



**Wind Turbine Working Group Meeting
Meeting Summary
August 10, 2011, AUC Offices
(#400, 425-1 Street SW, Calgary, AB)**

Attendees:

AUC:

Don Popowich
Raymond Lee
Jack Davis
Mark Kavanagh
Jonathan Chui
Leah Howard

Director, Facilities
Senior Advisor, Regulatory Policy
Environmental Specialist
Senior Environmental Specialist
Science Specialist
Summer Student

Participants:

Teresa Drew
Richard Patching
Henk de Haan
Don South
Clifford Faszer
Adam Nerland
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RWDI Air Inc.
Patching Associates Acoustical Engineering
Golder Associates Ltd.
ERCB
FFA Consultants in Acoustics and Noise Control Ltd.
TransAlta Corporation
HFP Acoustical

1. Introduction

- Participants and staff were introduced.
- Don Popowich gave an opening remarks. He extended thanks to all participants and feedback from stakeholders. Don indicated that one of the outcomes from June 28 and 29 meetings was the need to form a working group to provide advice regarding wind turbine issues. AUC is seeking recommendations from consultants and industry to develop measurement protocol for wind turbine noise compliance.
- As well, the AUC is in the process of developing a web based wind turbine resource map. Once this is developed, the user will be able to find out the existing and approved wind farm locations and their associated application numbers. This map should help consultants, industry stakeholders and the public to obtain wind turbine development information.
- There were no questions for Don.

2. Topics Discussion

Discussions of each topic are summarized as follows:

2.1. Compliance Measurement Protocol or Guideline

- AUC is seeking input from consultants and industry stakeholders to develop a measurement protocol for wind turbine noise compliance.
- It is anticipated this working group will help and provide input to develop the protocol.

2.2. Reasons for Compliance Testing of Wind Turbines

- From the complaints', developers' and interveners' initiative, AUC requires compliance testing as a part of the approval conditions,
- One participant indicated that the intervener's initiative is usually complaint driven, unless it's an inquiry. In a situation where we have an existing project or facility we could do a survey or measurement to make sure there is room left in existing noise levels. This might be filed under the developer's initiative. Also, a complaint to the AUC might be another reason for compliance testing.
- When conducting a compliance assessment, certain receptors might be right on target. Given a range of normal precision room for error, post construction monitoring is required and how close we are to the target. There are a lot of marginal receptors. The more turbines in an area the more energy you can generate. We need some guidance around that, especially on an application specific.
- In terms of monitoring, it is not anticipated to model the worst case scenario. It's worrisome if it happens to get the worst case scenario on the day that you choose to measure. That's why some consultants steer away from monitoring for their clients. We have to set parameters and it's easier to not model. Clients need to know the risk of modelling. So for compliance testing, is it about finding the worst case day or about the modelling?
- Currently, it is not mandatory to monitor under the Rule 012. However, AUC is expecting post construction monitoring at seven locations.
- In the past, that would not be the condition with the ERCB. That sounds that it become of a more common thing with AUC.
- The intent of post construction monitoring to confirm how valid the prediction is and is an application specific and cumulative.

2.3. Representative Conditions

- What is representative? We have been arguing for 30 years. Is it representative of the environment (i.e.10%) or is it representative of the complaint. The complaint should occur on the worst case day. Two approaches, we could model for the worst case or 10% of the time it is over but that is allowable. Essentially, the PSL has to allow for certain percentage over the PSL or we will have to look at the worst case. That would put on more restriction on the developer. The cumulative requirement reduces the limit by 1.7 dBA already. Are we going to address that for one-day of complaint out of the whole year? AUC needs to decide at what point we are discouraging development or at what point are we protecting the public (e.g. in sewage system, do you design for one in a 10-year rain storm or one in a 100-year?).
- If we want to demonstrate compliance for the worst case scenario, it will put on a large barrier on wind farm development.
- In a situation when conducting monitoring and the result is over the limit, will AUC enforce the developer to shut down the turbines? If the measurement is 41 dBA for two days a year, is the AUC going to request mitigation? Currently, the 10% in defining "frequent occurrence" is for a season. Assuming 90 days per

season, does it mean if the sound level exceeds the limit for 8 days, it is OK but for 10 days it is not? The Commission has not informed us what they are going to do with the data. We need to understand the use of the data and develop more certainty, bear in mind that practical mitigation may be feasible for some projects.

