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To

Federal Senate Committee for the Environment and Communications

Copy by separate email

Senator Madigan

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October 30, 2012

**Re: Renewable Energy (Electricity) Amendment (Excessive Noise from Wind Farms) Bill 2012**

Dear members of the Federal Senate Committee for the Environment and Communications

The purpose of this letter is to share the experiences regarding the serious risks to health that can occur when industrial wind turbines are sited in close proximity to residents.

As background, I have held senior executive positions at a teaching hospital, a professional organization and Health Canada (PMRA). I am a former Director of Publications and Editor in Chief of the *Compendium of Pharmaceuticals and Specialties (CPS)*, the book used by physicians, nurses, and health professionals for prescribing information in Canada.

I am the author or co-author of five peer reviewed and published references on the topic of adverse health effects from industrial wind turbines with more pending. In addition, I presented three papers at InterNoise 2012 New York City (co-author of a fourth) and was given the opportunity to present current findings to the Canadian *Standing Senate Committee on Energy, the Environment and Natural Resources, October 18, 2011*.

Contact with those experiencing adverse health effects which correlated with the onset of industrial wind turbine operations, inspired my research on this topic.

I volunteer my time and expenses, self support research and other activities such as education regarding the science related to wind turbine health effects. Some of my activities include meeting with physicians, health and other authorities, locally, provincially, and federally.

A colleague and I initiated a self reporting health survey in March 2009. WindVOiCe (Wind Vigilance for Ontario Communities) follows the principles for Health Canada's *Canada Vigilance Programs* for self reporting suspected adverse events for prescription and consumer products, vaccines and other. The result of this research is published in a special edition of a peer reviewed scientific journal <sup>1</sup> and is cited in the British Medical Journal <sup>2</sup> and Nissenbaum et al (2012). <sup>3</sup>

I have also researched societal impacts relating to this topic. This article has also been published in a peer reviewed journal. <sup>4</sup>

Based on several years of investigation:

"My research demonstrates that IWTs were initially welcomed into communities. The reported adverse impacts were unexpected..."

"In addition to physiological and psychological symptoms there are individuals reporting adverse impacts, including reduced well-being, degraded living conditions, and adverse societal and economic impacts. These adverse impacts culminate in expressions of a loss of fairness and social justice." <sup>5</sup>

Several months after the publication of my article, Shepherd et al (2011) noted:

"... wind turbines were initially welcomed by many communities due to their environmental credentials..."

"... residents living within 2 km of a turbine installation reporting lower overall quality of life, physical quality of life, and environmental quality of life. Those exposed to turbine noise also reported significantly lower sleep quality ..." <sup>6</sup>

Nissenbaum et al (2011) et al. states:

"Most respondents in the present study welcomed the IWT installations as offering economic benefits."

"We conclude that IWT noise at these two sites disrupts the sleep and adversely affects the health of those living nearby... setbacks of less than 1.5 km must be regarded as unsafe." <sup>7</sup>

Shepherd et al (2011), Nissenbaum et al (2011) and Krogh et al (2011), are cited in a March 2012 peer reviewed editorial published in the British Medical Journal. <sup>8</sup>

Quality of life and social well being are important health considerations. I have found the stressors occurring within the home and community environment as the result of a change

in the environment, i.e. industrial wind turbines, are contributing to adverse health effects. To date, there is no mitigation or resolution available to those suffering other than leaving the environs of the wind turbines.

