

Notes on the Cameron Hall Memorandum

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Introduction

On August 15, 2011 Wind Concerns Ontario (WCO) posted an internal memo written by a senior environmental officer from Ontario's Ministry of the Environment (MOE) in April of 2010. This memo came to light only as a result of an FOIA request by WCO. The memo contained Hall's comments about the proposed setback/noise regulations of wind turbines. The industry-friendly government was proposing a series of limitations that Hall regarded so lenient that public adverse reactions would result. In a remarkably prescient 5-page memo he reviewed the problems with the proposed regulations and offered some suggestions for improvements. In spite of his findings the government went ahead with their proposed regulations which have in fact caused a significant number of problems among the wind project neighbors.

The importance of the memo is that the MOE leadership cannot continue to say they didn't know of the consequences of adopting their original regulations. The government made a conscious decision to disregard the well-being of the neighbors in an effort to allow the wind industry to install and operate their projects in more densely-populated (and more profitable) areas.

A full appreciation of the memo requires some background. These notes are my effort to provide that background and to give the readers a sense of the issues Hall covers. In summary the ideas Hall presents are remarkably similar to many of the ideas expressed by myself and a number of other more authoritative voices. In the same manner that the Ontario government has ignored our voices, it now appears that they also ignored their own internal voices.

References/Links

In case any reader wants to look more closely at the references Hall mentions I have provided links and backup copies below, plus some immediate media reaction.

1) Original Hall memo, as posted by WCO:

http://windconcernsontario.files.wordpress.com/2011/08/foi_pgs_45-501-c_hall-5page1.pdf

backup link: <http://windfarmrealities.org/wfr-docs/moe-hall-memo-100409.pdf>

2) WCO posting on the Hall memo

<http://windconcernsontario.wordpress.com/2011/08/15/mcguinty-liberal-ministers-hide-wind-turbine-truth/>

3) Ottawa Citizen Article

<http://www.ottawacitizen.com/technology/Wind+turbines+noisy+internal+Ontario+government+memo+says/5258338/story.html>

backup link: <http://windfarmrealities.org/wfr-docs/butler-ottawa-citizen-110815.pdf>

4) Podcast of WCO's Laforet on Zoomer Radio

<http://zoomerradio.ca/dale-goldhawk/2011/08/15/john-laforet/>

- 5) Technical Bulletin Number 6 (what Hall was reviewing)
http://www.downloads.ene.gov.on.ca/envision/env_reg/er/documents/2010/Bulletin6.pdf
backup link: <http://windfarmrealities.org/wfr-docs/moe-tech-bulletin-6.pdf>
- 6) Ontario Regulation 359/09 (The “Green Energy Act”)
http://www.e-laws.gov.on.ca/html/source/regs/english/2009/elaws_src_regs_r09359_e.htm
backup link: <http://windfarmrealities.org/wfr-docs/ontario-reg-359-09.pdf>
- 7) 2009 Ministry Setback Development Publication
http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_080767.pdf
backup link: <http://windfarmrealities.org/wfr-docs/moe-devel-setback-wind-farms.pdf>
- 8) Acoustic Consulting Report (Ramakrishnan, 2007)
http://www.downloads.ene.gov.on.ca/envision/env_reg/er/documents/2008/Noise%20Report.pdf
backup link: http://windfarmrealities.org/wfr-docs/ramakrishnan_report.pdf
- 9) NPC-104
http://www.oakville.ca/Media_Files/General/npc104.pdf
backup link: <http://windfarmrealities.org/wfr-docs/npc104.pdf>
- 10) 2008 NPC Guidelines Interpretation
http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079435.pdf
backup link: http://windfarmrealities.org/wfr-docs/moe_interpretation_oct_08.pdf
- 11) Reference 30, from Ramakrishnan, which is the Hayes Low Freq Study on 3 Wind Farms
<http://webarchive.nationalarchives.gov.uk/+http://www.berr.gov.uk/files/file31270.pdf>
backup link: <http://windfarmrealities.org/wfr-docs/hayes-measurement-low-freq-3-farms.pdf>

