

## **A Proposal**

**Health Standing Committee, Health Canada**

**Safety Code-6 and Industrial Wind energy Facilities**

**March 9, 2015**

**By Beth Harrington and Carmen Krogh**

### **Introduction:**

The Health Standing Committee is undertaking a comprehensive study on human exposure to electromagnetic energy:

“that the Committee undertake a comprehensive study of no fewer than two meetings, plus one to consider a draft report, to study the Health Canada Safety Code 6 on human exposure to electromagnetic energy, that it invite relevant witnesses to appear, and that the committee reports its findings to the House.

That the Committee hear witnesses concerning Safety Code 6 on Tuesday, March 24, and Thursday, April 2, 2015.”

### **Purpose:**

The purpose of this submission is to:

- § propose that industrial wind energy facilities be considered for inclusion in the Committee’s study of Health Canada’s Safety Code-6 on human exposure to electromagnetic energy;
- § provide a snapshot of evidence to assist the Committee in its deliberations; and
- § suggest a few witnesses that could contribute to the Committee’s study.

### **Background**

Globally, there is increasing interest and debate about risks associated with radio and electromagnetic energy including that of ELF (extremely low frequency) fields, power quality (dirty electricity) in buildings, high frequency ground current in the KHz range, and increased exposure occurring as a result of technology innovations.

Safety Code-6 (2009) notes that concerns have been raised regarding radiofrequency electromagnetic energy “produced by many man-made sources including cellular (mobile) phones and base stations, television and radio broadcasting facilities, radar, medical

equipment, microwave ovens, RF induction heaters as well as a diverse assortment of other electronic devices within our living and working environments.”<sup>1</sup>

The BioInitiative Working Group (2012) [BioInitiative 2012] published an extensive report on this topic and states it “documents bioeffects, adverse health effects and public health conclusions about impacts of non-ionizing radiation (electromagnetic fields including extremely-low frequency ELF-EMF and radiofrequency/microwave or RFEMF fields).”<sup>2</sup>

BioInitiative (2012)<sup>3</sup> notes with respect to this topic, that since its review of 2007:

“Roughly, 1800 new studies have been published in the last five years reporting effects at exposure levels ten to hundreds or thousands of times lower than allowed under safety limits in most countries of the world.”

“This Report is the product of an international research and public policy initiative to give an overview of what is known of biological effects that occur at low-intensity EMFs exposures (for both radiofrequency radiation RF and power-frequency ELF, and various forms of combined exposures that are now known to be bioactive). The Report examines the research and current standards and finds that these standards are far from adequate to protect public health.”

A variety of terminologies, definitions, and descriptors are used to characterize radiofrequency radiation and electromagnetic frequency waves.

BioInitiative (2012) report indicates:

“...two types of EMFs: (1) extremely low frequency electromagnetic fields (ELF) from electrical and electronic appliances and power lines and (2) radiofrequency radiation (RF) from wireless devices such as cell phones and cordless phones, cellular antennas and towers, and broadcast transmission towers.” and that in its report it will use the term EMFs when referring to all electromagnetic fields in general; and the terms ELF and RF when referring to the specific type of exposure.”

### **Industrial Wind Energy Facilities: electromagnetic energy and operations**

As indicated, concerns have been raised regarding radio frequency and electromagnetic energy “produced by many man-made sources.”<sup>4</sup>

As a result of the infrastructure and operational requirements associated with industrial wind energy facilities, these projects emit electromagnetic energy such as RF and ELF.

Examples of the infrastructure and operational support required for a wind energy facility include wires, electrical cables, communications network and messaging systems, digital or analogue interfaces, GIS interfaces, remote monitoring, databases and data transfer, transformer stations, smart meters and other mechanisms that utilize WiFi.