Recently, Nissenbaum et al. (2012) published a cross-sectional study involving two rural sites concluding:

“... that the noise emissions of IWTs disturbed the sleep and caused daytime sleepiness and impaired mental health in residents living within 1.4 km of the two IWT installations studied. Industrial wind turbine noise is a further source of environmental noise, with the potential to harm human health. Current regulations seem to be insufficient to adequately protect the human population living close to IWTs. Our research suggests that adverse effects are observed at distances even beyond 1 km.”<sup>9</sup>

The Brown County Board of Health (Wisconsin) USA acknowledges that some individuals maybe unable to live in their homes:

“...formally requests temporary emergency financial relocation assistance from the State of Wisconsin for those Brown County families that are suffering adverse health effects and undue hardships caused by the irresponsible placement of industrial wind turbines around their homes and property. The State of Wisconsin emergency financial assistance is requested until the conditions that have caused these undue hardships are studied and resolved, allowing these families to once again return safely to their homes and property.”<sup>10</sup>

The Falmouth Board of Health (Massachusetts) USA (note: bold face emphasis is that of the Falmouth Board of Health):

“... requests that **Mass DPH immediately initiate a health assessment of the impacts of the operation of wind turbines in Falmouth.** This appeal is compelled by two years of consistent and persistent complaints of health impacts during turbine operation.”<sup>11</sup>

**“Due to the increasing intensity of the reported health impacts, the Board is considering emergency actions.** To determine the appropriateness of such actions, the Board requests immediate guidance on interim measures to protect the health of affected individuals while the complete health assessment is being conducted.

We look to your Department, as that which holds the highest duty to protect the health of the citizens of the Commonwealth, to assist us in this matter.”<sup>12</sup>

There is compelling evidence supporting the health risks associated with industrial wind turbines.

An Ontario, Canada Freedom of Information request is helpful:

“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...” [Ontario Ministry of Environment, memorandum, Ontario Senior Environmental Officer, April 9, 2010]

Note that Ontario’s Wind Turbine Guidelines have a minimum setback of 550 meters and a 40 dBA noise modeling (computer model) noise study. However, the approval of the wind facility allows up to 51 dBA with increased wind speeds.

In 2009 The American Wind Energy Association and Canadian Wind Energy Association funded experts to conduct a literature review which identifies a causal link (through annoyance) to the reported adverse health effects.

The authors of the industry convened report determined the documented “wind turbine syndrome” symptoms (sleep disturbance, headache, tinnitus, ear pressure, dizziness, vertigo, nausea, visual blurring, tachycardia, irritability, problems with concentration and memory, and panic episodes associated with sensations of internal pulsation or quivering when awake or asleep are symptoms) are not new and have been published previously in the context of “annoyance” and are the “well-known stress effects of exposure to noise”.<sup>13</sup>

The *Wind Turbine Sound and Health Effects – An Expert Panel Review – December 2009* states that: wind turbine sound/noise may cause annoyance [p. 5-3], stress [p. 4-3, 4-10] and sleep disturbance [p. 4-3], which may have other consequences [p. 4-3, 4-10].<sup>14</sup> Annoyance may seem of little consequence in everyday language; however, in clinical terms it has negative health consequences. The term annoyance is acknowledged as an adverse health effect.<sup>15, 16, 17, 18</sup>

Now that the experts funded by members of the wind industry have identified a causal link steps must be taken to ensure these negative health outcomes are avoided.

Three of the authors of this industry report testified at an Ontario Environmental Review Tribunal which was conducted under oath. Twenty-six expert witnesses from around the world testified (10 Appellants, 16 Respondents – Ministry of Environment and Suncor Inc developer). The evidence and testimony of this tribunal is further evidence that wind turbines can harm human health.

The Ontario Environmental Review Tribunal Decision, July 18, 2011 states:

