Wind Turbine Noise: Recap of Current Trends

AWMA Noise Conference 2012

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HGC Engineering

May 8, 2012

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Recent Trends in Ontario

- Continued opposition & unruly public open houses
- Environmental Review Tribunal hearing
- Infrasound, low frequency sound and health concerns
- Annoyance
- Amplitude modulation
- Increased scrutiny on MOE assessments for REA
- Acoustic audits

Life in the shadow of a wind turbine blows

BARBARA ASHBEE

The Globe and Mail, Monday, June 8, 2009

ENERGY // WIND POWER

The answer's blowing in the wind, but not all of us want to hear it

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Ontario

Ontario Becomes Wind Power Leader In Canada

October 30, 2008 11:41 AM

McGuinty Government Celebrates Canada's Largest Wind Farm

Ontario is the leader in wind power in Canada with today's launch of the second phase of the Melancthon EcoPower Centre near Shelburne, On

The announcement, which pla... topping second at the ballot box today in an effort to turn the page on Mr. Ahmadinejad's fire-brand rule.

» SEE 'IRAN' PAGE 14

election, ... has ever held.

Robin Wright, public policy scholar

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...ader ...e area

NATIONAL

Friday, November 7, 2008

Are turbines making some people sick?

James Cowan, National Post

1st SESSION, 39th LEGIS. 58 ELIZABETH

Bill 150

An Act to enact the Green Energy Act, 2009 and to build a green economy, to repeal the Energy Conservation Leader... Act, 2006 and the En... and to ...

Loi de 200... et visant à ... une économie ... abrogeant la Loi de ... sur le leadership en matie... de conservation de l'énergie et la ...dement énergétique ...lois

INSIDE TODAY'S GLOBE AND MAIL

The winds of change As government investment in wind power grows, so does opposition. PAGE 13

Trial by media There's no justice in the treatment of Sarah Kramer, Marcus Gee writes. PAGE 11

Gee takes questions on the eHealth scandal at 12:30 pm (ET) today. GLOBEANDMAIL.COM

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...ated that ...rack ...st black ...s of the ...ation ...ned the ...ge. ...liate Mr. von the U.S. ...useum, ...nal ...eavy se... ...ered it

thestar.com

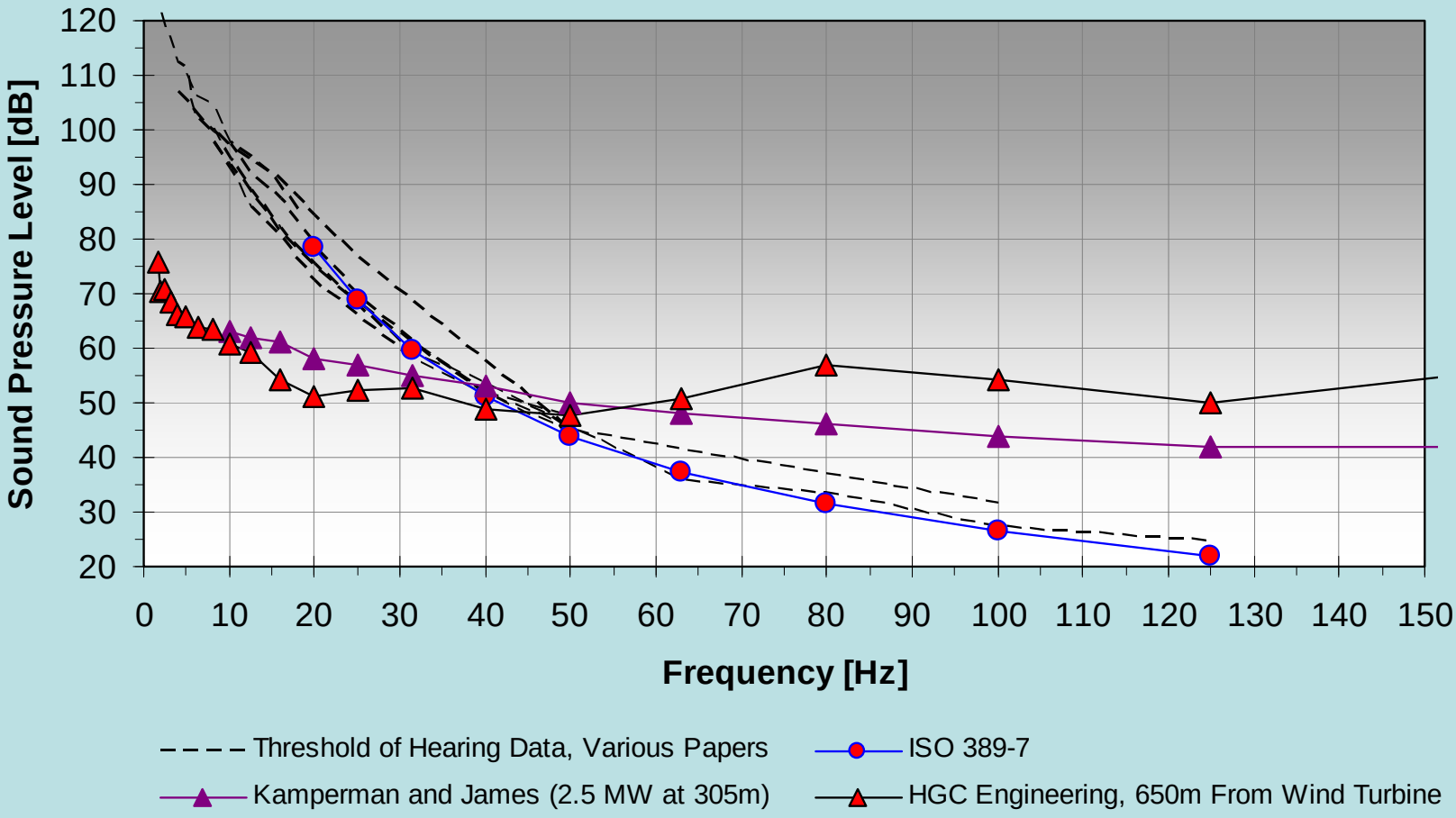
Province to fast-track wind turbine proj...