Hall mentions the EAAB. The Environmental Assessment and Approvals Branch is responsible for reviewing applications for approval of facilities under the Environmental Protection Act (EPA), the Ontario Water Resources Act (OWRA) and related environmental legislation. At WCO, they made it into a previous posting which, like the Hall memo posting, was precipitated by an internal MOE memo:

<http://windconcernsontario.wordpress.com/2011/06/15/leaked-memo-eaab-has-knowingly-issued-unenforceable-certificate-of-approvals/>

Links to materials that I reference in my comments.

1) Harrison’s Submission:

<http://windfarmrealities.org/wfr-docs/harrison-ebp-jul-2009.pdf>

2) Robert Rand’s Independent Assessment of Sound Quality

<http://randacoustics.com/wind-turbine-sound/wind-turbines-published-articles/wind-turbine-noise-an-independent-assessment-of-sound-quality/>

3) Rand, High Annoyance Siting Chart

<http://randacoustics.com/wind-turbine-sound/wind-turbines-high-annoyance-siting-chart/>

4) My This Was All Predictable posting

<http://windfarmrealities.org/?p=927>

The Gory Details

The memo is a very readable 5 pages long, with Hall's ideas clearly presented. I counted 10 different "sections" to the memo, as follows:

- 1) A brief introduction,
- 2) Uncertainty,
- 3) Tonality,
- 4) Amplitude modulation,
- 5) Regulatory effects of above,
- 6) Directional,
- 7) Test layout,
- 8) Masking,
- 9) Ambient noise
- 10) Conclusion

At the risk of being tedious, I'll go through each one and relate it to other sources so the reader can see just how closely Hall's conclusions agree with many disinterested professionals. In the following sections the entire body of the Hall memo will be divided into the above "sections" and be in **bold type**.

1) Introduction

I have reviewed the subject document per your request and offer the following comments. The Technical Bulletin is essentially an interpretation of the requirements already spelled out in the Renewable Energy Approvals Regulation, Ontario Regulation 359/09. As such, any comments about the Technical Bulletin must ultimately be comments about the Renewable Energy Approvals Regulation, Ontario Regulation 359/09.

Links to the Technical Bulletin and Regulation 359/09 are above. The regulation was in force at the time the memo was written, but many of the details, like setbacks, were left to the regulators. At this point those details were mostly in draft form, like the Technical Bulletin.

2) Uncertainty

The setbacks were reportedly determined in accordance with the Ministry of Environment's 2009 Publication "Development of Noise Setbacks for Wind Farms" ("2009 Ministry Setback Development Publication"). The setbacks were determined using a computer model which reportedly has an output error of +/- 3 dB. The computer model uses sound level emissions data provided by the manufacturer of the wind turbines generators (WTGs). In the case of the Melancthon Ecopower Centre General Electric WTGs the sound level emissions are reported to have an error of +/- 2 dB. So in fact, the Ministry is using a computer program with an output error of +/- 3 dB, where the data input into the computer program may have a +/- 2 dB error. It is not clear if these errors are added, subtracting, multiplied or divided by each other. If the errors are simply added, then the potential error in the predicted sound level limit at the receptor is +/- 5 dB. In the Melancthon Ecopower Centre case, an approval was issued where the

predicted sound levels at most of the receptors was 40 dBA (rounded-off). If a 5 dB error is applied, then the predicted sound level at the receptor could actually be as low as 35 dBA or as high as 45 dBA. Given the errors involved in the computer modelling it appears reasonable to suggest that a conservative approach might be to only establish setbacks and approve locating WTGs where the predicted sound levels at the receptors are 35 to 37 dBA.