Rideout, Copes and Bos (2010) from the National Collaborating Centre for Environmental Health state:

“Electromagnetic fields (EMF) around wind farms can originate from the grid connection lines, wind turbine generators, electrical transformers, and underground network cables.\*The grid connection lines are similar to other power lines and generate low levels of EMF, comparable to those generated by household appliances. Turbine generators are located inside the turbine’s central housing, which is situated 60 to 100 m above ground, and results in little or no EMF at ground level.<sup>26</sup> Transformers generate EMF highest within the wind farm itself. The underground cables that connect the turbines effectively generate no EMF at the surface because of the close placement of phase conductors and screening of the cables.\* Thus, wind turbines are not considered a significant source of EMF exposure.”<sup>5</sup>

*\* Note that the original quote includes references*

At the time of its publication, Rideout, Copes and Bos (2010) indicates in a summary table:

**Table 1.** Summary of potential wind turbine hazards and mitigation options

Hazard	Possible Sources	Evidence	Mitigation
EMF	Generators Grid connection lines Transformers Underground cables	<ul style="list-style-type: none"> <li>• No community exposure from turbine EMF</li> <li>• No EMF generated at surface from underground cables</li> </ul>	• N/A

### *Electromagnetic interference (EMI)*

Electromagnetic interference (EMI) occurring from the operations of industrial wind turbines may be of interest to the Committee:

Authors from Siemens, a global leader in industrial wind turbine manufacturer indicates:

“**Abstract:** Electromagnetic interference (EMI) can both affect and be transmitted by mega-watt wind turbines. This paper provides a general overview on EMI with respect to mega-watt wind turbines.”<sup>6</sup>

Excerpts from the Siemens reference include:

#### **“1. Introduction**

Wind turbines (WT) cause electromagnetic interference (EMI) via three principal mechanisms, namely near field effects, diffraction and reflection/scattering [1-4]. Near field effects refer to the potential of a wind turbine to cause interference to radio signals due to electromagnetic fields emitted by the generator and switching

components in the turbine nacelle or hub. Diffraction occurs when an object modifies an advancing wavefront by obstructing the wave's path of travel. Diffraction effects can occur when the object not only reflects part of the signal, but also absorbs the signal. Reflection/scattering interference occurs when turbines either reflect or obstruct signals between a transmitter and a receiver. This occurs when the rotating blades of a turbine receive a primary transmitted signal and they act to produce and transmit a scattered signal. In this situation the receiver may pick up two signals simultaneously, with the scattered signal causing EMI because it is delayed in time (out of phase) or distorted compared to the primary signal."

#### **“Conclusions:**

“This paper presents a general overview on electromagnetic interference with respect to wind turbine related aspects. A wind turbine can act as both a transmitter and receiver of electromagnetic interference.”<sup>7</sup>

Potential impacts from EMI are posted on the RWE website. The website notes that “RWE AG is a German [electric utilities](#) company based in [Essen, North Rhine-Westphalia](#). Through its various subsidiaries, the energy company supplies electricity and gas to more than 20 million electricity customers and 10 million gas customers, principally in Europe. RWE is the second largest electricity producer in Germany.”<sup>8</sup>

#### **“7.4 Potential Impacts**

##### **EMI impacts**

7.4.1 Wind turbines may cause EMI to communication systems through three principal mechanisms:\*

- i) Near field effects: Near field effects refers to the potential of a wind turbine to cause interference to radio signals due to electromagnetic fields (EMF) emitted by the generator and switching components in the turbine hub and by electrical cables;
- ii) Diffraction: Diffraction occurs when an object (such as a wind turbine) modifies an advancing electromagnetic wave by obstructing the wave path of travel. Diffraction effects can occur when the object not only reflects part of the signal, but also absorbs part of the signal – with the path of travel or the part of the wave which is not absorbed being altered (the characteristics of the wave are not altered); and
- iii) Signal scattering/reflection: Reflection/scattering interference occurs when turbines either reflect or obstruct electromagnetic signals between a transmitter and a receiver. This occurs because when rotating blades of a turbine receive a primary transmitted signal they act to change the direction of the signal in an irregular fashion, thus ‘scattering’ it. The wavelength and frequency are not altered.