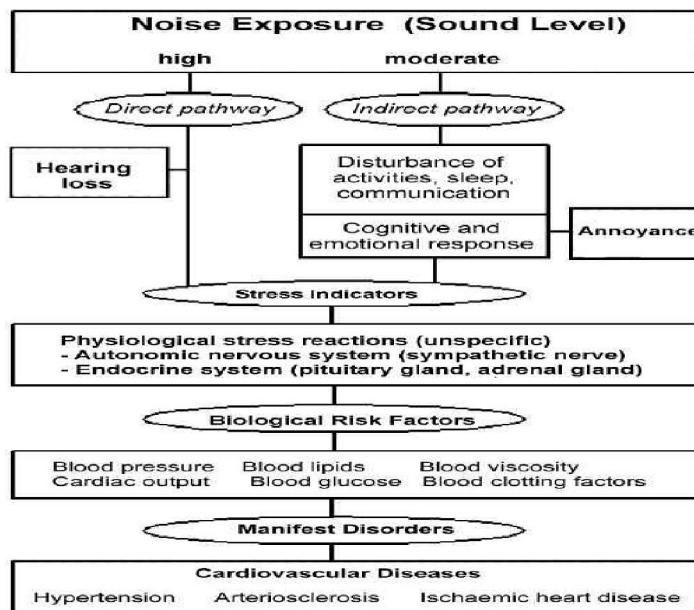
"This case has successfully shown that the debate should not be simplified to one about whether wind turbines can cause harm to humans. The evidence presented to the Tribunal demonstrates that they can, if facilities are placed too close to residents. The debate has now evolved to one of degree." <sup>19</sup>

The indirect pathway is often given a low priority regarding this topic. The Ontario Environmental Review Tribunal expressed concerns with respect to *The Potential Health Impact of Wind Turbines (Chief Medical Officer of Health (CMOH) Ontario Report) – May 2010*.

"...about the Director's apparent lack of consideration of indirect health effects and the need for further work on the MOE's practice of precaution..." <sup>20</sup>

To better understand the importance of the indirect pathway, please note the World Health Organization noise schema below. Symptoms being reported are through the indirect pathway. Testimony under oath during the Environmental Review Tribunal acknowledged that the indirect pathway was not considered by the CMOH. <sup>21</sup>

Statements indicating there is no evidence of a "direct" causal link may be accurate but is also an incomplete assessment of the health risks. The indirect pathway of noise annoyance, sleep disturbance and stress leads to consequences (cardiac). When one focuses on a "direct" effect one omits consideration of an equally significant part of the health equation i.e. indirect effects.



Reference: World Health Organization, Night Noise Guidelines for Europe, 2009  
[http://www.euro.who.int/InformationSources/Publications/Catalogue/20090904\\_12](http://www.euro.who.int/InformationSources/Publications/Catalogue/20090904_12)

Some have referenced that World Health Organization Noise Guidelines (2009) recommend a 40 dB noise level for industrial wind turbines; however, this is an incorrect interpretation of these guidelines. The WHO guidelines are based on road, rail and air craft noise, not on industrial wind turbine noise. Peer reviewed studies consistently acknowledge wind turbine noise is perceived to be more annoying than transportation noise or industrial noise at comparable sound pressure levels.<sup>22</sup> Therefore the premise of 40 dB applying to wind turbines is not supported - research<sup>23</sup> and Ontario Ministry of Environment field officer<sup>24</sup> propose 30 to 32 dB.

A December 2010 report commissioned by the Ontario Ministry of Environment, submitted as evidence during the Environmental Review Tribunal and released December 2011 by the Ministry notes:

“The audible sound from wind turbines, at the levels experienced at typical receptor distances in Ontario, is nonetheless expected to result in a non-trivial percentage of persons being highly annoyed. As with sounds from many sources, research has shown that annoyance associated with sound from wind turbines can be expected to contribute to stress related health impacts in some persons.”<sup>25</sup>

This report also states

“Stress symptoms associated with noise annoyance, and in particular low frequency annoyance, include sleep interference, headaches, poor concentration, mood swings...”<sup>26</sup>

During 2011 and 2012, there has been significant progress in acknowledging the harm that can occur when industrial wind turbines are sited too close to residents.