February 21, 2009

Kent Breeze ERT

- Great amount of evidence on sound and health
- Decision in July 2011 rejected appeal of project but left room for further investigation
- Tribunal noted that the debate was not whether wind turbines can cause harm to humans – rather it is a matter of degree

Example Sound Level Data at Low and Infrasonic Frequencies



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Health Issues

- Exposure to high levels of infrasound is problematic.
- Exposure to low levels of infrasound: controversy in this area.
- Ontario Chief Medical Officer of Health Report:

  " … the scientific evidence available to date does not demonstrate a direct causal link between wind turbine noise and adverse health effects."

  " Low frequency sound and infrasound from current generation upwind model turbines are well below the pressure sound levels at which known health effects occur."

- However, annoyance with audible sound can lead to stress. Stress is associated with health effects.

Recommendations from HGC Engineering Study for MOE

1) Outdoor A-weighted sound levels should continue to be used to evaluate compliance, with penalties for audibly distinctive mechanical tones which often occur within the low frequency range.

2) Continue to monitor developments and regulatory policies in other jurisdictions with respect to low frequency sound and infrasound; need to leave flexibility in any protocols to allow for future developments.

3) Consider adopting or developing a protocol to provide guidance for addressing complaints related to low frequency sound which often arise from the characteristics of the sound impact indoors.

4) Routine measurement of infrasound not clearly warranted; but consider endorsing measurement procedures utilized by other international bodies that could be used to quantify infrasonic sound levels in specific situations.

Infrasound Monitoring

Measurement

- NASA Langley Research Centre bringing a compact in-ground infrasound measurement system to market.
- Paper at upcoming LFN Conference – Stratford-Upon-Avon