7.4.2 The above mechanisms may result in an electromagnetic receiver picking up both an intended primary signal and a secondary distorted or undesired signal simultaneously. The secondary distorted signal or undesired signal may be out of phase or distorted compared to the primary signal resulting in EMI. The secondary or undesired signal may be a result of the EMF created by the wind turbine or a scattered/reflected signal or diffracted signal of the primary signal from the wind turbine.

7.4.3 These effects have the potential to interrupt the following forms of electromagnetic emissions:

- i) RADAR (Radio Detection and Ranging);
- ii) Cellular radio communications;
- iii) Aircraft instrument landing systems;
- iv) Terrestrial microwave links;
- v) Television broadcasts; and
- vi) Satellite communications.

7.4.4 Research undertaken by the National Radiological Protection\* has shown that there is no proven connection between the emission of EMF and human health at the exposure levels anticipated from the proposed development. On the basis of this information it is concluded that there will be no health impacts on local communities as a result of EMF emissions and this is not considered further in this assessment.<sup>9</sup>

*\* Note that references are included in the excerpts*

The Australia Wind Energy Association comments on Electromagnetic Radiation and EMI:

## **“FACT SHEET**

### **What Is Electromagnetic Radiation?**

Electromagnetic radiation (EMR) is a wavelike pattern of electric and magnetic energy moving together. Types of EMR include X-rays, ultraviolet, visible light, infrared and radio waves. As a natural phenomenon, EMR is emitted by natural sources like the Sun, the Earth and the ionosphere. Radio frequency (RF) EMR is commonly used for a wide variety of communications applications from the broadcast of television and radio, through to radars and mobile phones. It is important that wind farms do not impact the quality of this communication.

### **Is EMR Safe?**

Whilst higher frequency EMR [eg X-rays] can be damaging to human health, only long-term exposure to very high levels of radio frequency (RF) EMR will heat or burn biological tissue. The levels of EMR that members of the general public are normally exposed to are far below these dangerous levels.

### **What About Electromagnetic Fields?**

Electromagnetic Fields (EMF) emanate from any wire carrying electricity and Australians are routinely exposed to these fields in their everyday lives. The electromagnetic fields produced by the generation and export of electricity from a wind farm, do not pose a threat to public health. Typically, electrical cabling between wind turbines is buried in the ground, effectively eliminating any EMF. Grid connection is usually made at no more than 132kV, similar to the voltages used by utilities in existing distribution networks.

### **What Do Wind Farms Have To Do With EMR?**

From a wind resource perspective, high and exposed sites are attractive. So it is not unusual for any of a range of telecommunications installations; radio and television masts, mobile phone base stations or emergency service radio masts, to be located nearby. Care must be taken to ensure that wind turbines do not passively interfere with these facilities by directly obstructing, reflecting or refracting the RF EMR signals from these facilities. There is also potential for a wind turbine to actively interfere by producing its own low energy RF signal.

### **What Is EMR Interference?**

Unwanted radio and background noise can impair effective telecommunications which rely on a strong signal to noise ratio. An appropriate transmitting antenna can dramatically improve this signal to noise ratio. A transmitting antenna can also increase the signal strength in a particular direction (ie toward a receiver). The directionality of a receiving antenna can also be enhanced, thus reducing the amount of unwanted noise.

### **How Are Wind Farm EMR Issues Managed?**

The impact of wind turbine generators on electromagnetic waves is relatively minor and a means of mitigation, avoidance or remedy can be found for all potential impacts. Any interference can be minimised or eliminated through a combination of appropriate turbine siting and special technical solutions.”<sup>10</sup>

### ***Remote data monitoring***

Remote data monitoring is used to assist with managing a wind energy facility including notification of a malfunction, service support, integration control systems, and data management.

For example, the ENERCON wind turbine indicates:

“Every ENERCON wind turbine has a modem link to the remote data monitoring facility.