- The Leq concept is structured in such a way that during the night time period or the period of compliance measurement, there can be exceedance. We would not get too hung up on the momentary exceedance if we are using the Leq concept. Then we are deviating from the worst case situation. If people cannot sleep for 1 hour out of the entire night time period, should the AUC address that? ERCB have not seen a wide range of sound level (i.e. 48 to 28 dBA) variation from facility in the complaint situation. Usually when people complain, the sound level is fairly stable condition and for a long period. The maximum predicted level may happen for a moment but we have not seen that too often.
- Wind farm noise is intermittent. Do we monitor for a year? In a BC wind farm example, the receptor insisted a monitoring period of a year. In some of the latest wind turbine designs, you can have up to 6 operating modes with 2-4 dB noise reduction. It was pointed out at the last meeting that we are modelling a worst case scenario based on high wind shear and maximum wind turbine emission. In cases where atmospheric conditions are rare or you are dealing with a vulnerable group of receptors, or receptor whose complaints may not be truly of a noise nature, should AUC consider that as non-compliance?
- Wind farm noise is an intermittent source. How about Leq for 9 hours, a season, a year? In some of the recent wind turbine developments, you can get up to 6 modes of operation with potential 2 to 3 dB reduction (with pitch control of blades). The technology is advancing and there are mitigative options available. Could existing turbines be retrofit? Not sure how they achieve the multi-mode operation. The Leq addresses the variability in sound level. Under Section 3.3 of Rule 012, "The predicted sound pressure level for a facility operating intermittently such as wind turbines or peaking units, is calculated based on noise generated for the duration of the operation. The calculation must not be an average of the entire night time or daytime periods if the facility does not operate for the entire periods."
- We should avoid the concept of monitoring for a whole year, everything in the Rule is based on summertime conditions. We should restrict that requirements to a certain season instead of the whole year.
- Because of the intermittent nature of wind (on/off/on/off), we need some guidance on how AUC is regulating it. What is representative? Every time you go to do a monitoring, it is always the wrong day or the wrong time, that is why the noise complaint form is critical. If we get it 5 % of the time, we are doing very well. Some receptors will refuse to provide a noise complaint form.
- How effective is the noise complaint form? Noise complaint form is useful in validating the complaint and the process. If we do not receive the form, it is not a valid complaint. That is an essential part of the CSL. That provides the basis of coming out to do the survey. Does the 10% ever get used in the noise complaint process? 10% does not really show up.
- We need to have a complaint procedure to quantify the complaint and representative conditions. That is the first thing we should ask for. Without the form, we cannot confirm which is the correct day even though the client is pushing you to go out.

