modelling, similar those used in Ontario's REA approval process, did not reflect the reality experienced by the residents living among the turbines.
2. The study reports that resident complaints in this project could not be linked to audible noise generated by the wind turbines.
3. Infrasound pressure waves matching turbine blade pass frequency were present in their homes.
4. When the resident observations were matched against the operating records for the wind turbines, the residents' complaints were linked to specific changes in wind speeds and turbine operations.

All of this recent health research on the effect of wind turbines on residents living among them raises serious concerns about the testing protocols that the MOECC uses to evaluate noise complaints received.

### **C. Changing Responses to Customer Complaints**

Since the 1980s, best practices in handling customer complaints have changed radically in the corporate world. In successful companies, complaints are no longer seen as a triviality to be

explained away but rather, complaints are viewed as an opportunity to understand and *fix* problems in service delivery. In a progressive organization, complaints are welcomed, standards are set for prompt response and open communication takes place with the customer. It is no longer sufficient to say that the activity that generated the complaint was compliant with existing rules. It is necessary to understand and address the concerns of the individual making the complaint. Like the new ‘Deliverology’ approach that is being embraced by the federal government, complaints are monitored at the executive levels of the organization with particular attention to the learning that has occurred and the improvements in process that have resulted.

At a high level, NPC-350 is a complaint response process for the MOECC. In the context of the current corporate complaint handling procedures, the complaint response procedures outlined in the protocol are a throwback to another time. This review provides the MOECC with an opportunity to bring its complaint handling processes in line with wider corporate best practices.

#### **D. Key Gaps in the Current Process**

By monitoring issues raised by our member organizations and individual members, the following section outlines key gaps in the current protocol that need to be addressed moving forward.

**Narrow Focus on Audible Noise** – The protocol only sets out testing procedures for audible noise ranges while it is clear that the majority of the complaints involve low frequency noise and infrasound. It is not sufficient for the MOECC to respond to the individual registering the complaint that the project meets published *audible noise* standards without addressing the *other* noise emissions that are causing the problem.

This is a particular issue in the context of the procedures being included with Renewable Energy Approvals which requires the approval holder to respond and address complaints about *any* ‘adverse effect’ linked to the wind turbine project. For the purpose of the approval, reference is made to the definition in the Environmental Protection Act which is 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;

Given the MOECC's role in tracking and monitoring this REA complaint process, the same scope of complaints needs to be accommodated within the protocol.

On this basis, the revised protocol should include procedures for addressing the full scope of complaints allowed for in the REA approvals, including testing the full range of noise emissions from wind turbines and acknowledge that lower frequencies travel greater distances with less attenuation. Only by understanding the full scope of the problem will the MOECC be able to respond effectively to complaints, and to meet its mandate to "ensure healthy communities." It will also allow the MOECC to understand whether wider changes are required in their noise protocols. To reach this objective, the protocol needs to be expanded to cover all types of noise emissions.

**Timelines** – It is an understatement to say that the current extended time periods needed to confirm whether a wind turbine project is operating within the REA limits are not acceptable. The operator of the Enbridge project, which became operational in November 2008, is *still* not able to provide a compliance report to the residents living within the project. Given the seasonal nature of wind turbine noise, this compliance testing may take some time but anything beyond six months of the operational start date is not acceptable.

Third-party testing shows that valid noise assessments can be completed in fairly short time frames. The complex and costly process of data reduction and selection in the protocol leads to time delays/expense for all parties using it while at the same time generating substantial uncertainty about the validity of the end results.

The protocol should be streamlined to allow testing to be completed with a maximum of six months. If a project operator does not meet this timeline, the MOECC should commission its own testing and/or base enforcement actions on results from properly conducted noise assessments of the project provided to the MOECC by affected individuals or municipalities.