If the wind turbine signals a malfunction, the service centre and the service branch in charge are notified via the SCADA remote monitoring system. The message is

automatically transferred to the ENERCON deployment planning software and displayed on the dispatchers' screen. With the aid of a specially developed locating system (GIS – Geo Information System), the deployment planning system automatically locates the service team that is closest to the wind turbine. Local service teams are able to access all turbine-specific documents and data via laptops, ensuring that all faults are dealt with as quickly and efficiently as possible. A new standard in service management.

#### ENERCON PDI (process data interface)

Today, integration into grid control systems and a connection to network control stations is a standard requirement for wind farms in many countries. ENERCON SCADA offers different optional PDI modules which act as communication interfaces between the various systems. This enables ENERCON's SCADA system to communicate via analogue or digital interfaces depending on requirements. Certain wind farm target values can be set and status messages or wind farm measurement values can be transmitted to the grid operator. If desired, wind measurement masts on the wind farms can be integrated in the data transfer system.

#### Local service

Local presence plays a key role in providing prompt service. Our local service employees are in close contact with the wind farm operators and are familiar with the site and local conditions. To enable our service teams to react as quickly and efficiently as possible, they also have remote access to all turbine specific documents and technical databases at all times. Furthermore, with the ENERCON SCADA system, the service employees have remote access to all turbines under service. Fault messages are transmitted to the Service office where an automatic dispatch system identifies the Service team nearest the relevant wind turbine.”<sup>11</sup>

General Electric (GE) is a global leader in wind turbine manufacturing. A GE brochure, GE Energy Wind Service, indicates the scale of its remote monitoring system:

“GE's customer support and remote monitoring centers in Schenectady, New York and Salzbergen, Germany provide continuous monitoring and diagnostics services 24 hours a day, 365 days a year and are designed to increase equipment availability, reduce downtime and reduce operational and maintenance costs. An on-site SCADA system connected to each turbine generator's control system links to the customer support center, constantly tracking specific operating parameters and relaying the information to specialists.”<sup>12</sup>

In 2010, according to WindPower Monthly a trade publication for the wind industry in the United States:

“On any given day, 24 hours a day, GE Energy's technicians are monitoring over 6,000 wind turbines globally from state-of-the-art remote operations centres in Schenectady in New York state, and Salzbergen, Germany. Each service centre uses automated software for remote resetting and troubleshooting, providing weather information to sites, and maximising turbine production by providing technical assistance to its customers.”<sup>13</sup>

### **Vulnerable population groups: children, fetus and elderly**

There is a growing concern regarding the increased exposure of vulnerable population groups.

As indicated previously, the BioInitiative (2012) report is a product of a international research. The following snapshots are drawn from some of its conclusions. They are not exhaustive and more detail is available by consulting:

“BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors.  
BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation at [www.bioinitiative.org](http://www.bioinitiative.org) December 31, 2012

### ***Fetus and Children***

**C. Evidence for Fetal and Neonatal Effects:** Effects on the developing fetus from in-utero exposure to cell phone radiation have been observed in both human and animal studies since 2006. Sources of fetal and neonatal exposures of concern include cell phone radiation (both paternal use of wireless devices worn on the body and maternal use of wireless phones during pregnancy). Sources include exposure to whole-body RFR from base stations and WI-FI, use of wireless laptops, use of incubators for newborns with excessively high ELF-EMF levels resulting in altered heart rate variability and reduced melatonin levels in newborns, fetal exposures to MRI of the pregnant mother, and greater susceptibility to leukemia and asthma in the child where there have been maternal exposures to ELF-EMF. Divan et al (2008) found that children born to mothers who used cell phones during pregnancy develop more behavioral problems by the time they have reached school age than children whose mothers did not use cell phones during pregnancy. Children whose mothers used cell phones during pregnancy had 25% more emotional problems, 35% more hyperactivity, 49% more conduct problems and 34% more peer problems (Divan et al, 2008). Aldad et al (2012) showed that cell phone radiation significantly altered fetal brain development and produced ADHD-like behavior in the offspring of pregnant mice.”