- For accuracy of modelling, in the ISO standard it shows a variability of +/- 3 dB up to 1000 m. We are usually modelling at 1500 m from a wind turbine but there nothing said about this. How far should the set back be? When you look at the +/- 3 dBA, do you add the 3 dBA? Using ISO 9613 and the +3 dBA is not the worst case, we use ENM (w/ Concawe). Some models are more sensitive to the ground terrain. No matter what we do, most people adjust the model such that it trend to the worst case but not necessarily the absolute worst case. What I am hearing from all of this is that the AUC should conduct longer term studies at different locations for wind farms and listen to the noise source to figure out what is representative. Base on the study, AUC could come up with some findings. It will be a long term solution. If you do that, you may be able to establish a set-back distance. However, the terrain could impact the set-back distance.
- Whatever we model with wind turbines, it may not realistically reflect the actual level. ISO does not represent the worst case; however, to some extent, it is offset or counter balance by the “all down wind” and “all operating” conditions. I would oppose the idea of an offset distance.
- CADNA A (a noise modelling program) has a “max search radius” of 2 km as default, should AUC be prescriptive about this search radius. In the example of 100 wind turbines, changing the 2km to 5 km could increase the predicted level by 1 dB and one could treat it as a safety margin. At the end of the day, no matter how we model, can we avoid or reduce potential complaint conditions?
- Ontario provides a scaled set-back depending on the number of wind turbines. If we have x number of turbines at x distance away, we do not need modelling. The set-back approach is not practical from the Ontario example. It may be a good pre-screening tool for risk assessment; however, it does not address the cumulative effect of multiple projects and existing energy related facilities. There is more complexity here because of the several factors, the cumulative nature of PSL, the two regulatory bodies, and the dispersion of existing oil & gas facilities in rural area.
- We have looked at different prediction models and validating the study. The model does work well. All the compliance distance is very tight, it does not go out to 1.5 km, it is closer distance such as 500 m. We can measure it at vast distances, it is not difficult but expensive.
- In an inversion layer study over the prairies, the requirement for the study is rather involved. It is not a practical approach to quantify the occurrence of an inversion
- What do we need to define representative conditions? There are two options in terms of representative conditions – is it representative of the complaint or is it representative of the local environment (the 10% limit falls in later category).
- The rule is based on both receptor and complaint driven. The Commission wants to emphasize more on the assessment phase to minimize the occurrence of complaints and optimize our ability to address complaints.
- Representative conditions would be in a summer season, night time period, should tighten it up to 5% occurrence, maximum noise emission output from WTG (all operating). Also, the representative conditions should be site specific, not only atmospheric conditions, but focus more on wind shear conditions. How about a site in where the conditions happen every night for a couple of hours, do we apply the 10% rule? We need to define what is repeatable? Not necessarily a hypothetical horrible but something that can happen. There can be some balance as to what needs to be defined as representative conditions.

- How to quantify wind shear, by the shear exponent? Many developers use Sodar technology which can measure site specific wind shear data accurately. The maximum swish sound was created in a wind farm we measured under high wind shear condition. There could be 5 dB increases in frequency modulation under high wind shear condition. It has to be measureable in a complaint situation. It is the variable wind speed along the blade that is causing the resonance.
- If we are monitoring for a complaint, it has to be representative of the complaint. We may not be able to measure inversion. One has to be careful when talking about stable atmospheric inversion versus temperature inversion, they are two different things. In temperature inversion, there is no wind and the turbine may not be operating.
- The basis on Rule 012 is to protect the residences with a PSL level at the time of complaint.
- ISO 9613 is limited up to 1 km. Harmonoise goes up to 2 km with +/- 5 dB accuracy. We are not getting 200 complaints a year as if the model is totally out. The model predicts fairly accurately. 5 to 6 dBA would be enough to create the perception. For most conditions, you are probably accurate but at certain condition. One could be out +/- 5 or 6 dB. Should we stick to the radius of 2 km? Some suggests 3 km max radius recommended in search radius.
- Potentially, a 2 dB difference in the case of 50-100 MW wind farm for changing the search radius. 5 km is not unreasonable. By extending it out, we are including some conservatism. Until we have conducted some long term studies, we may not have a right answer.
- In European study, anything beyond 1.5 km is considered invalid. In some software, it is possible to use dynamic range (based on source strength) to control that. Dynamic means that it searches for the theoretical difference in the result for using different distance range. If it is loud enough, the search radius will increase accordingly.