**Enforcement Strategy** – The process outlined in the protocol essentially has the project operators responsible for most of the compliance testing. These companies hire their own consultants to implement the testing and then submit a report that is approved by the MOECC. There is no review of the actual measurement results to confirm that the analysis is completed appropriately. The process has no traceability as the consultant selects the measurements to be binned and validated for the statistical analysis without oversight by the MOECC — even though up to 95% of the data collected is excluded.

The Ministry needs to take a more proactive role in supervising the compliance testing including commissioning of independent tests where the level of resident complaints suggests additional follow-up is required.

**Openness and Transparency** – The implementation of this protocol as it relates to formal complaints to the MOECC is not at all open and transparent to people making the complaints or affected by the problem turbines. The number of complaints received by project and the record of actions taken to address these complaints should be a matter of the public record without any consultation with the wind companies. The current process where little or no public information is available is not only in contravention of the government’s stated policies on ‘openness and transparency’ but also reinforces the public perception that the MOECC is colluding with the wind industry to keep non-compliant turbines operating, rather than fulfilling its role of protecting Ontario residents from environmental health risks.

**Documentation to Support Results** – With the availability of equipment to log the actual results of the noise emission testing, it should be possible to provide people registering complaints with full results to document the testing undertaken and confirm the performance of the turbines involved. This information would be helpful in explaining the gaps in results between concurrent testing completed by the MOECC and individuals/municipalities.

**Use of Noise Models in Compliance Assessments** – In many Environmental Review Tribunal (ERT) hearings of appeals, the validity of the computer models to properly assess the impact of noise has been challenged. Steven Cooper raises the same concerns in his ASA article on the testing at Cape Bridgewater in Australia. In this context, it is not appropriate to base any follow-up activity on the predictive noise models. Only *actual* test results from the operating wind farm should be considered. There are plenty of examples of situations where the actual noise generated by the wind project is greater than predicted by the computer models. There are numerous examples of noise being magnified by the positioning of buildings that reflect the noise, elevation differences between the turbine and the receptor location and the impact of noise from one turbine being amplified as it passes through another turbine before reaching the recipient location. Testing at the actual site is required for all complaints about wind turbine noise.

**Cyclical Noise** – The methods used in the protocol are designed for use in steady state noise conditions but are not appropriate metrics for cyclical or impulsive noise sources. Many of the complaints are about a ‘whooshing’ sound; using an averaged sound pressure level to assess the potential for disturbance is not appropriate.

**Seasonality of Turbine Noise** – Resident reports about wind turbine noise emissions are more frequent in the winter than in the summer. In this context, the statement recommending that

noise testing does not take place in December through February does not seem appropriate. If equipment being used for noise testing is not capable of operating at low temperatures, alternate equipment that is capable of testing in these months should be obtained.

Capability to test during winter months is important as the testing environment needs to match the conditions when a complaint was made. If the complaint is about turbine noise when temperatures are below freezing, the testing related to that complaint also has to take place when temperatures are below freezing.

At the same time, sounds of background noise in nature like leaves on trees, birds and insects are also much less of an issue in winter months. This would appear to make it an ideal time for testing of turbine noise without the problems created by background noise.

**Exterior Testing** – Many of the complaints are about the effect of noise emissions inside homes. Residents of Ontario generally do not sleep at a height of 4.5 metres in trees that are 5 metres away from their house. Assessments of complaints need to deal with the situation described in the complaint.

In many cases, the reports are of noise emissions being worse inside the home than outside of the home. In fact some people have taken to sleeping in tents or trailers outside of their homes.

In the context of this evidence, the current protocol limiting testing to outside of homes is not appropriate. Confirming compliance outside the house when the complaint is about inside the home does not address the issue being raised by the individual making the complaint. Any new protocol should include procedures for concurrently testing both inside and outside homes when inside noise is the subject of the complaint.

