

Keith Miles
1580 McBeth Street
Trail, B.C. V1R 1Z4
E-Mail: kemiles@telus.net

...in the Kootenays



Telephone: (250) 368-8728

January 24, 2013

Submitted via E-mail

Erica Hamilton - Commission Secretary
British Columbia Utilities Commission
Box 250 – 900 Howe Street – Sixth Floor
Vancouver, BC V6Z 2N3

Dear Ms. Hamilton,

**Re: FortisBC Inc. Application for a Certificate of Public Convenience and Necessity
for the Advanced Metering Infrastructure Project
Evidence Submission Items**

Further to BCUC Exhibit A-25 Procedural Information and BCUC Exhibit A-14 Order G-177-12 Regulatory Schedule, I am enclosing the following evidentiary documents for inclusion in the Oral Hearing process March 4, 2013.

1. Carpenter Expert Opinion Quebec Energy Board R-3770-2011-C-SÉ-AQLPA-0075-
PREUVE-RAPPEXP-2012_05_15

I am not certain whether this is a duplicate submission with Mr. Shadrack, but it is of current significance for the health considerations of the Panel, and I had intended to make sure it was included.

2. Citizens for Safe Technology Society obo others v. B.C. Hydro (Reasons for Decision – Representative Complaint) 012 BCHRT 300

BCHRT 300, 2012, appears to be an active issue related to determinations of health and RF. In considering the restrictive 'opt-out' provisions by FortisBC, not yet fixed, there appears to be no provision for accommodation by FortisBC where an individual medically at risk or affected by RF has costs of opting out waived for medical reasons. My view is that this position is particularly discriminatory as the potential requirement to 'opt-out' would be beyond the control of the affected individual. I believe the Panel, in considering the health concerns of RF, should ensure there is consideration provided in any cost assessments by FortisBC against at risk individuals, and that the entire project should absorb those costs.

Sincerely,

Keith Miles
1580 McBeth Street
Trail, B.C. V1R 1Z4
250-368-8728

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Trail, B.C. V1R 1Z4

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Attachments:

B.C. Human Rights Tribunal, (2012). *Citizens for Safe Technology Society obo others v. B.C. Hydro, 2012 BCHRT 300*. Retrieved from http://www.bchrt.bc.ca/decisions/2012/pdf/aug/300_Citizens_for_Safe_Technology_Society_obo_others_v_BC_Hydro_2012_BCHRT_300.pdf

Carpenter D. O. (2012). *The State Of Scientific Research As To Whether Advanced Meters Transmitting By Radiofrequencies, As Proposed In The Present Case, May Constitute A Risk Of Serious Or Irreversible Damage To Health*. Retrieved from <http://www.emfandhealth.com/CarpenterHydroBrief.pdf>

Date Issued: August 28, 2012
File: 9854

Indexed as: Citizens for Safe Technology Society obo others v. B.C. Hydro,
2012 BCHRT 300

IN THE MATTER OF THE *HUMAN RIGHTS CODE*
R.S.B.C. 1996, c. 210 (as amended)

AND IN THE MATTER of a complaint before
the British Columbia Human Rights Tribunal

B E T W E E N:

Citizens for Safe Technology Society obo Una St. Clair and others

COMPLAINANTS

A N D:

B.C. Hydro

RESPONDENTS

**REASONS FOR DECISION
REPRESENTATIVE COMPLAINT**

Tribunal Member: Enid Marion

Counsel for the Complainants: David Aaron

Counsel for the Respondent: Shelley-May Mitchell

Introduction

[1] Citizens for Safe Technology Society (“Citizens”), in a representative capacity, filed a complaint on behalf of Una St. Clair and others against B.C. Hydro (“Hydro”) alleging discrimination on the basis of physical disability, contrary to s. 8 of the *Human Rights Code*. Una St. Clair is the Executive Director of Citizens, and is also a member of the proposed class of persons on behalf of whom the complaint is brought.

[2] The Tribunal requested submissions on whether or not to accept the complaint as a representative complaint. Both parties filed extensive submissions. Citizens also filed a revised Form 2 – Representative Complaint Form and referred to certain amendments to the complaint in the course of its submissions. Hydro notes that a complaint amendment form was not filed, as required by the Tribunal’s *Rules of Practice and Procedure*. Despite this, Hydro was able to substantively respond to the issue under consideration in this decision.

[3] This decision only addresses whether to accept the complaint as a representative complaint. In order to put the decision in context, I first review the background to the complaint as provided in the materials filed by the parties. In doing so, I make no findings of fact. I also note that, for the purposes of this decision, it is not necessary to identify any individual, other than Ms. St. Clair.

Background

The Complaint

[4] In late spring 2011, Hydro announced that premises serviced by it would receive a wireless Smart Meter. Hydro acknowledged that some persons would object to the installation of radiofrequency-based technology and indicated it would be respectful and responsive to find mutually acceptable solutions.

[5] Citizens says that it wrote to Hydro requesting wired meters for those persons with a health diagnosis that required they avoid wireless meters. It says that Hydro replied that there was not enough market demand and it was “too troublesome” to provide wired meters.