2.4. Measurement Location

- If something is 1.5-2 km away from the receptor, then will it be an accurate measurement? Should we set a maximum distance? Should the AUC specify a maximum limit for compliance measurement distance between a receptor and the nearest wind turbine. This all depends on the sound power level of the turbine. It would typically be around 105 dBA.
- Fixed distance would not be recommended. Signal to noise ratio is important; however, we will need data on background sound level of ASL. If we have to quantify the impact of the turbine, you do need the ASL.
- Is it feasible to ask operator to turn off wind turbine? Yes, for a short period of time. Signal to noise ratio, it may not be 35 dBA, it could be 20 dBA. Do we have complaint from wind turbine farm? How bad is this problem? Have there been any communications with the people who have measured wind farms in Ontario? So far, we have a Micro-turbines complaint, not the big wind farm. We are building the Rule such that we know what to do if there is complaint or non-compliance issue.
- In Ontario compliance testing, the measurement cannot separate ambient from the wind turbine contribution. Ontario has a greater density of development.
- What is causing the complaint? It is the characteristic of the sound instead of the level of the sound. Most of the complaint is the characteristics of the sound.

- The idea the Board has used in the last few years is to measure near the house and not far away. The signal to noise ratio can be a real problem. What about the secondary wind screen? We need research to quantify the Insertion Loss (IL). Is there anything commercially available? What about the infrasound whether it exists or not. There are lots of papers out there but it involves a lot of do it yourself.
- AUC could specify or clarify the measurement height. Is it 1.5 m or higher for second storey bedroom. What height for a compliance situation? For residences past a certain distance, we may need an intermediate distance measurement or some sort of sound power validation. That applies to conventional noise sources oil wells. We would like the idea of a suggest distance, if that is exceeded, we also like to see a method for max signal to noise ratio measurement would be useful. Reasonable consistency is required. How about validating the “as built” PWL? That may be a practical way to approach that issue.
- Consistency with Directive 038 is required. If you have 100 wind turbines, how many of them should be turned off. The maximum distance would provide that guidance.
- If there is a complaint, you have to measure at the house, whether it has impact or not. For compliance testing, you are just getting the data to validate the model. The Commission is asking for compliance testing, but if you cannot measure it, it could be a problem. Generally 700 to 900 m range for the nearest turbine from the receptor. It is good to have a set distance in where we allow the measurement close the wind farm to verify the model. The signal to noise ratio is important. As long as we can defend what you use and justify it with data, the fix distance is not practical.
- We deal with complex multi facilities sources such as Fort McMurray or Fort Saskatchewan, everyone is presumed guilty. In addition to receptor measurement, the consultant will take source measurement. The methodology is there. A method or approach provided by consultant should be justified. That is being done now and with accuracy. If we measure somewhere and it is below ambient, then it is not an issue.
- In a marginal situation where the ASL and turbine contribution is close, it may be difficult to quantify whether there is impact or not. How do we separate them? What is the Commission going to do in those cases.
- The peaking type noise is never really an issue to isolate. Other sources such as wind noise could be difficult to isolate. We could reference the graph provided for an example of a dynamic ASL associated with wind speed and the cumulative effect of wind turbine contribution with ASL. At lower wind speeds, the impact from ASL could be a lot higher than the impact at higher wind speeds. The measured ASL data presented is based on the UK measurement protocol document.
- Signal to noise ratio can be hard to quantify in some situations. In architectural, you are look to 10 dB in signal to noise ratio. Quality or the characteristic of noise could be an issue. Professional judgement is important. The maximum limit of 500 m or more could be used for validating the model, but not for a complaint driven case. Will the Commission consider the professional judgement factor.
- There are uncertainties for compliance measurement as compared to a complaint driven measurement. The Commission needs to address that.