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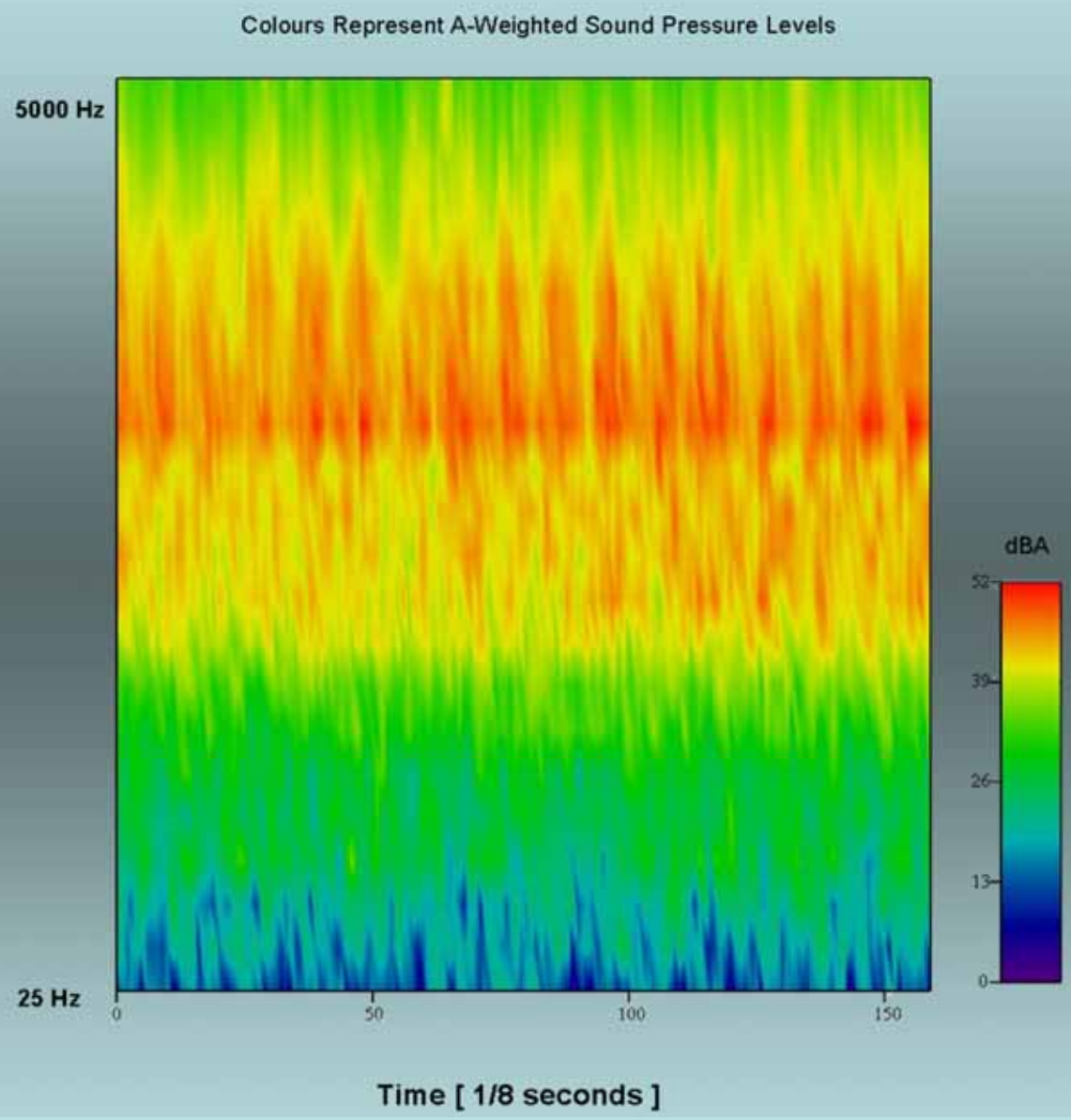
Annoyance

- Relationship between level and annoyance is a complex one. Response of individuals varies and is impacted by attitude towards source.
- Audible wind turbine noise (not specific to low frequencies) may be more annoying than other noises at similar sound level exposures.
  - Exposure to 45 dBA road traffic noise: Approx 5% annoyed, 2% highly.
  - Exposure to 45 dBA wind turbine noise: Approx 20% annoyed, 8% highly.
- Other studies suggest that up to 20% ‘very annoyed’ at 40 to 45 dBA
- Audible low frequency sound may be particularly prone to causing annoyance. Tonal sound also associated with annoyance.
- Infrasonic sound (not specific to wind turbines): when present at audible levels, infrasound tends to cause annoyance.

Learned Obtrusiveness - Training the Ear

- Wind turbine noise is fairly broadband, and often unremarkable at first exposure: “I drove up to one and I could barely hear it”.
- Once attuned to the sound, discernment becomes easy and automatic. Wind Farm noise impact can be objectionable when sound level impact is below ambient (and within MOE guidelines).
- Those most annoyed, hear it best.