**Nature of the Complaint** – Feeling a pulsing *sensation* in the body is a common symptom reported by people living among wind turbines. These sensations are commonly linked to low frequency noise and/or infrasound emissions. Responding to these complaints solely with audible noise testing is not addressing the likely symptom and is not credible. In particular the blade pass frequency pulses below 10 Hz are ignored in the current protocol. The full range of noise emissions should be assessed when responding to all complaints, particularly in response to pulsing sensations.

**Compliance Testing by Wind Companies** – The current process has wind project operators hiring their own consultants to conduct the noise compliance tests. Large amounts of data are collected in the process but up to 95% of the data observations are excluded for the final assessment. This selection is done by the consultants selecting which data is being binned and included in the statistical analysis with no independent validation of whether data in exceedance of the regulation is being eliminated in this process. The MOECC should not only

approve the report but also review the data manipulation undertaken by the consultants prior to finalizing the data used in the report.

**Response to Supplied Data** – In the absence of effective testing by the MOECC and the project operators, individuals and municipalities are undertaking their own tests of noise emissions from wind projects, conducted by individuals who meet the qualifications outlined in the noise testing protocol. When the results of these tests are provided to the MOECC, the Ministry should provide a formal written response and act on the findings of the testing in the absence of conflicting actual noise test data from other sources. If there is conflicting data, details on testing needs to be provided to the individual and/or municipality.

**Addressing Symptoms Reported in Complaints** – The protocol does not adequately address sleep disturbance and neglects other health symptoms reported to them such as increases in vertigo, migraine headaches, and sea sickness symptoms such as nausea. These form part of many complaints received by the MOECC and need to be addressed in the complaint process. It is no longer acceptable just to ignore these complaints. The protocol needs to include some form of reference to another authority with the appropriate level of follow up to ensure that the individuals making the complaints get satisfactory answers.

## **E. Specific Comments on Protocol Contents**

**Preface** – The statement on page (i) that the Ministry of the Environment and Climate Change is committed to ensuring that its policies and protocols regarding wind facilities continue to reflect current science is commendable as an operating principle. The scientific understanding of wind turbine noise is rapidly evolving and, if properly conducted, the field testing of actual turbine noise undertaken in conjunction with this protocol provides a good learning opportunity for the MOECC staff involved in testing and reviewing compliance reports. Unfortunately, the bulk of the protocol so narrowly defines the testing to be undertaken that these learning opportunities will be missed. For this reason, WCO is recommending that the scope of testing be substantially broadened, not only to bring it in line with this stated objective but also so that the reality of the complaints about wind turbine noise can be properly assessed.

**Definitions – Abatement** - Education and outreach should not be tracked as an ‘abatement activity’ particularly when it relates to discussions with people complaining about noise from a wind project. Explaining how a turbine is compliant with the MOECC’s narrow definition of allowed noise does not resolve the situation that triggered the complaint. A situation where a turbine is operating within compliance but is still triggering complaints is a critical learning opportunity for the MOECC. These circumstances should be tracked under a separate category so that the Ministry can identify gaps in their policies.

**Complete E-Audit** – Section 15 only references wind speeds of 6,7,8,9 or 10 meters/second. Lower wind speeds should also be required as there can be difference between ground level wind speed and turbine height wind speed. At slow wind speeds the noises from leaves and other sources will be low and the amplitude modulation is not masked by wind noise giving a truer reading on the wind turbine noise. Other sections do refer to ‘all applicable wind speeds’.

**Noise Abatement Action Plan** – Nowhere in Section A2 23 is the MOECC mentioned; this suggests that the noise abatement plan is entirely up to the wind power developer. The section should be amended to provide a role for the MOECC in guiding, supervising and making recommendations relative to this action plan.

**Sound Level** – In light of the growing scientific evidence and information on the nature of complaints mean that the focus on A-weighted Sound Pressure Levels suggested in definition 32 is no longer appropriate. While the regulations may be solely based on audible noise levels, A-weighting is only one of many approaches to evaluating wind turbine noise emissions. To properly investigate complaints, a broader definition of sound power level is required. Recent research, including presentations at the May 2016 Salt Lake City Acoustical Society of America, indicate that different types of measurement are appropriate in different circumstances that the MOECC faces.