- What wind speed should be used in the model? Should speed be the max noise emission at the min wind speed when that occurs. In ISO 9613, you do not need specify the wind speed unless you are look at very unique situation. ENM is different, we have to define wind speed based on Concawe. WHO used 25 dBA for sleep disturbance, that translates to 40 dBA outdoor and that is not a coincidence with the 40 dBA night time limit in the Rule. We are interested in condition when the wind speed reaches 40 dBA outdoor. Anything on the left side of the graph (less than 7 m/s at hub height) is not representative.
- It comes back to the wind induced noise. We like the idea of modelling at minimum wind speed at max noise emission for that particular mode of operation. Do we use the maximum noise level at all point, what if we use it like VFD for fans. Most turbines reach max at that 7-8 m/s wind speed at hub height range.
- Do we need to establish the ASL for every receptor or the most impacted receptors. Not sure if we need the measure the ASL but this is very useful understanding the nature of the issue. There are all sorts of ways you can use the approval conditions to understand and learn the issue.

2.5. Noise Measurement

- In regards to the corresponding table, is this too prescriptive? We think it is necessary to be prescriptive to a certain degree. Stuff that comes in could be all over the map. The content in the table is consistent with Directive 038. The aspect of secondary wind screen may need more work.
- IEC recommends the secondary wind screen but the IL should be quantified. Type 1 or 2 should be allowed. Just do not put in something that nobody has.
- There is a change in ANSI standard (i.e. Class A or Class B). Some Type 1 may not be certified as Class A anymore. 2260 is still a Type 1 but not ANSI Class A. If there is a tonal assessment, there has to be a 1/3 octave band analysis. What about the LFN, is it a primary or secondary investigation. If it is a primary investigation, Type 2 is OK but for secondary investigation, Type 1 and detailed analysis is required.
- What about conducting all measurements in linear and get them all. It will be overwhelmed by wind noise. Particularly a problem with doing dBC in wind farm as wind has a strong low frequency component. If we specify the wind speed measurement limit, can we minimize that? We can hear it as well from the audio equipment. The concept of fast or slow response should not be relevant if doing Leq.
- The concept of compliance is something we should address. Modelling at the minimum wind speed at max noise emission is essential in NIA.
- Should we be looking for C-weighted measurement? If there is no LFN issue in the complaint, then the consultant would not need to measure dBC. If you are measuring dBA, you might as well measure dBC.
- If there is no complaint related issue, would the ERCB still be looking for dBC measurement? The dBC measurement has been requested from the audit group even though the complaint is not LFN or tonality driven. That should not be the case. Like the consideration of the Ln or statistical level. It is included in the A2 adjustment straw-man document “used as reference”.
- Can AUC provide more clarification on the word “reference”, can we use it in a calculation or can we present it. The intent is that the consultant can present the data, but it will not be the critical factor in your compliance or acceptable. It will

to some degree affect the decision. You are taking about certainty level. If there is a margin of uncertainty, the Ln data is going to help AUC in making a decision.

