Presentation to Inter-Council Wind Turbine Working Group – May 12, 2011
Notes from the 4th International Wind Turbine Noise Conference
Rome, Italy, April 2011

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This was my third opportunity to attend and present a paper at the International Wind Turbine Noise Conference. These notes give my overall impressions from the conference as well as an overview of the presentation made this year, all shrunk to fit a 10 minute presentation window. A more detailed presentation with slides can be made on request.

The Wind Turbine Noise Conference has grown in number of participants and number of papers presented over its 4 sessions.

Year / Location	# Participants	# Papers	Palmer Paper
2005 / Berlin, Germany	130 22 countries	29	(not attended)
2007 / Lyon, France	160 24 Countries	33	Uncloaking the Nature of Wind Turbines Using the science of Meteorology
2009 / Aalborg, Denmark	163 23 countries	47	A New Explanation for Wind Turbine Whoosh – Wind Shear
2011 / Rome, Italy	199 22 countries	70	Evidence Based Study of Noise Impacting Annoyance

It was clear from a number of papers this year that the issue of noise is a major stumbling block to the installation of wind turbines in many countries. Negative impressions of wind turbines were specifically mentioned to be due to noise in Japan, Italy, Denmark, Sweden, Finland, Canada, United States, Australia, New Zealand, Spain, France, The Netherlands, and the United Kingdom. However, participants continue to speak of government objectives to increase the fraction of their electrical generation derived from wind, and many are quite frank that the development of wind turbines amounts to "big money" and listening to complaints would cost the countries a great deal. Money is ruling, not people's interests.

It was noted this year that the thrust of the conference has changed from purely measuring the noise, to considering the effect of the noise on people, and yet to date there are few hard rules. WHO guidelines are spoken of, but are considered by some supporters of wind turbines to be unrealistic objectives.

There were some clear messages delivered. One is that, even in much smaller countries, large numbers of wind turbines are not placed as close to people as they are in Ontario. Even where countries may have standards that are similar to those in Ontario, there are not as many homes near turbines as in Ontario. For example, Denmark would permit a wind turbine installed at 4 x the tip height from a home, or a turbine with a 85 metre tower and a 100 metre blade diameter as installed at the Kent Breeze array in Ontario would be set back a minimum of 540 metres from homes while in Ontario, they would be 550 metres from homes. However, in Denmark, any home within 6 times the tip height (810 metres) would qualify for an

immediate assessment on property devaluation. Similarly, descriptions from Denmark, New Zealand, France, and Australia all show that the number of homes within 1 to 2 km of wind farm arrays is considerably less than seen in Ontario.

Noise standards in Ontario stand out compared to regulations elsewhere. Ontario permits higher noise at homes than do regulations in Germany, the Netherlands, France, Italy, Denmark, Sweden, the United Kingdom. In many of those countries, the sound limit at homes at night is 3 dB above the background, while in Ontario regulations allow sound that is 10 to 15 dB above background at night in many rural locations.

The issue of the cyclic noise from wind turbines, generally identified as "amplitude modulation" was a common subject for discussion in many papers. Recently revised standards in New Zealand penalize a wind farm if amplitude modulation is experienced. Ontario regulations specifically refuse to consider a penalty for "cyclical noise" from wind turbines even though Ontario sound regulations call for a penalty if it is present.

Larger wind turbines are identified to result in more low frequency noise but the fact that A-Weighting of the sound makes this low frequency to be ignored was mentioned in several papers. The subject of going away from A-Weighting of wind turbine noise was mentioned by a number of authors. Similarly, it was noted that although waves and waterfalls can produce low frequency sound, they do not show either the same frequency or the disruptive amplitude modulation of wind turbines.

A number of papers identified that the sound from wind turbines can impact health, and in fact, surveys of those living near wind turbines, either taken as blind surveys (as in New Zealand) or as identified surveys (as in the United States) shows a difference in quality of life near wind turbines compared to distant from wind turbines.