**Sound Power Level** – Definition 34 references CAN/CSA-C61400-1 which states that up to 7dB error may result with the measurement of this Sound Power for the equipment. This section should be amended to confirm that this 7dB variance should be accounted for in the model that MOECC approves in the compliance report.

**Sound Pressure Level** – Given that at least a portion of the noise pressure waves emitted by wind turbines is related to the movement of the blades past the tower, the reference to wind turbines in Definition 36 is not appropriate. The definition should also be adjusted to reflect the view of the receptor which can be dealing with the sound pressure levels from multiple turbines whose pressure emissions may be modified as they pass through a nearby wind turbine before it reaches the recipient.

**Scope** – Section A4 limits the scope of the document to audible noise which is not consistent with the statement on page (i). While the approval for the wind project is based on estimated/predictive audible noise levels from assumptions used in the noise models that supported the proposal, the complaints are based on the *actual* experiences of individuals responding to perception of the noise present in their environment. A process to evaluate complaints that only considers one type of noise is not an appropriate approach to complaint resolution. The MOECC cannot pretend that other types of noise reported in complaints do not exist. The cause of each complaint needs to be determined and this is only possible through an

examination the full range of noise emissions from wind turbines. If the noise regulations prevent response to problems with a wider range of noise emissions, the regulations need to be changed.

**Background Noise** – Section A5 reports that conventional equipment used in noise assessment has difficulty in distinguishing between wind turbine noise emissions and other background sounds. Equipment and software is available that addresses these issues using narrowband noise measurements. These allow the lower levels and frequencies of wind turbine noise emissions to be separated from the higher frequency noise sounds of nature avoiding the complex sampling and analysis outlined in section D. Correct separation of the background noise from wind turbine noise is critical to the process as over-estimates of background noise can result in too much noise being removed from the assessment, understating the real wind turbine noise emissions.

**Initial Screening** – Section 2.1 assumes that beyond a 1,500 metre distance, any detectable sound levels from land based wind turbines will not exceed MOECC's sound level limits. Given the number of complaints by people living beyond 1,500 meters from a wind turbine, *actual* testing is required to understand the situation that prompted the complaint. Rather than just dismissing these complaints, the MOECC should commit to learning from them.

The operating mode of the turbine should also be confirmed with the operator. The Cape Bridgewater, Australia study of wind turbine noise indicated four turbine operating conditions that were statistically correlated with complaints about wind turbine noise. The operating conditions of the project should be confirmed with the operator to assess if any of these four conditions were met at the time of the complaint.

**Site Visit** – Section 2.2 outlines a series of items to be observed during a site visit. In addition, the investigation should consider site conditions that could amplify the actual sound levels above those predicted by the noise modeling process used in the approval. This could be structures that reflect sound pressure waves in manners not predicted in the model as well as topography and ground absorption conditions at the time if the complaint that also could change the validity of the output from noise models. More than the closest wind turbine should be assessed; the amplification effects of noise from one turbine passing through another turbine are not considered in the model.

**Set-Back Reductions** – Section 2.3 requires that the actual setback distances should be confirmed. Projects have been approved where receptors are located very close to the 40 dBA noise levels predicted by the noise models. In addition, the centre of the home rather than the exterior of the home or the property line is used to assess compliance with the 550 metre set-

backs. As a result, any reduction in the constructed project design that places turbines closer to the receptors should be considered a major project design change.

With the GPS tools available today, the proponent should be held accountable for building the project as approved, just as municipal building inspectors would not allow any deviations in setbacks from property lines in any other construction project. Given that the Green Energy Act overrides municipal planning authorities, the MOECC should put in place a procedure to ensure that turbine projects are being built exactly as approved. The alternative would be to re-instate normal municipal planning powers which ensure that this takes place with all other construction projects.