Fetal (*in-utero*) and early childhood exposures to cell phone radiation and wireless technologies in general may be a risk factor for hyperactivity, learning disorders and behavioral problems in school.

Common sense measures to limit both ELF-EMF and RF EMF in these populations is needed, especially with respect to avoidable exposures like incubators that can be modified; and where education of the pregnant mother with respect to laptop computers, mobile phones and other sources of ELF-EMF and RF EMF are easily instituted.

A precautionary approach may provide the frame for decision-making where remediation actions have to be realized to prevent high exposures of children and pregnant woman.

(Bellieni and Pinto, 2012 – Section 19)

## II. SUMMARY OF THE SCIENCE

### A. Evidence for Cancer

#### 1. *Childhood Leukemia*

The evidence that power lines and other sources of ELF are consistently associated with higher rates of childhood leukemia has resulted in the International Agency for Cancer Research (an arm of the World Health Organization) to classify ELF as a Possible Human Carcinogen (in the Group 2B carcinogen list). Leukemia is the most common type of cancer in children.

**There is little doubt that exposure to ELF causes childhood leukemia.**

**Children who have leukemia and are in recovery have poorer survival rates if their ELF exposure at home (or where they are recovering) is between 1mG and 2 mG in one study; over 3 mG in another study.**

**There is some evidence that other childhood cancers may be related to ELF exposure but not enough studies have been done.**

## *2. Other Childhood Cancers*

Other childhood cancers have been studied, including brain tumors, but not enough work has been done to know if there are risks, how high these risks might be or what exposure levels might be associated with increased risks. The lack of certainty about other childhood cancers should not be taken to signal the “all clear”; rather it is a lack of study.

The World Health Organization ELF Health Criteria Monograph No 322 (2007) says that other childhood cancers “cannot be ruled out”. (8)

**The consequence of prolonged exposures to children, whose nervous systems continue to develop until late adolescence, is unknown at this time. This could have serious implications to adult health and functioning in society if years of exposure of the young to both ELF and RF result in diminished capacity for thinking, judgment, memory, learning, and control over behavior.**

### *General population*

**People who have used a cell phone for ten years or more have higher rates of malignant brain tumor and acoustic neuromas. It is worse if the cell phone has been used primarily on one side of the head.**

**People who have used a cordless phone for ten years or more have higher rates of malignant brain tumor and acoustic neuromas. It is worse if the cordless phone has been used primarily on one side of the head.**

**The current standard for exposure to the emissions of cell phones and cordless phones is not safe considering studies reporting long-term brain tumor and acoustic neuroma risks.**

**The evidence from studies on women in the workplace rather strongly suggests that ELF is a risk factor for breast cancer for women with long-term exposures of 10 mG and higher.**

**Given the very high lifetime risks for developing breast cancer, and the critical importance of prevention; ELF exposures should be reduced for all people who are in high ELF environments for prolonged periods of time.**

**Studies of human breast cancer cells and some animal studies show that ELF is likely to be a risk factor for breast cancer. There is supporting evidence for a link between breast cancer and exposure to ELF that comes from cell and animal studies, as well as studies of human breast cancers.**

**Alzheimer's disease is a disease of the nervous system. There is strong evidence that long-term exposure to ELF is a risk factor for Alzheimer's disease.**

**There is little doubt that electromagnetic fields emitted by cell phones and cell phone use affect electrical activity of the brain.**

**The effects of long-term exposure to wireless technologies including emissions from cell phones and other personal devices, and from whole-body exposure to RF transmissions from cell towers and antennas is simply not known yet with certainty. However, the body of evidence at hand suggests that bioeffects and health impacts can and do occur at exquisitely low exposure levels: levels that can be thousands of times below public safety limits.**

**Both ELF and RF exposures can be considered genotoxic (will damage DNA) under certain conditions of exposure, including exposure levels that are lower than existing safety limits.**

**Very low-level ELF and RF exposures can cause cells to produce stress proteins, meaning that the cell recognizes ELF and RF exposures as harmful. This is another important way in which scientists have documented that ELF and RF exposures can be harmful, and it happens at levels far below the existing public safety standards.**