For consideration, research indicates New Experts i.e. humans, “are objective measuring instruments...”<sup>27</sup>

Soundscaping, an acoustic discipline is scientifically established and is becoming standardized under ISO 12913 through the work of ISO TC43/SC1/WG54. Of interest is that the science of Soundscaping development stems from work initiated in the 1960s and subsequently published in 1977 by the Canadian researcher / musician / environmentalist / professor Raymond Murray Schafer from Simon Fraser University, British Columbia, Canada.<sup>28</sup>

Soundscaping combines physical and psycho- acoustical measurements with scientific

evaluation of perceptual responses to environmental noise.<sup>29</sup> An ISO working group proposes to define Soundscaping as “perception of the acoustic environment as perceived by people in that place, in context”.<sup>30</sup>

The concept of Soundscaping, has gained momentum.<sup>31, 32, 33, 34</sup> It is considered to be different from noise control engineering.<sup>35</sup> Soundscaping considers the people living in the environment as local experts,<sup>36</sup> an essential component of the evaluation,<sup>37</sup> and that perception of the soundscape “can provide comfort, tranquility, and needed information to the person concerned or may be a source of annoyance.”<sup>38</sup>

With respect to very low frequency noise which may not be audible, humans are being considered as “objective measuring instruments (New Experts), whose reports and descriptions must be taken seriously and quantified by technical measurements.”<sup>39</sup>

In a recent conference paper, presented to the Acoustical Society of America regarding very low frequency noise measurement, Bray (2012) states:

“A central tenet of the Soundscape concept is that humans immersed in sonic environments are objective measuring instruments (New Experts), whose reports and descriptions must be taken seriously and quantified by technical measurements.

The Soundscape concept centering on human responses, New Experts, is as important and applicable to responses to effects from sound as it is to responses to directly audible sound. In a wider sense, this is a new sound quality and psychoacoustic issue.”<sup>40</sup>

Bray (2012) elaborates:

“Soundscaping integrates two relationships of sound and people: that people are the ultimate analysts or data sources about their responses to sound because it is they who are immersed in it or make it, and that sounds (receptions by people) are always part of human contexts; panoramas involving other senses, the environments in which people live or work, and the people’s cognitive as well as sensory circumstances.

Sounds must be “taken out from under the microphone” where they have historically been studied in isolation, and put into the “big and anthropocentric sound field” – the soundscape.

At present a growing number of people are reporting sleep deprivation, unease and even illness which they most often ascribe to low frequency sound either near the hearing threshold or, more frequently, sub audible. Such reports are most frequent in rural or quiet suburban areas following the installation of large wind turbines, a

new sound source without historic acoustic reference. " 41

Ambrose et al (2012) state:

"The best acoustic analyzer for determining human response is the human listening. This research shows it is not appropriate to use unattended sound measurement instruments." 42

Krogh et al reports on human perception to noise:

"Reviewed literature, case reports, freedom of information documents and expert testimony are presented which support the conclusion sound that is perceived and considered "unwanted" can result in serious negative effects.

Perception can be defined as: "... awareness of one's environment through physical sensation...". Human perception of sound can result in a number of responses which can be positive (music), negative (noise) or neutral. Presence of sound does not necessarily signify the presence of noise. "Physically, there is no distinction between sound and noise. Sound is a sensory perception and the complex pattern of sound waves is labeled noise, music, speech etc. Noise is thus defined as unwanted sound." Sound meters can assess sound; however, humans assess "noise". Sound becomes a risk to human health when it is considered to be noise." 43

It is important that the voices of those at risk from, and / or adversely affected, by the siting of wind turbines in rural communities be heard.

The recent Australian initiatives and a published recommendation by the Society for Wind Vigilance regarding a minimum 2 km setback is a starting point. 44, 45, 46 Indications are that further distances may be required and it is anticipated that ongoing research will assist with clarifying guidelines which protect human health.

Social well-being is acknowledged to be a determinant of health: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (World Health Organization [WHO], 1948). Many jurisdictions, including the Canadian federal, provincial, and territorial governments and health officials have accepted WHO's definition of health (Health Canada, 2004, vol. 1, p. 1-1)." 47

To summarize, associations, symptoms and causation have been acknowledged through peer reviewed and published references, testimony under oath, and / or disclosure evidence and / or witness statements and through other references as briefly provided in this letter.



To conclude: "In all cases, noise should be reduced to the lowest level achievable in a particular situation. Where there is a reasonable possibility that public health will be damaged, action should be taken to protect public health without awaiting full scientific proof." <sup>48</sup>

Thank you for giving this matter your consideration.