Where there are deviations in the as-built setbacks, comprehensive noise testing should take place to determine whether or not the project is in compliance. Once the project is constructed, continued use of predictive noise modeling techniques is not appropriate.

Section B2.3 also refers to voluntary reductions in sound levels but states that in these cases no further assessment is required. Testing is required in these cases as the MOECC needs to confirm that the voluntary reduction has been sufficient to address the concerns that generated the complaint.

**Check Predicted Noise Impact** – Section B2.4 gives the Ministry staff discretion about further assessment if predicted noise indicates compliance within a margin of at least 5 dB. The validity of the noise modeling used in the approval process has been questioned and many field studies have shown that the models can at best provide a general indication of the noise that will be experienced at a receptor site.

If the MOECC receives a complaint about noise levels, it is fundamental to its mandate that testing be done to understand the cause of the complaint.

**Complaint Assessment Process** – Various sections describing the quantitative assessment process in Part C suggest objective of the testing is to replicate and validate the computer modeling that formed the basis of the approval. Once the turbines are operating, these model predictions are no longer relevant to the situation except as learning for revising the modeling process.

The overall objective when responding to complaints should be obtaining a noise assessment that as closely as possible reflects the location, the timing and the character of the complaint. The process is driven by the assumptions in the modeling and does not align with most of the complaints in terms of the location of testing, the associated conditions and type of information collected. Using equipment that is only capable of detecting audible noise will not address complaints about low frequency noise and infrasound.

**Attended Screening Measurements** – Section C2 sets out procedures for MOECC follow-up visits for noise complaints. As the complaints related to very specific conditions occurring at the time of the complaint, it is important that the conditions at the time of the testing align with the original conditions that triggered the complaint. Of most concern is the statement that the measurement takes place when wind speeds do not exceed 3 to 4 m/s. If the wind speed was above this level at the time of the complaint, the results of the site visit will not address the complaint. Similarly, testing triggered by complaints made at night, should be conducted at night.

**Sound Level Measuring Instrumentation** – Section 2.1 sets out some classes of equipment needed to perform testing. In general, the equipment used to measure turbine sound should be:

- Capable of measuring the full range of sound pressures waves in audible, low frequency and infrasound ranges.
- Capable of operating at below freezing temperatures to deal with situations when low sound absorption by frozen ground could be a contributing factor and background noise is more limited.
- Digital recorders should be used for all complaint investigations to allow full analysis of the results and to provide detailed information on the findings to the individual registering the complaint.

**Microphone Position** – The position of the microphone described in Section C2.3.4 places the equipment in direct exposure to wind disturbance. The impact of wind screen noise could be substantially reduced if the microphones were positioned in locations where they are sheltered from the wind. Similarly the microphone position should be selected to avoid capturing road noise. Further details are required on the ‘alternate measurement location’ mentioned in this section with a small vertical reflecting board attached to the building façade.

**Tonality** – If the complaint references tonality, Section C2.3.9 should be modified so that a quantitative assessment should be required whether or not it is audible.

**Compliance** – When responding to a complaint, steps should be taken to determine if the wind turbine noise is being masked by higher levels of background noise during higher wind periods as assumed by the regulations and outlined in Section C2.5. The existence of a complaint could suggest that the predicted masking is not accurate.

If the predicted noise effect for various wind speeds is not producing the masking effect assumed in the regulations, then abatement measures should be initiated at the source turbines.

If the measurements obtained from the testing comply with the MOECC limits for audible turbine noise, further analysis of the results should be undertaken to identify the type of noise

that drove the complaint, rather than telling the person who initiated the complaint that there is no problem. Obviously there *is* a problem, otherwise the individual would not have complained.