**There is substantial evidence that ELF and RF can cause inflammatory reactions, allergy reactions and change normal immune function at levels allowed by current public safety standards.**

## **Global concerns and initiatives**

Some have suggested there are no risk factors associated with industrial wind energy facilities.<sup>14, 15</sup>

In a study funded in part by a wind energy firm, McCallum et al (2014) states:

“Overall, our results support the official position of Health Canada, in that: “Health Canada does not consider that any precautionary measures are needed regarding daily exposures to EMFs at ELF. There is no conclusive evidence of any harm caused by exposures at levels found in Canadian homes and schools, including those located just outside the boundaries of power line corridors.”<sup>16</sup>

However, concerns regarding this general topic are being expressed globally.

The World Health Organization,<sup>17</sup> physicians<sup>18, 19, 20</sup> and researchers<sup>21, 22, 23</sup> reveal health issues.

The International Agency for Research on Cancer (IARC), an arm of the WHO has classified ELF and RFR as being a possible carcinogen.<sup>24</sup> This covers the full frequency range associated with wind turbines. The monographs may be obtained from WHO ELF <http://www.who.int/peh-emf/publications/Comple DEC 2007.pdf?ua=1> and RF [http://www.who.int/peh-emf/research/rf\\_ehc\\_page/en/](http://www.who.int/peh-emf/research/rf_ehc_page/en/)

It is reported that:

“Today, the World Health Organization's (WHO) new monograph on cancer risk from mobile phones and other sources of RF radiation is featured on the home page of the WHO's International Agency for Research on Cancer (IARC).

According to the monograph:

- "Positive associations have been observed between exposure to radiofrequency radiation from wireless phones and glioma and acoustic neuroma" (p.421).

- “Radiofrequency electromagnetic fields are possibly carcinogenic to humans (Group 2B).” (p. 421)

Children are particularly vulnerable as “the average exposure from use of the same mobile phone is higher by a factor of 2 in a child’s brain and higher by a factor of 10 in the bone marrow of the skull.” Also, the child’s brain is developing at a much greater rate than the adult’s brain.<sup>25</sup>

Boardman (2012) reports:

“Constant exposure to electromagnetic radiation (EMR) affects all of us. Women’s College Hospital in Toronto is the first Canadian hospital requiring its doctors to be trained in treating the effects of EMR, even as Health Canada, the Canadian government health agency, claims EMR is probably harmless.”<sup>26</sup>

With respect to industrial wind turbines Havas and Colling (2011) state:

#### **Abstract**

People who live near wind turbines complain of symptoms that include some combination of the following: difficulty sleeping, fatigue, depression, irritability, aggressiveness, cognitive dysfunction, chest pain/pressure, headaches, joint pain, skin irritations, nausea, dizziness, tinnitus, and stress. These symptoms have been attributed to the pressure (sound) waves that wind turbines generate in the form of noise and infrasound. However, wind turbines also generate electromagnetic waves in the form of poor power quality (dirty electricity) and ground current, and these can adversely affect those who are electrically hypersensitive. Indeed, the symptoms mentioned above are consistent with electrohypersensitivity. Sensitivity to both sound and electromagnetic waves differs among individuals and may explain why not everyone in the same home experiences similar effects. Ways to mitigate the adverse health effects of wind turbines are presented.<sup>27</sup>

See the Appendix for examples of activities in other countries and animal research.

#### **Conclusion**

BioInitiative (2012) comments on “today’s world”:<sup>28</sup>

In today's world, everyone is exposed to two types of EMFs: (1) extremely low frequency electromagnetic fields (ELF) from electrical and electronic appliances and power lines and (2) radiofrequency radiation (RF) from wireless devices such as cell phones and cordless phones, cellular antennas and towers, and broadcast transmission towers. In this report we will use the term EMFs when referring to all electromagnetic fields in general; and the terms ELF and RF when referring to the specific type of exposure. They are both types of non-ionizing radiation, which means that they do not have sufficient energy to break off electrons from their orbits around atoms and ionize (charge) the atoms, as do x-rays, CT scans, and other forms of ionizing radiation. A glossary and definitions are provided in Section 18 to assist you. Some handy definitions you will probably need when reading about ELF and RF in this summary section (the language for measuring it) are shown with the references for this section.