Respectfully submitted,

Ms Carmen Krogh, BScPharm

Attachments have been uploaded as directed.

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<sup>1</sup> Krogh, CME, Gillis, L, Kouwen, N, and Aramini, J, (2011), WindVOiCe, a Self-Reporting Survey: Adverse Health Effects, Industrial Wind Turbines, and the Need for Vigilance Monitoring, Bulletin of Science Technology & Society 2011 31: 334, DOI: 10.1177/0270467611412551,

<http://bst.sagepub.com/content/31/4/334>

<sup>2</sup> Hanning C, Evans A, Wind turbine noise, British Medical Journal March 8, 2012 :BM J2012;344:e 1527

<sup>3</sup> Nissenbaum, Michael A., Aramini, Jeffery J., Hanning, Christopher D., Effects of industrial wind turbine noise on sleep and health Noise & Health, September-October 2012, Volume 14, p243,

[www.noiseandhealth.org](http://www.noiseandhealth.org)

<sup>4</sup> Krogh, CME, (2011), Industrial Wind Turbine Development and Loss of Social Justice? Bulletin of Science Technology & Society 2011 31: 321, DOI: 10.1177/0270467611412550,

<http://bst.sagepub.com/content/31/4/321>

<sup>5</sup> Krogh, CME, (2011), Industrial Wind Turbine Development and Loss of Social Justice? Bulletin of Science Technology & Society 2011 31: 321, DOI: 10.1177/0270467611412550,

<http://bst.sagepub.com/content/31/4/321>

<sup>6</sup> Evaluating the impact of wind turbine noise on health-related quality of life by Daniel Shepherd, David McBride, David Welch, Kim N. Dirks, Erin M. Hill. Noise & Health, September-October 2011, 13:54,333-9

<sup>7</sup> Nissenbaum M, Aramini J, Hanning C. Adverse health effects of industrial wind turbines: a preliminary report. Proceedings of 10th International Congress on Noise as a Public Health Problem (ICBEN), 2011, London, UK. Curran Associates, 2011.

<sup>8</sup> Hanning C, Evans A, Wind turbine noise, British Medical Journal March 8, 2012 :BM J2012;344:e 1527

<sup>9</sup> Nissenbaum, Michael A., Aramini, Jeffery J., Hanning, Christopher D., Effects of industrial wind turbine noise on sleep and health Noise & Health, September-October 2012, Volume 14, p243,

[www.noiseandhealth.org](http://www.noiseandhealth.org)

<sup>10</sup> Brown County Board of Health Resolution Requesting Emergency State Aid for Families Suffering Around Industrial Wind Turbines, January 18, 2012, Green Bay, Wisconsin, USA

<sup>11</sup> Falmouth Board of Health, Correspondence June 11, 2012, Falmouth, Massachusetts USA, Massachusetts Department of Public Health (MASS DPH)

<sup>12</sup> Falmouth Board of Health, Correspondence June 11, 2012, Falmouth, Massachusetts USA, Massachusetts Department of Public Health (MASS DPH)

<sup>13</sup> Colby, W. D., Dobie, R., Leventhall, G., Lipscomb, D. M., McCunney, R. J., Seilo, M. T., & Søndergaard, B. (2009). Wind turbine sound and health effects: An expert panel review 2009. Prepared for American Wind Energy Association and Canadian Wind Energy Association.

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[http://www.canwea.ca/pdf/talkwind/Wind\\_Turbine\\_Sound\\_and\\_Health\\_Effects.pdf](http://www.canwea.ca/pdf/talkwind/Wind_Turbine_Sound_and_Health_Effects.pdf)

<sup>14</sup> Colby, W. D., Dobie, R., Leventhall, G., Lipscomb, D. M., McCunney, R. J., Seilo, M. T., & Søndergaard, B. (2009). Wind turbine sound and health effects: An expert panel review 2009. Prepared for American Wind Energy Association and Canadian Wind Energy Association.