**Acoustic instrumentation** – In section 3.3.1 requires the following changes:

**Device 1** – In Point 5, reference is made to the submission of a digital recording. This section should be amended to require submission of both the original and edited audio recording so the MOECC can verify any edits made against the original recording.

**Device 2** – In section 3.3.1 Point 5 should be amended to specify what is being calculated from this recording.

**Wind Screens** – The changes to section 3.3.4 suggest that separate wind screens are no longer mandatory, only recommended. The section should also be amended to indicate that an outdoor microphone with a wind screen provided by the manufacturer is also suitable for this measurement.

**Acoustic Measures** – Section C3.4.6 specifies a sampling rate of 8000 samples/sec which would allow a frequency bandwidth of 4000 Hz or lower. One would not be able to hear noises above 4000Hz. Certain species of crickets and some species of birds in Ontario have much higher levels. This would lead to an inaccurate background assessment. Modern measurement analyzers use 24-bit 48,000 sampling rates.

Other measurement of LAeq's covers bandwidths of 20kHz meaning that the recording should also be 20kHz. The bandwidth proposed here for validation is 5 times lower than the LAeq measurement bandwidth. This reduction of bandwidth by a factor of 5 times will subsequently filter out anything above 4 kHz. In other words the LAeq of background noise includes 4,000Hz-20,000 Hz frequencies but the audio recordings do not and therefore one cannot validate that the LAeq is correct by listening with this procedure.

**Recording Intervals** – Section 3.4.8 needs clarification. Are these recordings made simultaneous to the reported LAeq's? Are these recordings also sampled at a minimum of 8000 samples/s, 16 bits. What are these recordings used for?

**Tonality** – The measurement methods should be specified in detail in this protocol and not subject to amendment at the discretion of the Director. As with all considerations in this document, amendments to the process to measure tonality should be managed through the EBR change process.

**Turbines Not Audible** – It is not appropriate as suggested in Section C3.5.2 to terminate the assessment of the complaint if the turbines are not audible on the recordings. Further analysis

of the full spectrum of sound pressure waves coming from the turbine are needed to completely assess the type of noise that drove the complaint.

**Turbines Audible** – Section 3.5 quotes the assumed effect of wind noise in masking wind turbine noise set out in the regulations. When responding to complaints, one has to start from the assumption that these relationships are not being supported in this instance, i.e., the person registering the complaint is hearing noise that is not being masked by the wind noise.

Further detail on how these higher levels limits for various wind speeds were established would be useful in evaluating complaints in this context. In particular, reference to documentation supporting these assumptions, i.e., how was the 51 dBA developed and/or any science supporting this method of varied LAeq as a function of integer wind speeds.

**Documentation** – The final comment in Section 3.6 on page 36 states that even if the Leq values exceed Approved limits, that does not necessarily mean that the turbines are not in compliance as the background noise could be contributing the excess. This comment raises serious concerns as it suggests that the MOECC is not confident that the detailed procedures outlined in this protocol are adequate to separate wind turbine noise from background noise. If the MOECC believes that the procedures are not adequate, the regulation should not be proclaimed until the Ministry has confidence in the proceeds. As the comment is currently written, it is nothing more than an escape option for turbines that are found not to be compliant.

In addition, further direction on how the observation on the presence or absence of tonality is determined should be provided in Section C3.6 3.

**Sound Level Measurement** – Section D2.1.1 accepts a Class II microphone with 25db noise floor even though Class 3 rural areas have been known to have ambient night time levels of lower than 25 dB. This measurement using a class II microphone would have internal electronic noise masking audible noise from the microphone itself making it inappropriate for use in the quietest of ambient measurements. The measurement of background noise for the purpose of logarithmic subtraction would then just subtract incorrect electronic noise instead of lower true ambient conditions that cannot be measured thus contributing to compliance. The section should be amended to only allow Class I microphones be used especially in Class III Rural.