Of interest is the proposed BILL C-648, an Act respecting the prevention of potential health risks from radiofrequency electromagnetic radiation.

Bill C-648 Summary states:

## SUMMARY

This enactment makes it an offence to sell radio apparatus for general public use without a warning label that cautions the user of potential health risks of exposure to radiofrequency electromagnetic fields associated with the use of this apparatus. The enactment also empowers the Minister of Industry to make regulations respecting the wording of the information to be printed on these warning labels, as well as the positioning, printing and dimensions of the labels. It also empowers the Minister to make regulations respecting the dissemination of information respecting the safe use of radio apparatus and providing for their sampling, testing, inspection and analysis.

BioInitiative (2012) notes:

“There is little labeling, and little or no informed choice. In fact there is often not even the choice to stay with safer, wired solutions, as in the case of the ‘smart grid’ and smart wireless utility metering, an extreme example of a failed corporate-governmental partnership strategy, ostensibly for energy conservation.”

Currently, with respect to industrial wind energy facilities, there i/are no warning labels or other form of disclosure to the public about the potential health risks of exposure to radiofrequency electromagnetic energy associated with living in proximity to industrial wind energy facilities. In addition, non-participants are exposed to these energy sources without consent.

Expectations are that more industrial wind energy facilities will be approved and operational throughout Canada.

Based on the requirements for the operations and infrastructure associated with industrial wind energy facilities and the risks factors associated with these exposures; there is an opportunity to consider the aggregate of all possible exposures to RF and EM emissions by including industrial wind energy facilities within Safety Code-6 regulatory requirements.

The evidence encourages that precautionary measures be invoked to prevent avoidable harm.

Regarding precaution, the WHO states

“...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>29</sup>

The Policy Interpretation Network on Children’s Health and Environment comments on policy and precaution:

“Policies that may protect children’s health or may minimise irreversible health effects should be implemented, and policies or measures should be applied based on the precautionary principle, in accordance with the Declaration of the WHO Fourth Ministerial Conference on Environment and Health in Budapest in 2004.”<sup>30</sup>

### **Recommendations:**

That Safety Code-6 be expanded to include:

- § Industrial wind energy facilities regarding electromagnetic energy;
- § The fetus, babies, children and youth, the elderly, including those with pre-existing medical conditions and special needs, and animals, both domestic and wild;
- § The following researchers and published authors be invited to share their expertise:
  - Dr. David Carpenter, MD
  - Dr. Sam Milham, MD
  - Dr. Magda Havas, PhD
  - David Stetzer
  - Paul Héroux, PhD

If this submission meets the Committee’s objectives, we are available to share our knowledge associated with industrial wind energy facilities.

Respectfully submitted,

Beth Harrington  
Carmen Krogh

**Appendix:** [References are not exhaustive: additional references available on request]

Dr. Gee comments on precaution and cell phones:

**Conclusion:** [Excerpt]

“Three main scenarios seem to face us with EMF, particularly with the RF from mobile phones. The first is similar to the case studies in the EEA reports on late lessons, where much avoidable harm was not prevented. The second is where precautionary actions to reduce EMF exposures avert much potential harm, whilst stimulating more sustainable innovation in the production and use of mobile phone technologies and energy systems. And the third is where such precautionary actions to reduce exposures are taken but they turn out to have been unnecessary, if reasonable, given the state of knowledge today. The choice is ours: to act or not to act, as Shakespeare might have said.”