[http://www.canwea.ca/pdf/talkwind/Wind\\_Turbine\\_Sound\\_and\\_Health\\_Effects.pdf](http://www.canwea.ca/pdf/talkwind/Wind_Turbine_Sound_and_Health_Effects.pdf)

<sup>15</sup> Health Canada. (2005). Community noise annoyance. Retrieved from <http://www.hc-sc.gc.ca/hl-vs/iyh-ysv/life-vie/community-urbain-eng.php#he>

<sup>16</sup> Michaud, D. S., Keith, S. E., & McMurchy, D. (2005). Noise annoyance in Canada. *Noise Health*, 7, 39-47

<sup>17</sup> Maschke, C., & Niemann, A. (2007). Health effects of annoyance induced by neighbour noise. *Noise Control Engineering Journal*, 55, 348-356

<sup>18</sup> Suter, A. H. (1991). Noise and its effects. Administrative Conference of the United States. Retrieved from <http://www.nonoise.org/library/suter/suter.htm>

<sup>19</sup> Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment Environmental Review Tribunal, Decision, p 207

<sup>20</sup> Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment Environmental Review Tribunal, Decision, p 206

<sup>21</sup> Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment Transcript of Dr. G. Rachamin, Mar, 4, 2011 [1] p. 211, [2] p. 216

<sup>22</sup> Pedersen, E., Bakker, R., Bouma, J., & van den Berg, F. (2009), Response to noise from modern wind farms in the Netherlands, *Journal of the Acoustical Society of America*, 126, 634-643

<sup>23</sup> Thorne, B. (2011), The Problems With "Noise Numbers" for Wind Farm Noise Assessment, *Bulletin of Science Technology & Society* 2011 31: 262, DOI: 10.1177/0270467611412557, <http://bst.sagepub.com/content/31/4/262>

<sup>24</sup> MOE memorandum, Ontario Senior Environmental Officer, April 9, 2010

<sup>25</sup> HGC (2010) Low frequency Noise and Infrasound Associated with Wind Turbine Generation Systems, A Literature Review, Ontario Ministry of Environment RFP December 2010

<sup>26</sup> HGC (2010) Low frequency Noise and Infrasound Associated with Wind Turbine Generation Systems, A Literature Review, Ontario Ministry of Environment RFP December 2010

<sup>27</sup> Bray Wade, Acoustical Society of America 164th Meeting, Kansas City, MO 22-26 October, 2012, 2aNS6, Relevance and applicability of the Soundscape concept to physiological or behavioural effects caused by noise at very low frequencies which may not be audible. [www.acoustics.org/press/164th/Bray\\_2aNS6.html](http://www.acoustics.org/press/164th/Bray_2aNS6.html)

<sup>28</sup> The World Soundscape Project (WSP), <http://www.sfu.ca/~truax/wsp.html>

<sup>29</sup> Schulte-Fortkamp, Brigitte, Vehicle exterior noise from the view point of new experts. *The Journal of the Acoustical Society of America*. 06/2008; 123(5):3134.

<sup>30</sup> Weber, Miriam, Quiet Urban Areas: repositioning local noise policy approaches – questioning visitors on soundscape and environmental quality. DCMR Environmental Protection Agency, the Netherlands

<sup>31</sup> Call for Papers on Soundscape in *Journal of the Acoustical Society of America (JASA) | The World Listening Project*. Cited 29/10/2012

<http://www.worldlisteningproject.org/cal-lfor-papers-on-soundscape-in-journal-of-the-acoustical-society-of-america-jasa/>

<sup>32</sup> Hot topics in soundscapes, COST action TD0804: "Soundscape of European Cities and Landscapes" workshop, Edinburgh UK, Novotel, 80 Lauriston Place, Thursday 29th – Friday 30th 2009, <http://www.cost.est.org>

<sup>33</sup> Soundscape. An environment of sound (or sonic environment) with emphasis on the way it is perceived and understood by the individual, or by a society. Truax, B. (1999). *Handbook for Acoustic Ecology* (2ndEd.). Cambridge Street Publishing

<sup>34</sup> Axelsson, Östen, Introducing soundscape, AESOP, 2012, 26<sup>th</sup> Annual Congress, July 11-15, Ankara, Turkey

<sup>35</sup> Brigitte Schulte-Fortkamp, Jian Kang, Soundscape research in networking across countries: COST Action, *The Journal of the Acoustical Society of America*. 03/2010; 127(3):1801.