My paper presented evidence of the change in sound present at "approved locations" (meeting regulatory approval) compared to "control locations" at a distance of twice or ten-times the approved distances. The evidence showed:

- when turbines were not operating, the conditions at all locations were very similar (see figure 1)
- when turbines were operating, even at very low power, the sound at the "approved locations" was greater than the sound at the "control locations" by some 20 dB for all low frequency octaves. (see figure 2)
- when turbines were at high power, on days with high ground level wind speeds, the sound at the "control locations" increased, but only to the level seen at the "approved locations" on days when the ground level wind sped there was very low. (see figure 3)
- the sound level at an "approved location" exceeded the projected sound level fully half of the time, and was 3 dB (readily discernable) on 25% of the time. This means that for locations that are predicted to have sound levels just meeting the regulatory approval, the sound will be above regulatory limits fully half of the time, and 3 dB above the limit 25% of the time. (see figure 4

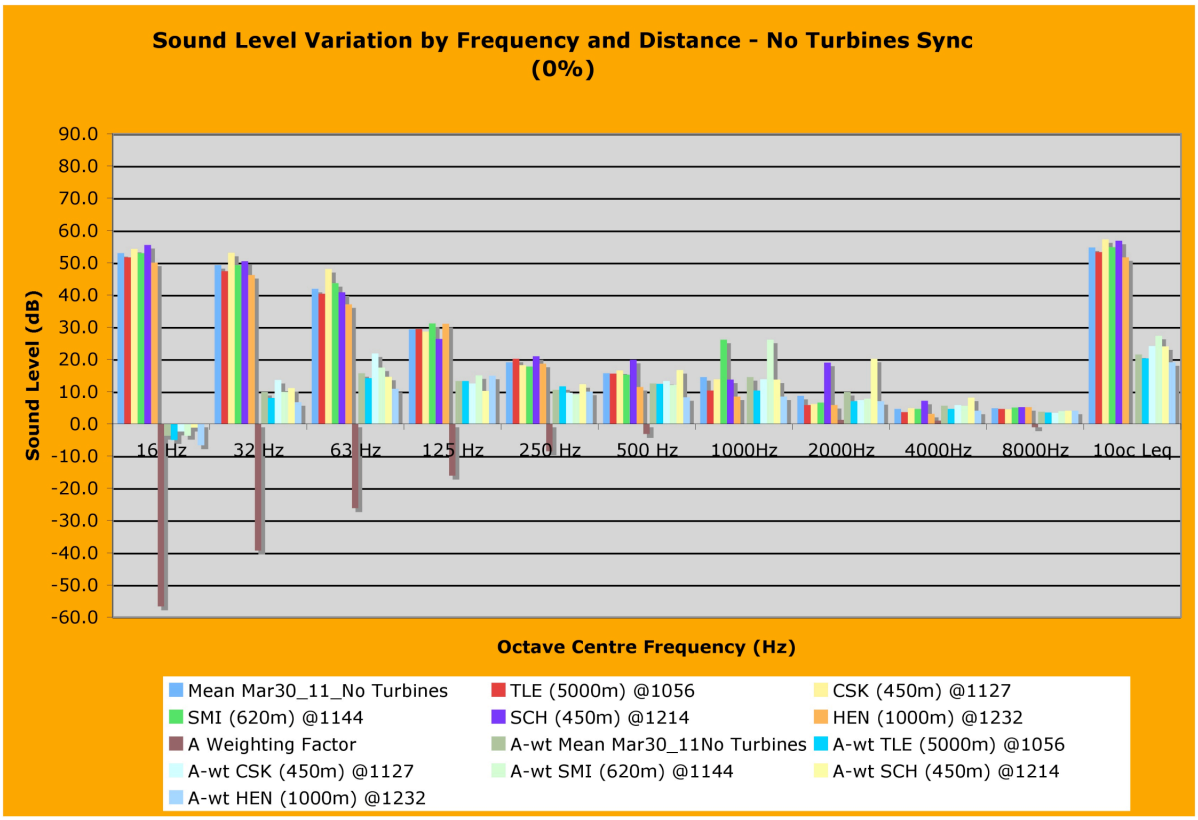

Figure 1 – No Turbines Operating – Ground Wind Speed 1 m/s

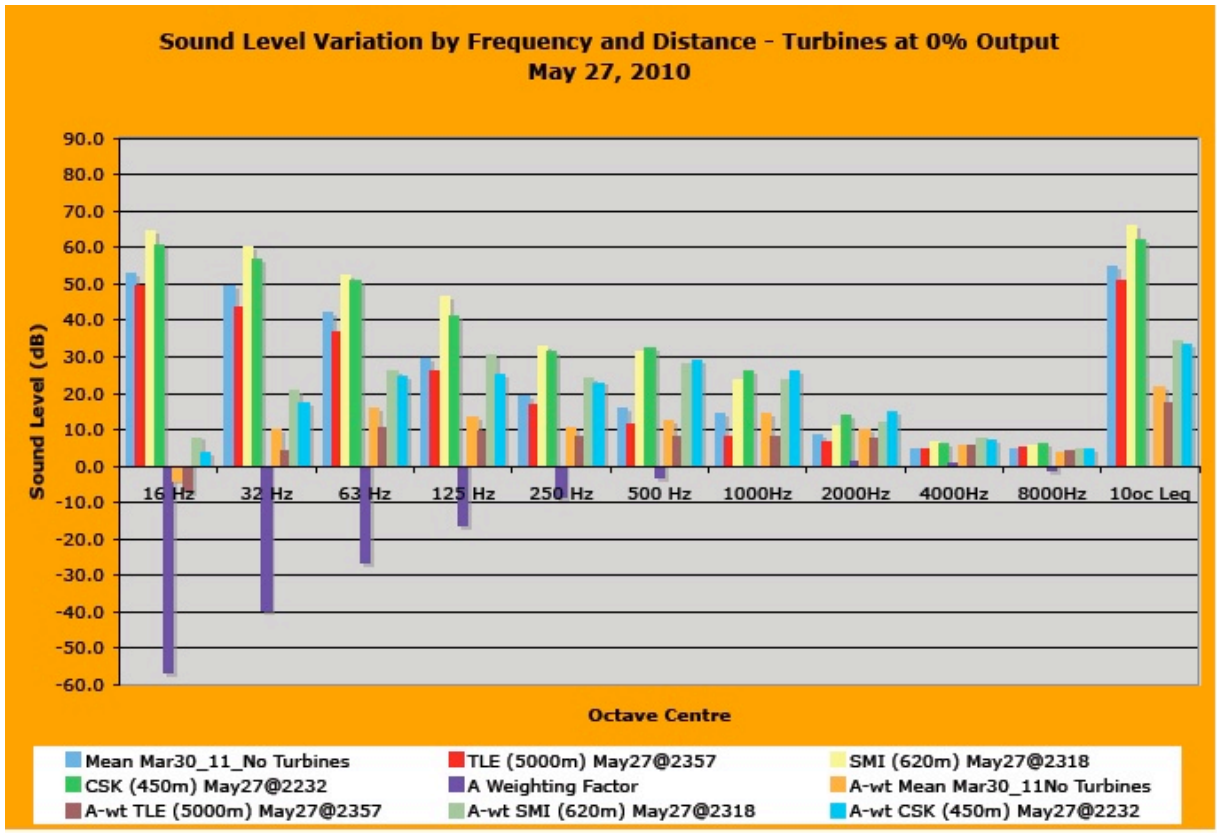

Figure 2 – Turbines Just Synchronized at 0% Power - Ground Wind Speed 1 m/s

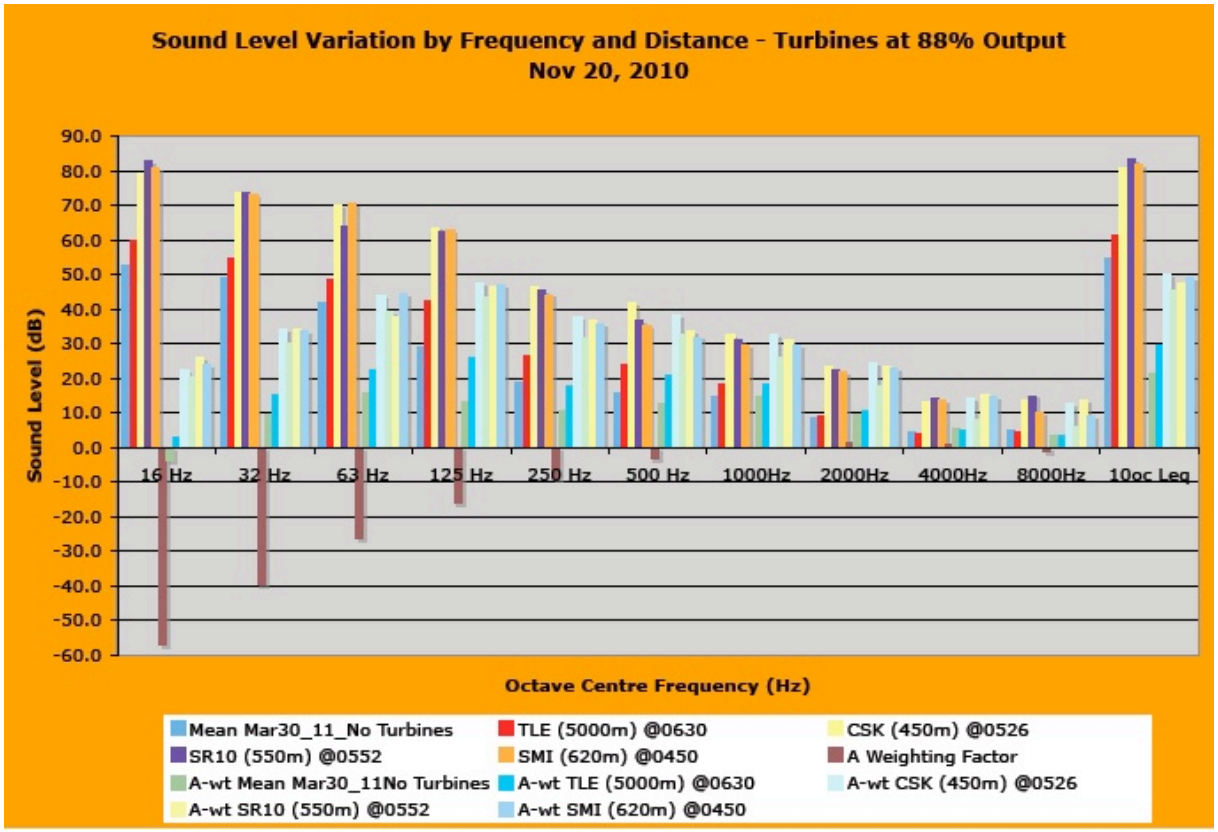

Figure 3 – Turbines at High Power – Ground Wind Speed 8 m/s

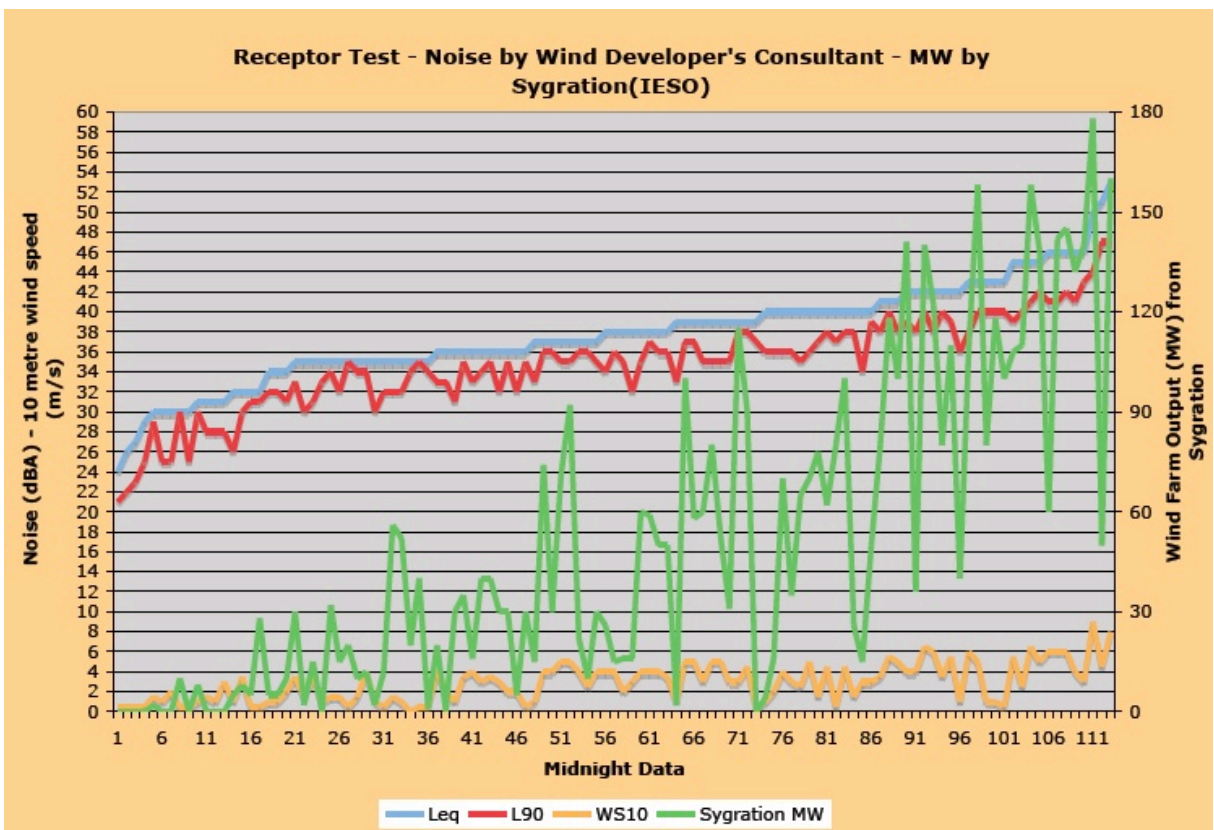

Figure 4 – Test for A Home Proposed to have Sound Level 36.6 dBA for 6 m/s wind speed