A link to the Development of Noise Setbacks is above. Hall mentions that there are uncertainties in both the noise produced by a wind turbine and in calculating the noise level at a receptor, and his numbers agree with Harrison's Submission. Unfortunately, so far the Province has accepted noise studies that place non-participating receptors (aka innocent homeowners and their families) right at the 40dB limit, when the uncertainty could result in their being exposed to as much as 5dB above the limit.

3) Tonality

The setback distances were determined on the assumption that the sound discharged from WTGs does not have a special quality of sound. In other words it is assumed the sound contamination discharged into the natural environment from WTGs does not have a tonal quality or a cyclic variation quality. The assumption that the sound contamination discharged from WTGs does not have a tonal characteristic or a cyclic variation characteristic is not supported by our field observations. Furthermore, the assumption that the sound contamination discharged from WTGs does not have a cyclic variation characteristic is not supported in the report, Acoustic Consulting Report prepared for the Ministry of the Environment Wind Turbine Facilities Noise Issues, by Ramani Ramakrishnan, December 28, 2007 (the "Ministry 2007 Acoustic Consulting Report").

The Ministry's Publication Noise Pollution Control 104 states, "(1) Tonality If a sound has a pronounced audible tonal quality such as a whine, screech, buzz or hum then the observed value shall be increased by 5"; "If a sound has an audible cyclic variation in sound level such as beating or other amplitude modulation then the observed value shall be increased by 5"; and, "(4) One Adjustment Only An adjustment may be made under one only of subsections (1), (2) and (3), provided that, if subsection (3) applies, it shall be used in preference to subsection (1) or (2)."

Our field observations at the Melancthon Ecopower Centre and those reported by HGC on behalf of Canadian Hydro Developers, Inc. conclude some of the WTGs at the Melancthon Ecopower Centre have an audible tonal characteristic. This tonal characteristic does not appear to be properly identified as a result of the manufacturer's testing done in accordance with the testing procedures deemed acceptable in the 2008 NPC Guidelines Interpretation and consequently the Technical Bulletin. It appears reasonable to suggest that a 5 dB penalty for tonal quality of the sound discharged into the natural environment from the WTGs may be required. I also noted tonal characteristics when making observations of the sound contamination discharged into the natural environment from the Vesta manufactured WTGs at Clear Creek.

The noise regulations of most jurisdictions include penalties for certain types of noise. In Ontario, which is typical, there are penalties if the noise has either a tone to it (it is not strictly a broadband noise) or if it varies. Unfortunately, Ontario has exempted uniquely the wind industry from both of these penalties, accepting the wind industry contention that wind turbines don't produce tones or varying levels of noise. In a critical admission, Hall reports that field observations DO NOT SUPPORT this exemption. The above paragraphs talk mostly about the tonality issue. Hall's field observations are backed up by Rand's Independent Assessment.

4) Amplitude Modulation

Most of the complainants who have contacted the Ministry about sound contamination from the Melancthon Ecopower Centre WTGs identify the characteristic "blade swoosh" or "swishing" sound contamination discharged into the natural environment from the WTGs as a quality of the WTG sound contamination which they find offensive. Provincial Officers have confirmed the "blade swoosh" quality of the sound contamination discharged into the natural environment from the WTGs throughout the Melancthon Ecopower Centre wind plant.

The Ministry 2007 Acoustic Consulting Report discusses the sound contamination characteristics of WTGs and includes discussing "the swishing (thumping) sound normally termed as the amplitude modulation phenomenon". The Ministry 2007 Acoustic Consulting Report includes the following:

"Due to the nature of the amplitude modulation phenomenon, the swishing or thumping exists all the time.";

"Reference 30 has addressed the issues connected with modulation. One of its principle findings is and we quote, "the common cause of complaint was not associated with low frequency noise, but the occasional audible modulation of aerodynamic noise, especially at night."; and,

"Finally, Reference 30 discussed the many possible mechanisms that can cause the amplitude modulation as well as provided measurement results to show that modulation can produce changes in noise levels of the order of 10 dB."

