Algonquin/Stantec Open House – Dec. 6th 2011.

Turbine Noise: A Report from the Association to Protect Amherst Island

A) Questions and Comments

The following questions were posed. The responses were as I remembered them and my comments are added.

Q: What are the sound power levels of the Siemens 2.3-113 turbine as a function of wind speed and turbulent intensity?
A: The noise level is given as 105 dBA but I do not know at what wind speed. Siemens will not release the detailed noise specifications to Stantec or Hatch; only to Algonquin Power. I believe that the turbulent intensity was 0.15 and again do not know how the sound power level varies with turbulent intensity.
Comment: This information is needed to properly judge the quality of the noise impact assessment. In addition, Hatch will need to present noise contours for a number of wind speeds for the REA process.

Q: Given that to date there are only two prototype 2.3-113 turbines operating, how can we be sure of the noise specifications?
A: We must trust Siemens to stand by the 105 dBA.
Comment: A firm sound power level analysis is required.

Q Are there different operating modes of the 2.3-113 turbines to adjust the sound power level?
A: Do not know.
Comment: Many turbines do have different operating modes.

Q: Why do the predicted sound pressure level contours not include:

a) The uncertainty in the ISO 9613-2 prediction algorithm?
b) The uncertainty in the sound power level of the 2.3-113 turbine?
c) The ground parameter applicable to the winter months?
d) Turbulent inflow noise?

A: We have followed the regulations. The regulations do not require consideration of any of the above.
Comment: Attention to all of the above will save Algonquin from itself. Algonquin and Stantec have sited the turbines so that the majority of homes are very close to the 40 dBA noise limit. The 40 dBA prediction is in reality a prediction of 40 ± 4 dBA; that is the range 36 to 44 dBA. We can therefore expect that a significant number of homes will have a sound pressure level above 40 dBA. They will be out of compliance and will be shut down. This lack of compliance will be exacerbated by c) and d) above.

Q: Have you identified the sites that Algonquin will be using for compliance testing as specified by the Ministry of the Environment protocol for turbine compliance.
A: Seemed not to know about the new protocol but said that the noise impact assessment is on-going.
Comment: Given the very high likelihood of non-compliance this draft protocol needs to be taken seriously.

Q: Why are you not building in enhanced setbacks to prevent Algonquin Power from having turbines shut down in the event of non-compliance? Investors and bankers will want to know of this risk factor.
A: We are following the regulations.
Comment: The question speaks for itself.

Q: When will you be releasing the wind speed gradient data so that individual residents can judge the noise impact assessment?
A: The final noise impact assessment will include this information.

Q: Are you aware that in Europe turbulent inflow noise is accepted as the main source of low frequency noise?
A: We are following the regulations.
Comment: As noted above, with the high density of turbines this is going to dominate the low frequency noise – the 'thumping", "jet engine", "train that never passes", "washing machine in the basement" noise.

Q: Will you release the turbulent intensity data from the test towers and when?
A: We will follow the regulations!

B) Report on Turbine Noise

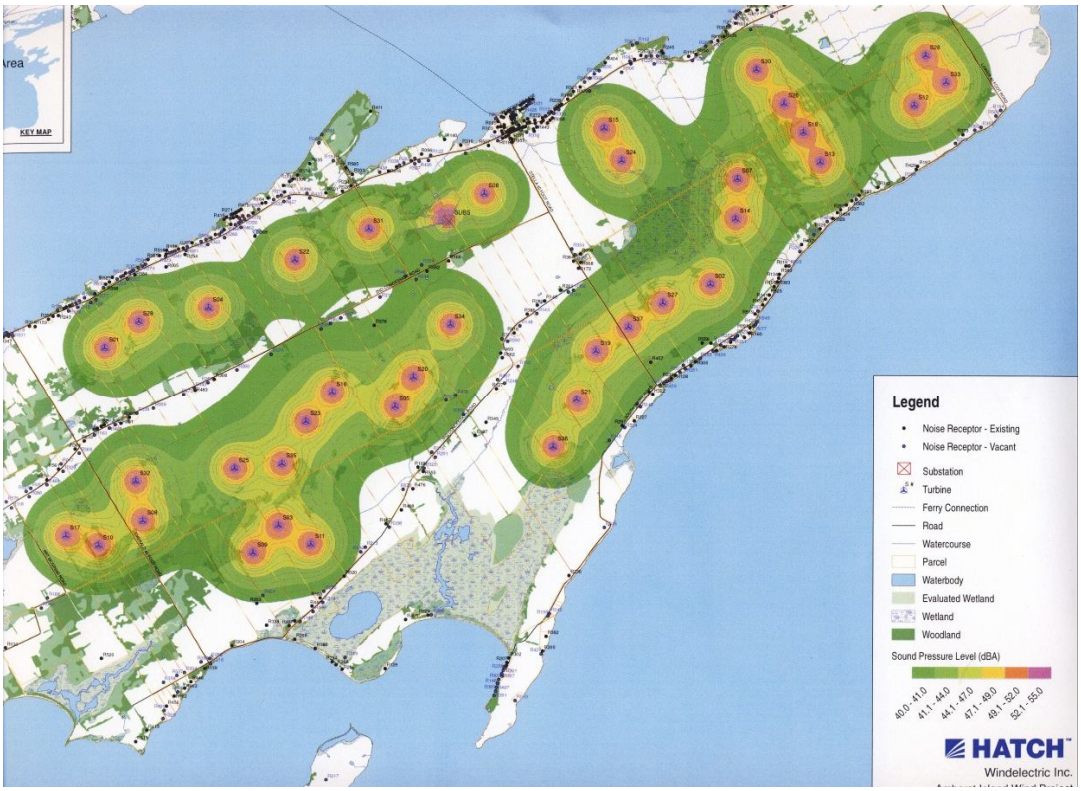
Turbine noise is going to be the major problem for islanders and Algonquin Power Company (APCo) unless APCo abandons the Amherst Island wind development. For reasons given below, it is certain that the project will not be compliant. If it were to go ahead, residents will suffer adverse health effects and will demand compliance testing. The only mitigation possible will be shut down and removal of the turbines or a massive and ruinous programme of house purchasing. The recent Kent-Breeze Environmental Review Tribunal found in favour of Suncor. However, the Tribunal also stressed that "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**."