Reference: Gee D [1], Late Lessons from Early Warnings: Towards realism and precaution with EMF? *Pathophysiology* 16 (2009) 217–231 [1] European Environment Agency, Kongens Nytorv 6, DK-1050 Copenhagen K, Denmark  
Received 17 December 2008; accepted 30 January 2009

### *Examples of actions in other countries*

§ Parliamentary Assembly, Council of Europe, Resolution 1815 (2011)<sup>1</sup> The potential dangers of electromagnetic fields and their effect on the environment. Text adopted by the Standing Committee, acting on behalf of the Assembly, on 27 May 2011 (see Doc. 12608, report of the Committee on the Environment, Agriculture and Local and Regional Affairs, rapporteur: Mr Huss

§ The Israeli Supreme Court Ordered the Israeli Government to Investigate the Number of Children Currently Suffering From EHS. July 23, 2013 From Dafna Tachover:

“On July 18, 2013, the Israeli Supreme Court ordered the Israeli Government to investigate how many children in Israel already suffer from EHS.”

§ Elza Boiteux, Published June 12, 2014 02:09 PM, Brazilian Courts order lower electromagnetic pollution <http://www.enn.com/pollution/article/47482/print>

“The Brazilian Judiciary determined to reduce the level of electromagnetic pollution generated by power lines to standard adopted by Swiss law (1.0 microTesla). NOTE: in Canada the public may be exposed to levels of 89 microTesla for any 24 hour period.]

The decision applied the provisions of the Brazilian Federal Constitution — which declare the protection of health and the balanced environment — and the precautionary principle contained in the United Nations Conference on Environment and Development (1992), also known as the Rio Summit, which intended to protect the population against damage to health and the environment.”

***Examples of animal research: Examples of animal research which is typically a precursor to assisting with determining exposure levels in humans indicates:***

Mer et al (2010):

“**Conclusion:** The overall findings indicated that whole body exposure to pulse-modulated RF radiation that is similar to that emitted by global system for mobile communications (GSM) mobile phones can cause pathological changes in the thyroid gland by altering the gland structure and enhancing caspase-dependent pathways of apoptosis.”

Reference: MER\_IC, ARDA ES, MEKAYA1, NESRIN SEYHAN1, & SUNA O' MERO GLU2 1Department of Biophysics, Faculty of Medicine & Gazi Non-ionizing Radiation Protection (GNRP) Center and 2Department of Histology and Embryology, Faculty of Medicine, Gazi University, Ankara, Turkey, Pulse modulated 900 MHz radiation induces hypothyroidism and apoptosis in thyroid cells: A light, electron microscopy and immunohistochemical study, Int. J. Radiat. Biol., Vol. 86, No. 12, December 2010, pp. 1106–1116 ISSN 0955-3002 print/ISSN 1362-3095 online 2010 Informa UK, Ltd. DOI: 10.3109/09553002.2010.502960

Bergethon et al (2013):

“These results support the formulation that ELF fields are a potential factor in both normal vessel biology and in the pathogenesis of atherosclerotic diseases including heart disease, stroke, and peripheral vascular disease”

Reference: Peter R. Bergethon, 1,2\* Dean D. Kindler, 2 Kevin Hallock, 1 Susan Blease, 2 and Paul Toselli 2 1 Department of Anatomy and Neurobiology, Laboratory for Intelligence Modeling and Neurophysics, Boston University School of Medicine, Boston, Massachusetts 2 Department of Biochemistry, Boston University School of Medicine, Boston, Massachusetts, Continuous Exposure to Low Amplitude Extremely Low Frequency Electrical Fields Characterizing the Vascular Streaming Potential Alters Elastin Accumulation in Vascular Smooth Muscle Cells, . Bioelectromagnetics 34:358–365, 2013 [2013 Wiley Periodicals, Inc.]

## References

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<sup>1</sup> Health Canada, Safety Code 6 (2009), Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz,

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- <sup>2</sup> BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors. BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation at [www.bioinitiative.org](http://www.bioinitiative.org) December 31, 2012
- <sup>3</sup> BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors. BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation at [www.bioinitiative.org](http://www.bioinitiative.org) December 31, 2012
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