Characteristics of Sound Levels Near Wind Turbine Generator



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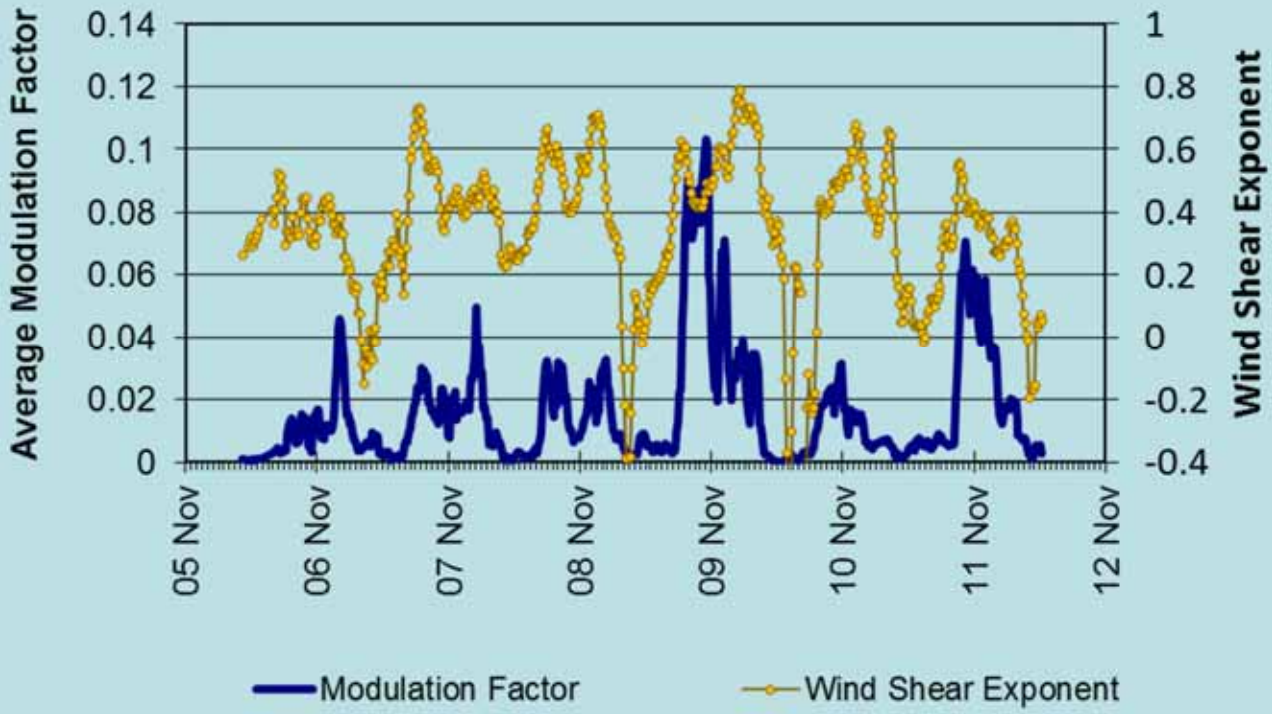
Calculated average modulation factor at 450 metres vs. wind shear exponent (with averaging).

Correlation, but imperfect. (McCabe, Rome, 2011)



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Sound Level Impact Assessment

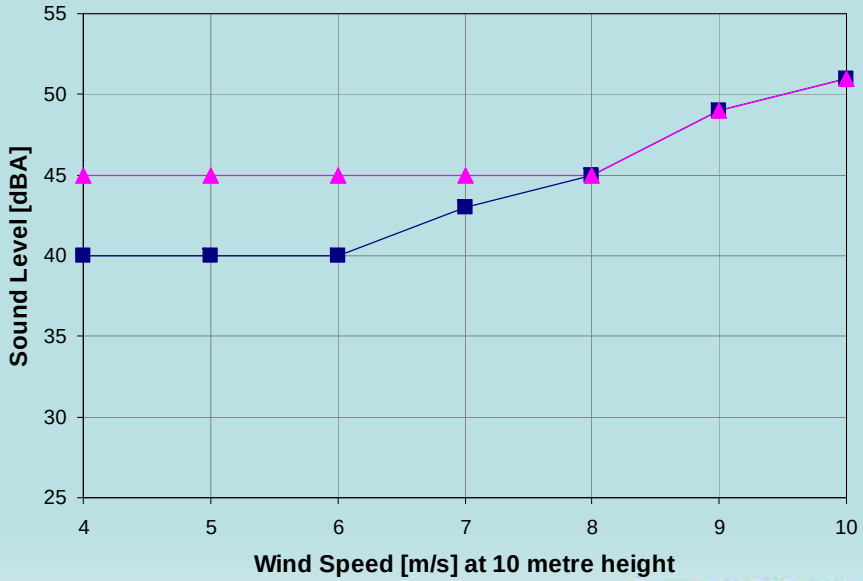
2004: First Noise Assessment Guide for Wind Projects

- Ministry guidelines generally based on minimum background sound levels. Inaudibility is not a criterion.