Field studies show that turbine noise at the 40 dBA level causes annoyance for about 20% of residents (see the separate report on adverse health effects). This compares with about 3% for traffic or industrial noise at the 40 dBA level. There are several reasons:

a) The 40 dBA is a predicted noise level for turbine noise but a measured noise level for road or industrial noise. There are good reasons for believing that the predictions under-estimate the actual noise.

b) The periodic nature of turbine noise (the swoosh-swoosh-swoosh) draws attention to the noise. Although the Ministry of the Environment has a regulation that applies a penalty of 5 dBA to noise of a periodic nature, it specifically excludes turbine noise from the penalty. That does not, of course, mean that turbine noise does not deserve the penalty!

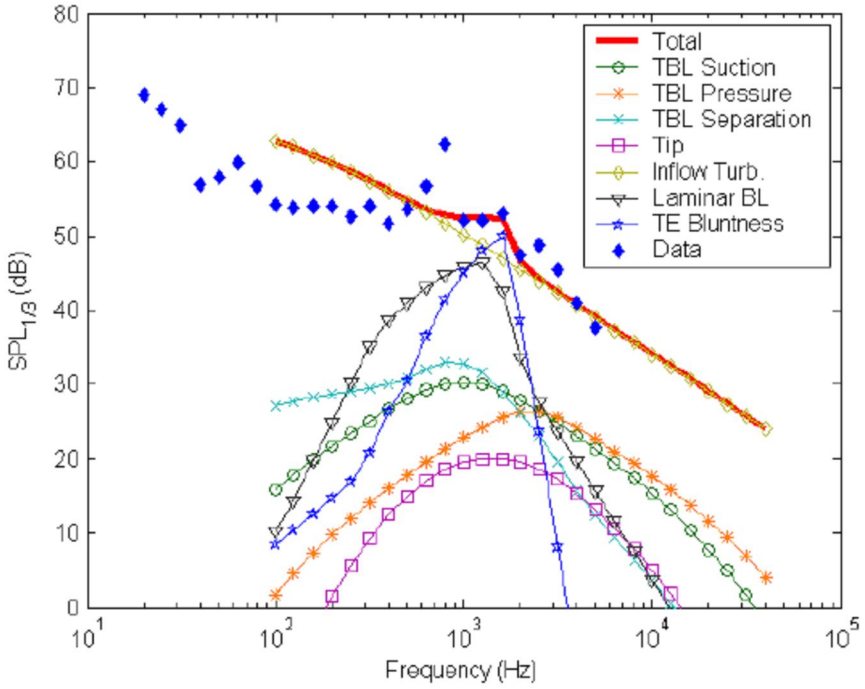
c) The predicted noise level carries with it an uncertainty of ± 4 dBA. Therefore, a prediction of 40 dBA really means a noise level most probably in the range 36 to 44 dBA. The figure, taken from the APCo/Stantec website shows the predicted noise contour map for the project.



Note the large number of residences at or close to the 40 dBA contour, the outer-most contour. At many of those residences, turbines will be non-compliant even without consideration of the problems discussed below.

d) Hatch has performed the noise contour assessment with a ground parameter of G = 0.7. While this is permitted under the MOE regulation it ignores the fact that for much of the winter the ground is covered by wind-swept snow. Like ice, this is acoustically hard (G = 0). Had a hard surface been used in the calculation, the predicted noise would have been 2 dBA higher.

