From:	MA.DR SWINBANKS
To:	dwalters@mpower.org; mary.templeton@comcast.net; Baldwin, Julie (DELEG);
CC:	MPSCEDOCKETS; MA.DR SWINBANKS;
Subject:	Wind Energy Resource Zone Board Comments: NASA-Langley Wind-Turbine Noise Research
Date:	Tuesday, January 05, 2010 8:05:44 AM
Attachments:	

Michigan WERZB Board, Case No U-15899

Dear Chairman, Vice-Chair &
Secretary,

I had submitted a written letter to the MPSC on December 8th, 2009.

My Qualifications.

As an applied mathematician, I worked with Professor Sir James Lighthill, one of the foremost 20th century mathematicians and responsible for developing the primary theory of aerodynamic sound generation. I worked also with Professor Ffowcs-Williams, a leading expert on aero-engine noise, whose work is now routinely used in wind-turbine noise-prediction computer codes. I served on noise committees for Rolls-Royce Aero Engines, relating to propeller noise and blade-wake interactions. Subsequently, I was asked by the US Navy Chief Scientist to transfer my theoretical and practical research in naval underwater acoustics to the United States.

So I have a thorough professional background in ***theoretical and practical aerodynamic noise generation, acoustics, and low-frequency noise.***

NASA-Langley Wind-Turbine Research, 1980-1990

Following my letter to the MPSC, I returned to the UK over the Christmas break, which enabled me to access papers from conferences I had attended in the 1980's. Specifically, NASA-Langley, probably the foremost aeroacoustic research organization in the world, carried out and published extensive research on wind-turbine noise, starting with their first computer predictive codes in 1980, and continuing through 1990.

During this period, NASA & NASA sub-contractors identified almost all of the specific issues relating to wind-turbine noise, that now are being re-learned the hard way, by bitter experience.

Specific Issues

NASA calculated the sound levels generated by ideal turbine blades operating in clean airflow, and identified how inevitably, inflow conditions associated with atmospheric turbulence could result in unsteady blade loadings, thus increasing these sound levels. (1982, [1]). Moreover, they extended the work to consider the effect of a wind gradient, whereby the incident wind velocity varies with height across the face of the turbine, and showed that substantially higher noise levels can then be generated. (1989, [2]).

Finally, they measured in practice the low-frequency threshold of hearing under laboratory conditions, for persons subjected to impulsive wind-turbine noise, and showed this could be almost 20dB lower (i.e. more sensitive) than the conventionally accepted noise threshold for less obtrusive sounds (1982, [3]).

Confirmation & Consequences

These results have recently been re-confirmed by the work of den Berg (2004, [4]) who has shown that wind gradients can increase sound levels at night by up to 15dB, and Pedersen (2004, [5]), who has reported that wind-turbine noise is very much more annoying and intrusive than the criteria set by conventional dBA (e.g. EPA) considerations. He showed that annoyance rises rapidly for wind-turbine noise levels above 35dBA-38dBA.

These latter two references are included in the Michigan report "Michigan Land Use Guidelines for Siting Wind Energy Systems", October 2007 [6]. But although explicitly cited, there is nothing in the actual content of this report that even begins to reflect the extremely important information that these references describe. A casual reader would be misled into thinking that they have been taken into account, but there is no evidence that their content has been absorbed.

The purpose of this email is to make clear that a comprehensive understanding of wind-turbine noise and its effects was established by thorough NASA research, over 20 years ago. Contrary to suggestion, this is not new science. The combination of wind-gradient amplification by up to 15dB, and the lowered (more sensitive) threshold of hearing for wind-turbine noise, substantially exacerbates the adverse effects of wind-farms placed too close to habitations. In this respect, problems such as those from the wind-farm recently established at Ubly, are not unexpected. Reports from families living close to Ubly who have had their lives disrupted by wind-turbines are entirely consistent with this prior NASA knowledge and research.

I hope you will be able to take these comments into consideration. It would be disgraceful if no heed were paid to the world-leading research of NASA, and people of the Thumb of Michigan were to be driven from their homes by intolerable noise levels from wind-turbines.

Sincerely,

M.A.Swinbanks, M.A., PhD
7087 Kinde Rd, Port Hope,
MI

[1] Radiation of Aerodynamic Sound from Large Wind Turbine Generators F.W.Grosveld,K.P Shepherd*, & H.H.Hubbard Inter-Noise 82, 17-19 May 1982

[2] Low Frequency Acoustic Emissions from Large Horizontal Wind Turbines, H.H.Hubbard & K. P.Shepherd* Inter-Noise 89, 4-6 December 1989
[3] Acoustical Criteria Applicable to Large Wind Turbine Generators K.P.Shepherd* & D.G. Stevens Inter-Noise 82, 17-19 May 1982
[4] Effects of the Wind Profile at Night on Wind Turbine Sound. J.Sound & Vibration, G.P.Van den Berg Volume 277, Issue 4-5, p. 955-970, 2004
[5] Perception & Annoyance due to Wind Turbine Noise – a Dose-Response Relationship E. Pedersen & K.P.Waye J. Acoustical Society of America 2004 pp3460-70
[6] Michigan Land Use Guidelines for Siting Wind Energy Systems. M. Klepinger, Michigan State University Extension, Land Policy Institute. October 2007

* Now Head of Structural Acoustics Branch, NASA-Langley Research Center