It should be noted that the more recent 2008 NPC Guidelines Interpretation differs from the 2004 NPC Guidelines Interpretation by stating no adjustment should apply to the cyclic variation quality "swishing sound" of the noise contamination discharged from the WTGs. The 2008 NPC Guidelines Interpretation suggests the blade swish noise is temporal. This conclusion is not supported by our field observations, or the findings in the Ministry 2007 Acoustic Consulting Report.

It appears it is reasonable to suggest the setback calculations should have included a 5dB addition to the sound level emissions from the WTGs to account for the amplitude modulation or blade swooshing sound of the WTGs. A 5 dB addition would address the Ministry observations and the Ministry 2007 Acoustic Consulting Report finding that the

sound contamination from WTGs has a blade swoosh or amplitude modulation characteristic. A 5 dB addition for this cyclic variation of the quality of the sound discharged into the natural environment from WTGS would also be consistent with the Ministry's Publication Noise Pollution Control 104.

As with tonality, Hall reports that complaints as well as field observations have confirmed that amplitude modulation (often referred to as “thumping” or “whooshing”) does in fact exist and should be penalized. Rand’s Assessment presents measurements that confirm this, and Harrison’s Submission goes into more details why the variations exist. Hall seemed to rely a great deal on the Ramakrishnan Acoustic Consulting Report, a link to which can be found above, including a link to Ramakrishnan’s “reference 30”, which is a Hayes study in the UK, and which also has a link above. Both of these references are generally used to justify ignoring complaints from the neighbors and it is interesting that Hall found some contrary information in them.

5) Regulatory Effects

The Ministry's Publication Noise Pollution Control 104 only allows for one 5 dB adjustment. It appears reasonable to suggest that a conservative approach to calculating setback distances might have been to include a 5 dB adjustment to the predicted sound levels at the receptors to account for the tonal and cyclic variation of the qualities of the sound contamination discharged into the natural environment from WTGs.

If a 5 dB adjustment is added to the 3 to 5 dBA error in the computer modelling results, then the acceptable sound level at the receptor would be 30 to 32 dBA (40 dBA minus 10 or 8 dB). Observations by several Provincial Officers at the Melancthon Ecopower Wind Plant indicate sound levels at the receptors below 35 dBA and in the range of 30 to 32 dBA would not cause or be likely to cause adverse effects in the opinion of the Provincial Officers. As such, it appears reasonable to suggest the setback distances should be calculated using a sound level limit of 30 to 32 dBA at the receptor, instead of the 40 dBA sound level limit.

Even though wind turbines meet both of the conditions needed to trigger a 5dB penalty, current Ontario regulations only allow one penalty. Obviously, Hall thinks the penalty should be applied. If the penalty is added to the uncertainties mentioned earlier, then a more reasonable limit at a receptor would be 30 to 32dB, not 40dB. This lower limit happens to agree with many other studies, like Rand’s High Annoyance Siting Chart.

6) Directional

Observations at the Melancthon Ecopower Wind Plant and at Clear Creek in Hamilton District indicate the sound contamination discharged into the natural environment from WTGs is directional. This directional nature of the sound contamination from WTGs is also reported in the scientific literature. EAAB was advised about our observations that the sound contamination was directional, but has not replied. It is not clear if the

directional nature of the sound contamination discharged into the natural environment from WTGs has been considered in the development of the setbacks.

The directional nature of the noise from wind turbines has been well documented, and was confirmed by field observations by MOE personnel. The Province, when setting up the setbacks, seems to have done simplistic non-directional modeling as noted in the Setback Development Publication, which says they calculated the distances with a spreadsheet (not even a computer model!). Depending on the wind conditions, this translates to some receptors getting more noise than modeled. Notice that the EAAB didn't even bother answering Hall, just as they've never answered anybody.