<sup>36</sup> B. Schulte-Fortkamp, "The tuning of noise pollution with respect of the expertise of people's mind", proceedings InterNoise, (2010) Lisbon Portugal, 13-13 June 2010

<sup>37</sup> Brigitte Schulte-Fortkamp, Bennett Brooks, Interventions through the soundscape approach. *The Journal of the Acoustical Society of America*. 10/2010; 128(4):2370.

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<sup>38</sup> Brigitte Schulte-Fortkamp, Bennett Brooks, Better soundscapes for all workshops on continuing development of soundscape techniques standardization: Workshop introduction. *The Journal of the Acoustical Society of America*. 11/2008; 124(4):2552.

<sup>39</sup> Bray Wade, Acoustical Society of America 164th Meeting, Kansas City, MO 22–26 October, 2012, 2aNS6, Relevance and applicability of the Soundscape concept to physiological or behavioural effects caused by noise at very low frequencies which may not be audible. [www.acoustics.org/press/164th/Bray\\_2aNS6.html](http://www.acoustics.org/press/164th/Bray_2aNS6.html)

<sup>40</sup> Bray Wade, Acoustical Society of America 164th Meeting, Kansas City, MO 22–26 October, 2012, 2aNS6, Relevance and applicability of the Soundscape concept to physiological or behavioural effects caused by noise at very low frequencies which may not be audible. [www.acoustics.org/press/164th/Bray\\_2aNS6.html](http://www.acoustics.org/press/164th/Bray_2aNS6.html)

<sup>41</sup> Bray Wade, Acoustical Society of America 164th Meeting, Kansas City, MO 22–26 October, 2012, 2aNS6, Relevance and applicability of the Soundscape concept to physiological or behavioural effects caused by noise at very low frequencies which may not be audible. [www.acoustics.org/press/164th/Bray\\_2aNS6.html](http://www.acoustics.org/press/164th/Bray_2aNS6.html)

<sup>42</sup> Ambrose Stephen E., Rand Robert W., Krogh Carmen M. E., Falmouth, Massachusetts wind turbine infrasound and low frequency noise measurements Invited paper presented at Inter-noise 2012 New York City, NY

<sup>43</sup> Krogh Carmen ME, Jeffery Roy D, Aramini Jeff, Horner Brett, Wind turbine noise perception, pathways and effects: a case study, InterNoise 2012, New York City, NY, August 19–23

<sup>44</sup> Amendment VC82, gazetted on 29 August 2011, Department of Planning and Community Development, Victoria Australia

<sup>45</sup> Draft NSW Planning Guidelines: Wind Farms, State of New South Wales through the Department of Planning & Infrastructure, December 2011

<sup>46</sup> A Global Guideline for the Minimum Siting Distance of Industrial Wind Turbines, the Society for Wind Vigilance, April 4, 2012 [www.windvigilance.com](http://www.windvigilance.com)

<sup>47</sup> World Health Organization. (1948). Preamble to the constitution of the World Health Organization as adopted by the International Health Conference, New York, 19–22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948. Cited Krogh, CME, (2011), Industrial Wind Turbine Development and Loss of Social Justice? *Bulletin of Science Technology & Society* 2011 31: 321, DOI: 10.1177/0270467611412550, <http://bst.sagepub.com/content/31/4/321>

<sup>48</sup> World Health Organization. (1999). Guidelines for community noise. Geneva; OMS, 1999, p 94. Ilus, Berglund, B., Lindvall, T., and Schwela, D. H.