- Recognizing that wind turbines tend to emit more sound at greater wind speeds, a guideline specific to wind turbines was first published in 2004.

- ISO 9613 *Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation*

- IEC 61400-11 *Wind turbine generator systems - Part 11: Acoustic noise measurement techniques*



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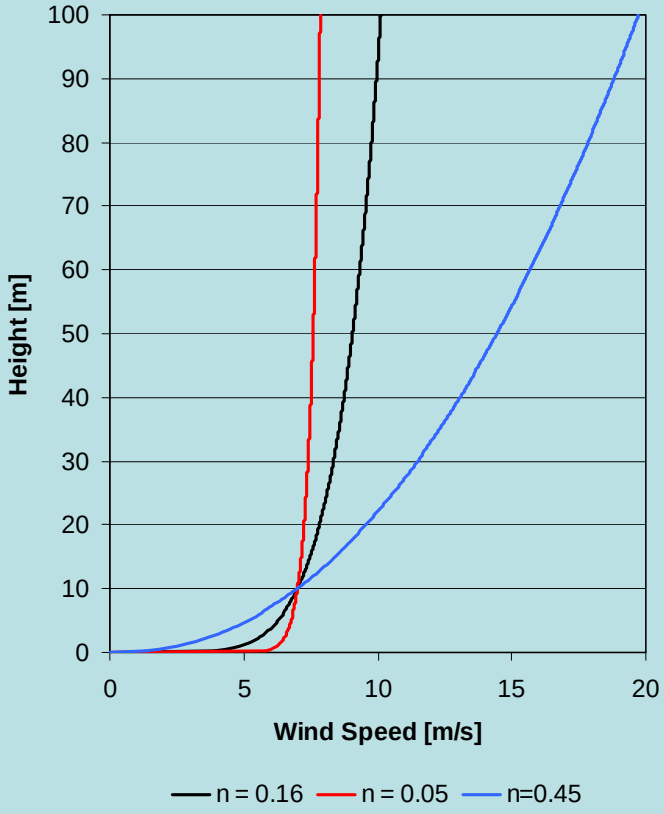
Sound Level Impact Assessment

Issues

- 2004 guideline did not specifically address wind shear, and other factors, resulting in large variation between assessors.

- Net result was variation in the typical minimum setbacks between assessors.

- Non-conservative assumptions, maximizing the wind resource, could lead to unacceptably small setbacks and complaints.



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Sound Level Impact Assessment

2008: Revised Noise Assessment Guide for Wind Projects

- Specific requirement to consider “average summer nighttime wind speed profile” at the site.

- Specified various assumptions affecting the ISO 9613 noise propagation model, such as ground absorption factors and factors affecting atmospheric absorption.

- Discussion of penalties to the sound level for such factors as tonal sound if present, but no penalties for amplitude modulation “swoosh”.

- Cumulative effect of all nearby wind plants and related transformers to be considered.

- Did not stipulate minimum setbacks.

Sound Level Impact Assessment

2009: Renewable Energy Approvals

- Previously, acoustic assessments often resulted in minimum setbacks in the 550 to 600 metre range. Range under the new guide:

Number of Wind Turbines	Setback in metres (m) from closest Point of Reception corresponding to wind turbine Sound Power Levels in decibels (dBA)				
	102 dBA	**103 - 104 dBA**	**105 dBA**	**106 - 107 dBA**	**> 107 dBA**
1 - 5 turbines	550 m	600 m	850 m	950 m	Noise study required
6 - 10 turbines	650 m	700 m	1000 m	1200 m	
11 - 25 turbines	750 m	850 m	1250 m	1500 m	
26+ turbines	Noise study required				

Sound Level Impact Assessment

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However: “option to complete a site-specific noise study consistent with the Ministry of Environment’s [2008 guideline]…and the noise level limit of 40 dBA… Under no circumstances can a site-specific study result in a setback lower than the minimum 550 metres.”

Increased Scrutiny

- Vacant lots – new homes
- Neighboring wind projects - gamesmanship
- Manufacturer’s sound power data
- REA and FIT requirements

– open houses, public, municipal and aboriginal ownership

Acoustic Audits

- Status is uncertain – not posted to EBR but included in newer REA's as a condition along with IEC sound power testing
- Compliance Protocol developed by Aercoustics for MOE
- Statistical assessment – off/on as a function of wind speed
- Still to be tested in public forum – some instants could have extended periods over criteria, but statistically OK
- Poses risk for developers

Thanks

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