7) Test Layout

The setbacks were established using computer modelling where the receptor location was located to one side of an array of WTGs where the WTGs were located in a grid pattern with 400 metre separation between the WTGs. As such, only one WTG would be the stated setback distance away from the receptor in the model used to develop the setbacks. All other WTGs would be located a distance greater than the setback distance from the receptor. For example, the calculation for the 600 metre setback, for five 104 dBA WTGs in the 2009 Ministry Setback Development Publication shows the first WTG located 605 metres from the receptor, the second and third WTGs located 725 metres from the receptor, and the fourth and fifth WTGs located 1003 metres from the receptor. The total calculated sound level at the receptor for these 5 WTGs is shown as 39.6 dBA.

The approach used to establish the setbacks failed to account for locating multiple WTGs the same setback distance from the receptor (the receptor could be located within the wind plant and not off to the side of the wind plant). If a receptor is located within a wind plant and five 104 dBA WTGs are each located 605 metres from the receptor, then the resultant sound level at the receptor is 42 dBA.

It appears reasonable to suggest a conservative approach might be to calculate the setback distances where the receptor is located within the wind plant and not off to the side of the wind plant.

When the setbacks were established the Province set up a grid of turbines representing the project and the receptor was off to one side. In the real world, quite often the receptor is inside the project, with turbines on all sides. As far as their calculations go this issue is probably not very important, as the Provincial grid had the turbines 400 metres apart, when in reality they are usually further apart than that. A bigger problem for any receptor surrounded by turbines is that now they get directionally-stronger noise when the wind is blowing from a larger range of directions, plus the thumping caused by turbulence (and not considered at all by the Province) is now more prevalent.

8) Masking

The setbacks and modelling continue to use wind speeds at 10 metres above the ground level to establish sound levels at ground level receptors. Our field observations at the Melancthon Ecopower Centre wind plant suggest there are many occasions where there is little or no ground level wind at the receptor and yet the nearby WTGs are producing electricity and discharging sound contamination at unacceptable levels. The use of wind speeds at 10 metres above the ground level appears to not address ground level wind speeds which may be significantly less than 10 metre wind speeds, and which therefore may not result in the assumed increase in background noise at the receptor. It appears reasonable to suggest that consideration should be given to modifying the approach of increasing acceptable sound level limits at the receptors with increasing wind speed at 10 metres above the ground level. This may require increasing the setback distances to ensure sound levels at the receptors do not exceed the applicable sound level limits.

Ontario is the last jurisdiction in the world to allow higher levels of wind turbine noise at receptors in higher wind conditions, on the theory that the wind itself generates enough noise to mask the noise of the turbines. The problem is that the wind can be blowing hard at hub height, causing the turbine to generate lots of noise, while not blowing very hard at ground level, causing no masking noise. Van den Berg was the first to document this and a major part of Ramakrishnan's report was devoted to undermining Van den Berg. Anyone who has listened to the sound of the wind blowing and the noise from turbines knows one does not mask the other, and Hall's field observations concur.

9) Ambient Noise

The sound level limits used to establish the setbacks fail to recognize the potential quietness of some rural areas. As a consequence, meeting the minimum sound level limits may still result in significant sound contamination levels intruding into the rural environment.

The Ministry 2007 Acoustic Consulting Report referred to a study which produced an "annoyance table". The annoyance table reportedly provides an estimated community response to the actual wind turbine generator sound levels measured at a receptor compared to the background sound level. The referenced study was reportedly conducted in the early 1980s using old type wind turbine generators; and the Ministry 2007 Acoustic Consulting Report suggests a more modern study is required to assess the threshold for modern wind turbine generators. Notwithstanding these limitations, the annoyance table suggests a 10 dB increase in sound level above background would result in estimated "widespread complaints"; a 15 dB increase in sound level above background would result in estimated threats of "community action"; and a 20 dB increase in sound level above background would result in estimated "vigorous community action".