**Acoustic Measurements** – Section 3.5.1 needs clarification. Currently it specifies that 1/3 Octave measurements during the 1 minute interval are required. Since thousands of different 1/3 octave spectra can be measured during a 1 minute interval the section should specify which 1/3 octave measurement is required/ MAX, Min, LAeq, LCeq etc.

**Supplementary Data** – Section D3.7 section 2 needs to be clarified by specifying which statistical noise indices should be provided for the interval, i.e., L10, L50, L90.

**Tonality** - Section D 3.8.3 needs further clarification. Since tonality can occur and disappear, instructions are required on the methods to be used to determine compliance. For example, does the duration of the tone come into consideration?

**Data Reduction** - Section D 5.2 excludes periods where rainfall has occurred within at least one hour. This is simple for witnessed measurements but a process is required to assure compliance with D5.2 2 if the measurement process is unattended.

In addition, this section limits testing to the early morning between 22:00 and 5:00 allows for 6 hours of measurements. If 120 one minute measurements are required for each integer wind speed from 5-10m/sec, then  $5 \times 120 = 600$  minutes is required if all the measurements are free of artifacts. This would require a minimum of 2 days.

However, the wind does not stand still at integer wind speeds meaning that months of measurements maybe required to meet the protocol.

This does not include the 60 measurements of ambient noise at each integer wind speed.

All measurements must also be reviewed with their corresponding audio recording for tonality, artifacts for birds and insects and wind turbine noise. This requires days of review for these measurements and one would question the entire process at this point due to its length and large potential for possible errors made during this process.

Once it is complete and submitted the end result needs to be validated by the MOECC including the validation of the measurement selections by the wind company's consultant.

A simpler, more straight-forward process is required so that the results of the analysis can be provided to the communities more quickly. This is particularly true in the context of the MOECC's statement at the end of Section 3.6 that the measurement processes for background noise may not be accurate.

**Data Analysis** - Section D5.5 requires averaged LAeq's to be binned for standard deviation and mean values. This removes the dynamic nature of wind turbine noise. The result will yield a static number, rather than a dynamic time variant noise which is the unique character of wind turbine noise.

These measurements do not describe on/off variations that cause wakefulness or the cyclical whooshing sounds.

**Documentation** – Section D7 lists documentation to be provided. In sub-section 3 references are made to presence of tonality and the adjustments made when tonality was observed. The section should be amended to include the specific penalty for tonality and instructions on how the adjustments should be made.

#### **F. Missing Information**

A number of situations that are critical to assessing wind turbine noise are missing from this protocol. These include:

- Methods to measure amplitude modulation and its contribution to the noise experience by people filing complaints with the MOECC.
- A proper assessment of noise emissions in the 25 – 250 Hz levels that are not properly assessed by A-weighting techniques.
- Descriptions of the cyclical nature of the whooshing noise emissions that are subject of many wind turbine complaints.
- Descriptions of infrasound that appears to be the root cause of many wind turbine noise complaints.

In addition, complaint response procedures should also include clear guidelines for a number of the steps in the complaint resolution process. These should align with the complaint handling process outlined for wind companies in the REAs and should include:

- A minimum timeline for contacting the individual making the complaint. Normally this is two (2) business days from the time of each complaint. In this initial contact, a preliminary assessment of the situation is provided and an action plan for follow-up and in this case, scheduling a time for a site visit and testing.
- A timeline to either resolve the complaint or to provide the next update to the individual making the complaint.
- Provision of a written statement on the final resolution of the complaint, including a full description of activities undertaken to investigate the complaint and actions taken to address the cause of each incident to which the complaint relates and to prevent a similar occurrence in the future.
- Confirmation from the individual making the complaint that the issue has been satisfactorily resolved.
- A tracking system for complaints that includes confirmation of those resolved and those still outstanding. This information should be tracked by the Environmental Commissioner's office and publicly reported on a regular schedule.

These deficiencies need to be addressed before the protocol is finalized.