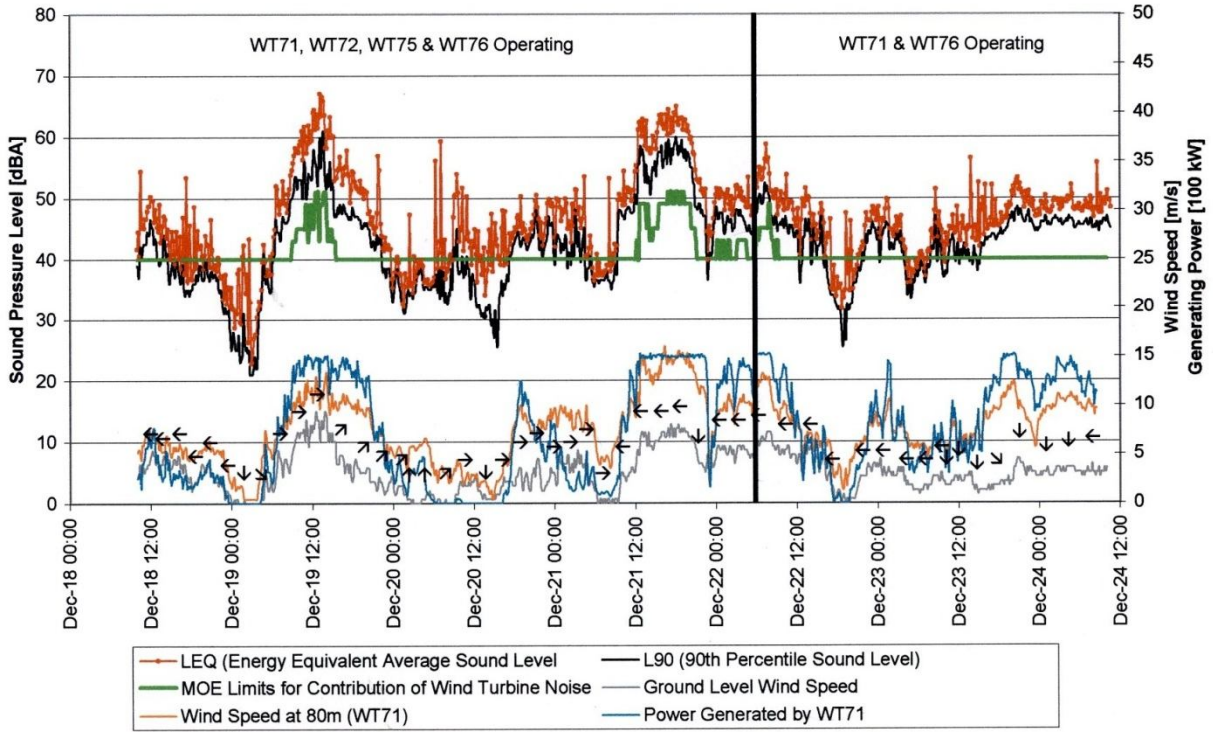
e) Hatch has ignored the extra noise caused by turbulent inflow to the turbine. This is widely recognized as an aerodynamic noise source but as yet is not required to be considered by MOE. Nevertheless it is a real contribution and its neglect will jeopardize APCo when it comes to a noise audit. For APCo's development the risk is heightened by the excess turbulence that will result from the very high density of turbines. Every turbine creates a turbulent wake. Most of the turbines planned for Amherst Island are within 5 or 6 blade diameters of an upwind turbine for the prevailing wind direction. Of particular concern is that turbulent inflow noise is primarily low frequency noise and dominates the total turbine noise below 500 Hz. Low frequency noise is not absorbed by the atmosphere and is especially annoying.



The figure illustrates predicted and measured turbine noise for a research turbine at the National Renewable Energy Laboratory in the USA. The blue diamonds show the measured noise. The yellow triangles show the predicted turbulent inflow noise. The turbulent intensity was 22%, relatively high. However, at a more typical turbulent intensity of 10%, the turbulent inflow noise would be only 6 dBA lower. The actual magnitude of the noise is not relevant here; the figure demonstrates the relative importance of a source of noise ignored by Hatch and MOE.

As a final word of warning, consider the result of a noise audit at a residence within the Canadian Hydro Developers (now Transalta) Amaranth project.

Figure 2: Sound Levels Measured at the Lormand Residence.
Comparison to Wind Speeds and Criteria. Canadian Hydro, Melancthon EcoPower Center.



This project had been approved by MOE but under earlier guidelines which allowed the turbine noise at a residence to rise from 40 dBA at a wind speed of 6 m/s to 51 dBA at a wind speed of 10 m/s. The red line is the turbine noise at the residence. The green line is the MOE noise limit. The difference is up to 15 dBA; clearly the turbine noise was non-compliant. In this case, the family agreed to a buy-out of their home. Transalta bought out several homes. Under the 2008 MOE regulations developers have lost the ability to go above 40 dBA.

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