- C-weight is not required but can be provided in the report for information purposes, as well as the Ln. The data can be very useful in the long term. We need to be very careful when including the C-weighted level in your assessment. Is it the wind or infrasound from the environment. You introduce another can of worms. In most cases, we would not present the data unless there is a complaint issue.
- Is that an impulsive and intermittent element to this. Are complaints related to these elements. How about other ways to limit the modulation nature of the noise? That would deviate from our approach. That could be a way to consider the characteristic of the sound. The current Rule 012 does not guarantee that one cannot hear the development. The C-weight method may not capture the modulation. We are looking at the highest sound power the wind shear worst case, how is the frequency modulation level compared to the Leq level.
- Would the Commission do further investigation? That will depend on future data and occurrence of complaints. We should sort out some of the current issues first such as the representative conditions. Depending on the nature of the sound, it could be 1 minute or 5 minute. I would prefer to inclusion of Ln measurement. The Leq is still the dominant factor. If measured in Leq, the fast or slow is not as significant. The fast setting is preferable. The concern is human reaction. Item 9 to 13 may require more Commission research such as the requirement on secondary wind screen. We need more research on this subject. The Commission is in the position to spearhead the research with our help.
- Any merits of the proposed table and being prescriptive on the parameters or range of parameters to use in noise compliance measurement of wind turbine? It will bring some level of consistency. Most agreed with putting the table in the rule. Everybody is on the same page and we are comparing apples to apples.
- The option of octave and 1/3 octave will be required for LFN – tonality. A1.5 m microphone height minimum (second storey bedroom), maybe introduce the word receptor height. What about audio recording? We agree that audio recording is valuable; however, some consider audio recording to be a violation of privacy. We have been doing audio signal for 18 years.
- In the Rule, we are recommending the use of audio signal. We need some sort of audio recording to identify the event, if not, some sort of digital or analog log data, field notes, or witness – have someone there to take field notes.
- To be considered as a complaint and a good valid complaint. It must be validated, witnessed, or logged. Item 10 in the table, minimum valid time period requirement, we have included the word cumulative, any comment on this? All agreed. Without the word cumulative, one could have a different interpretation. Some jurisdictions specify minimum one week of measurement. The 3 hours intent is to start with one full 24 hours and get the minimum 3 hours of acceptable data after isolation analysis.
- For a wind farm, we may want a weather system to go through generally, it will take a week. Possible in the ruling for case where one makes an honest attempt to do a measurement (i.e. two weeks) and use the best data available. There is a maximum limit there. Client may not want to pay for 3 weeks of monitoring. Is the 3 hours data for a day period or a week period. Should be for a day. 3 hours as per night time period (9 hours).

- Should it be only night time period we are interested in? We think it should be night time because it is the more sensitive period. We should focus on night time. What about the wind statistics? For absolute minimum, you set it up such that we have 6 hours of daytime and 9 hours of night time. We may have 3 hours continuous before and after the night time period. Call it nominal 24 hours that is the absolute minimum I recommend. Normally, we prefer to go for 24 hours. We do 24 hours because it is in the Rule just because we do not want the debate. We do need the methodology and data to show the daytime compliance. The only way to get that is by the daytime measurement. Looking at the graph with the cut-in speed, the source is intermittent, not continuous.
- We should be prescriptive about what makes that three cumulative hours level acceptable. That's why we need to define that range for representative conditions.
- Is the measured ASL consists of environment wind noise and wind induced noise on the wind screen. We should have site weather condition data to find out when that wind shear will occur. During which season and what is the likelihood of the occurrence. We can plan the monitoring on that to guarantee better success.
- You may only be able to measure during certain times of a year. Due to different operating conditions of wind turbine during a 24 hours period, we need to consider both daytime and night time. In terms of wind direction, it should be downwind conditions. In multiple turbine installation surrounding a receptor, how do we consider downwind, from which turbine? What are the options that will provide downwind conditions all the time in a survey? In some receptors, the prevailing wind may always be upwind. What do we do? Why do we want to measure in upwind condition. May be if there is a complaint.
- For a wind farm, as it is a distributed source, in most cases, we will have a downwind condition with respect to one or more turbines.
- Is this for compliance or complaint. Are we separating the two? When you get a complaint, you will need to do a measurement to prove compliance. It has always been complaint based.
- Do we do a compliance the same way that you modelled? We can consider using the IEC method to validate the sound power level and use the model to prove compliance.
- Does the Commission entertain the idea of using model prediction to prove compliance in a non-complaint situation? Problem with the IEC method and modelling. The potential complainant may question that you modelled before and you got it wrong, why should I believe in this model now. In addressing the complaint, we cannot use modelling.
- There is always going to be some variability in the results from measurement. How does the Commission decide on that? Based on the evidence that the practitioner provides. We would hope that it is based on good science. At the end of the day, we have to convince the Commission that we have done a good job. Complaint and compliant monitoring should be the same.
- the PSL is still the same and the process of setting up the measurement what you measure should be the same. One is for approval and other is from complaint. The conditions for monitoring are different for the two. If it is a compliance situation, would we not be monitoring under the model situation to compare apples to apples? If we got a complaint situation, it may be under a different representative conditions, but the process of monitoring should be the same. Not necessarily, if we have to get a representative complaint condition for

2 nights out of the summer, do we have to have the same conditions to meet PSL for those 2 nights? Yes, what else would we meet?