Sound measurements undertaken by HGC and the Ministry within the Melancthon Ecopower Centre wind plant during periods when there was little or no ground level wind and when the nearby WTGs were not operating have found background sound levels to be equal to or less than L90 equal to 20 dBA and Leg equal to 23 dBA. The 2008 NPC Guidelines Interpretation approved maximum sound level limits for the sound

contamination discharged into the natural environment from WTGs is 40 dBA with 10 metre height wind speeds less than 6 m/s, rising to 51 dBA with 10 metre height winds speeds of 10 m/s or greater. The 2008 NPC Guidelines Interpretation approved sound limits, without adjustment for tonal or cyclic variation qualities of the sound contamination, would allow the sound contamination discharged into the natural environment from WTGs to exceed the background sound level by 17 to 28 dBA. According to the report referenced in the Ministry 2007 Acoustic Consulting Report, the estimated community response would be "threats of community action" to "vigorous community action" where the sound contamination from wind turbine generators intrudes 15 to 20 dB above background levels.

Developing the setbacks in accordance with the 2009 Ministry Setback Development Publication 2009 might have including considering the details provided in the Ministry 2007 Acoustic Consulting Report with respect to allowing the intrusion of sound levels greater than 7 to 10 dB above background. An intrusion of 7 to 10 dBA above background in our case would result in sound level limits at the receptors in the range of 30 to 33 dBA. As noted earlier, observations by several Provincial Officers indicate sound levels at the receptor in the range of 30 to 32 dBA would not cause or be likely to cause adverse effects in the opinion of the Provincial Officers.

My “This Was All Predictable” posting covers this same ground, as does the Robert Rand material. When the penalties, masking allowances, uncertainties and directional attributes are all accounted for it was entirely predictable that the neighbors would react strongly – as in lawsuits and pitchforks.

Conclusion

Given all of the above, the following statement in the Technical Bulletin on page 6 should likely be amended: "While the minimum setback of 550 m must be met in all cases, proponents are given the option of conducting a noise study to prove that siting turbines closer than the setbacks in Table 1 will not cause an adverse effect." It appears compliance with the minimum setbacks and the noise study approach currently being used to approve the siting of WTGs will result or likely result in adverse effects contrary to subsection 14(1) of the EPA. As such the sentence might be changed to read as follows: "While the minimum setback of 550 m must be met in all cases, proponents are given the option of conducting a noise study to prove that siting turbines closer than the setbacks in Table 1 will not cause exceedances of the applicable sound level limits.

Here's where Hall really calls it when he says “It appears compliance with the minimum setbacks and the noise study approach currently being used to approve the siting of WTGs will result or likely result in adverse effects contrary to subsection 14(1) of the EPA.” For reference, that section reads, in part “a person shall not discharge a contaminant or cause or permit the discharge of a contaminant into the natural environment, if the discharge causes or may cause an adverse effect.” Unfortunately, his proposed rewriting of the offending sentence doesn't really fix the problem, as it simply replaces “will not cause an adverse effect” with “

will not cause exceedances of the applicable sound level limits.” Either way, the Province can game the rules to let their friends in the wind industry continue to install the turbines too close to residences, as they have continued to do in spite of all their lofty-sounding promises to protect the neighbors.

Other Links

Renewable Energy Approval Technical Guidance Bulletins overview page, including the link to Bulletin #6, which was the subject of Hall’s memo.

<http://www.ebr.gov.on.ca/ERS-WEB-External/displaynoticecontent.do?noticeId=MTA5MTE3&statusId=MTYzODk4>

The Ontario Environmental Protection Act, from which section 14(1) was taken.

http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90e19_e.htm

Here’s some additional links from my web site, all of which was conveyed to the Province along with Hall’s memo, none of which did any good.

A listing of all of John Harrison’s work, a large part of which was about noise

<http://windfarmrealities.org/?p=234>

A listing of all of Bill Palmer’s work, a large part of which was about noise

<http://windfarmrealities.org/?p=242>

My Noise category on windfarmrealities.org, where you can go to get more information.

<http://windfarmrealities.org/?cat=3>