- Historically, this has never been an issue. We get enough nights based on the information from the noise complaint forms. We have to make a call or statement in your report that states if that is representative or not.
- How does that sit with the 10%? It has never really been an issue. The people who do a lot of CSL measurement do not have the 10% issue.
- In dealing with a complaint situation, one practical approach would be (1) run a NIA first (2) calibrate the model (3) put in an inversion condition (4) if you still cannot identify the complaint situation, you will start to question the receptor to assess whether the complaint is valid or not.

2.6. Wind Measurement

- Is the level of precision acceptable? In wind turbine monitoring, we need to quantify the wind in two locations, one at the monitoring location and other at the wind turbine hub height. In relation to the anemometer location, can we quantify vicinity?
- Within 100 m of the sound level meter with no obstruction. We would like to see the height at the same height as the microphone. Anemometer should be the same height as the microphone. There should be no obstruction between the ground microphone location and the anemometer. We almost need another anemometer between the sound meter and the wind turbine in an exposed area.
- The intermediate area does not tell you what is happening around the microphone. If we are trying to decide what is happening between the wind turbine and the house, we need that anemometer on the other side of the wind break away from the house. Wind at the turbine, wind at the receptors during the turbine operation, wind at the receptor during ambient conditions.
- Wind contamination can be heard from the microphone. In some cases, the anemometer may show a high wind speed but the wind noise might be audible. So audio recording is important for that reason. Wind contamination at the microphone is a big issue. Portable equipment is relatively inexpensive and can be used to take measurements. If we do spot measurements that correlate with your audio that helps. It isn't just about the number, the audio recording is also very important to know if we are getting wind noise on the microphone.
- The anemometer should be located between the source and receptor, somewhere in between. Open area is more important. The intent is to have some minimum requirement. What should be the sampling period for wind?
- Weather Hawk used for ERCB, we used 5 minutes and get about 6 days of day.
- The anemometer precision and resolution should not have a defined limit in the Rule 012, however, the practitioner should report the specification for reference purpose.

2.7. Compliance Assessment

2.7.1. Isolation Analysis

- Currently, 6 m/s for the wind speed isolation limit at receptor is that sufficient? That works out to 9m/s at hub height for a logarithmic wind shear, which will reach the maximum noise emission point for most wind turbines.
- 6 m/s (21 km/hr) at receptor height is a good limit. The 6 m/s will create 40 dBA wind induced noise which is a reasonable cut off unless there is specific reason to exceed such as complaint condition.

2.7.2. CSL and PSL Comparison

- Do we use the assumed 35 dBA ASL or the measured ASL in the CSL calculation. Where are we measuring your ASL? At the same receptor location.
- Unless we turn off all the turbines, we may not get the same wind condition. Can we quantify the ambient. We have to get a range. Unless we have a separate unit several km away, we cannot get the ASL without turning the wind turbine off.
- Is there a need to separate your CSL? If the measured CSL level is below PSL, not an issue. The ASL curve does not represent our representative conditions because we are looking at a real ambient conditions which are not high wind shear. If we monitor for potential for complaint, what we are interested in low ground level wind speed implies a low ambient level.
- Is there a need to do the ambient level if you measure at a low enough wind speed already. Are we suggesting that we measure with and without the wind turbine operating and subtract the contribution. Quantifying that would be a very difficult. In some situations, we may need to do that in the example of a receptor far away where turning the turbine on/off would not make any difference. We do need to turn off the wind turbine.
- Could we not do some propagation studies or measurement between the wind turbine and the receptor. When we begin to pick up the measurement and the wind turbine contribution. Consultant would decide how long you need to measure. It is easily done with steady noise source but not so with wind turbines.
- The wind noise from the blade and the nature of wind noise is quite similar. We almost have to put a siren on top of the wind turbine to quantify the propagation.
- How do you separate that out? If it is under the PSL, then it is not a problem. We may need to do further analysis to determine when we hear it or how to separate it? We could go back to the combined receptor and source measurement method.
- Commission will be looking for input to address the situation when the CSL exceeds the PSL. Is there is a collective agreement on how to analysis the CSL data further, whether it is using a combine source and receptor measurement or using the turning wind turbine on/off approach. How about getting the A2 adjustment?
- The idea of the A2 adjustment is for a constant steady ambient level. However, a dynamic ambient is different from a constant A2 adjustment situation. Using the A2 for this would be very difficult and messy.
- Is there a full EIA done. Isn't there some baseline measurements done? Not all applications will conduct baseline measurement. May not even obtain representative conditions.
- How many wind turbines in some of the approved (7) projects? The large wind farm has 97 in one wind farm, considering the adjacent farm could bring the number up to 140 in total.
- We can consider doing pre-construction baseline measurements as an approval condition. For wind farm, may be you can make them to do some ambient measurements before installation. We may need to do the ambient monitoring a season before. How long is the construction period? The construction period is about 1 year. We typically flag the receptor of concerns during the pre-screening stage. If we conduct the ambient measurement, we might want to use the ASL in the assessment. That will deviate for the current PSL approach. A dynamic PSL is problematic. Do we use the measured ASL for wind farms and using the assumed ambient of 35 dBA for to other facilities. It might be difficult to present

or explain to the public. We need a less complicated approach. Stick to the constant PSL where possible. If we run into compliance or complaint issue, we could deal with it technically if the situation arises. A dynamic PSL could be messy particular from the cumulative perspective with other energy regulated facilities. If the Commission runs into a complaint situation, it could be dealt with it on a technical basis case by case.

- By doing the ambient after installation, it does provide data such that you can extract the ambient from the CSL. That would be the only reason for it. Ideally, it should come after the initial assessment but before construction.
- What is the typical spacing? It depends on the turbine size. Roughly a 600 to 700 m apart or 3 or 4 times the hub height (80-100m). Does it depend on the terrain as well? At the receptor with potential concerns, the baseline measurement could be valuable in your back pocket.
- What about the smaller components such as a substation in a large wind farm project? In Fort McMurray, it is not uncommon to conduct ambient survey. The information is in your back pocket. As a consultant, it is good information that the client should have.

2.7.3. Multiple Operating Wind Farms

- The issues also relates to other energy stations, not just wind farms. In order to isolate the noise levels, the easiest way is to get close to the source.

3. Documentation Requirement

- Should we be prescriptive in this table? Or should there only be certain elements in the Rule? It will be valuable to have references with the Rule. However, clients may take issue with disclosing information and have it specified in the table. The document requirement table is a reasonable thing to include in the Rule. It makes it more concise and helps us educating the development of what we are doing and why we are doing it.
- What kind of acoustic practitioner information the Commission is looking for. In AUC Rule, section 1.14. The requirement of the practitioner name and credential is required.

4. Ambient Noise Measurement

- Please see above for discussion as this was already covered.

5. Reference Documents

- Referencing these documents so that people can look up this information is useful. However, we don't believe in referencing standards. Use the word "may be" instead of "to be". Need to be identified as a partial list. May be a series such as ANSI standard.

6. Next Steps

- Participants were requested to submit their written input, particularly on the content in the tables and the discussion topics of PSL and CSL.
- Feel free to call Jack and Jonathan if there are questions on the submission request. Ideas and input will be summarized and be presented to the Commission in helping with their decision with the approval of next version of Rule 012.
- All written submissions should be forwarded to Raymond Lee not later than Friday, August 19, 2011.