[6] Citizens further says that Hydro was contacted throughout 2011 to the date of the complaint advising that certain persons with health concerns did not consent to the installation of wireless meters and requesting wired meters. Citizens says they were refused wired meters.

[7] Citizens says that Hydro is refusing to accommodate disabilities through the provision of wired meters and the fact that there is no available opt-out choice. In particular, it says that Hydro has discriminated against:

Those with electrohypersensitivity or medical conditions who are medically advised to avoid exposure to wireless smart meters, who have requested accommodation from Hydro and who have not received an unconditional commitment from Hydro within 3 weeks of their request that wireless smart meters would not be installed in their residence or residential complex.

[8] On the other hand, Hydro says that, in 2010, the *Clean Energy Act* was introduced which included a requirement that Hydro install and operate Smart Meters and related equipment by the end of 2012. Hydro says that this was a critical infrastructure upgrade that involved the replacement of existing meters with modern, fully-integrated Smart Meters. It says that the Smart Meter Program is expected to improve public safety, provide operating efficiencies and provide Hydro customers with tools they can use to monitor and reduce their consumption of electricity.

[9] Hydro says Citizens has participated in, or filed, various complaints against the Smart Meter Program and Hydro, including with the B.C. Utilities Commission.

Legal Framework

[10] Pursuant to s. 21 of the *Code*, the Tribunal has the discretion to refuse to accept a representative complaint. In exercising that discretion, the Tribunal has noted in several decisions the importance of representative complaints to addressing issues of systemic discrimination, and the importance of not making the requirements for proceeding with such a complaint overly onerous.

[11] For example, in *C.S.W.U. Local 1611 v. SELI Canada and others (No. 3)*, 2007 BCHRT 423, the Tribunal stated:

Representative complaints filed on behalf of a group provide the Tribunal with an effective means of addressing systemic discrimination where all members of a group are alleged to have experienced discrimination. The Tribunal must exercise care when setting the requirements necessary for proceeding with a group or class complaint to ensure that it does not make the requirements so onerous that the purposes, efficiency and advantages gained from proceeding with a representative complaint are nullified. (para. 101)

[12] In *C.S.W.U. (No. 3)*, the Tribunal also set out a number of factors it considers when assessing whether or not to accept a representative complaint for filing:

For the benefit of future representative complaints, the panel provides the following guidelines regarding the filing of a representative complaint on behalf of a group or class.

Upon the filing of such a complaint, there are three matters of concern to the Tribunal. First, as is the case with respect to all complaints, the Tribunal considers whether the complaint alleges facts which, if proven, could amount to a breach of the *Code*. This assessment is important because it defines those issues over which the Tribunal has jurisdiction.

Second, the Tribunal must determine whether the complaint as framed is appropriate for a group or class complaint. Here the factors the Tribunal may consider include whether:

- i) the group or class is defined, or is capable of definition, by clear parameters or characteristics;
- ii) the alleged contravention is similar for all members of the group or class, and, in particular, there are issues in common for all of the individuals in the group or class;
- iii) proceeding with the complaint is in the interest of the group or class on behalf of which the complaint is made.

Third, the Tribunal may consider whether:

- i) the representative has notified the group or class members of the complaint, or has proposed a method for doing so;
- ii) the representative has proposed a method for keeping the members of the group or class informed of the progress of the complaint;
- iii) the representative has notified the group or class members of a right to opt out of the complaint, or has proposed a method for doing so; and
- iv) there is a potential conflict between the members of the group or class and the representative.

These are matters which the Tribunal will, to the extent possible, at such an early stage of the proceeding, consider when making the screening decision whether to accept a representative complaint for filing. Such complaints will often be suitable for the case management stream where a Tribunal member will determine what steps should be taken. (paras. 102-106)

[13] I will review each of these factors in turn.

Does the Complaint Allege a Breach of the Code?

[14] Citizens says that the complaint is a representative complaint, filed in accordance with s. 21 of the *Code*, that is brought on behalf of a class of individuals persons with the following characteristics:

1. The individual is a resident of British Columbia.
2. The individual resides in a residence and/or a residential complex that gets its electricity from Hydro.
3. The individual has been advised, in writing, by a physician licensed to practice medicine in all or part of Canada, to avoid, for reasons of illness and/or disability, residing in a residence and/or residential complex at which a wireless smart meter device is operating.
4. The individual, on his/her own behalf or by way of a representative, has requested, as an accommodation, that Hydro refrain from installing and/or operating a wireless smart meter at the individual's place of residence and/or residential complex
5. Within three weeks of making the request for accommodation, the individual has not received an unconditional written commitment from Hydro that it will refrain from installing and/or operating a wireless smart meter at the individual's place of residence and/or residential complex. ("Defining Characteristics")

[15] Citizens notes that in *National Automobile, Aerospace, Transportation and General Workers of Canada (CAW – Canada) Local 111 v. Coast Mountain Bus Company (No. 7)*, 2005 BCHRT 478 ("*Coast*"), the Tribunal described the distinction between a class and group as follows:

A group of persons is a number of individuals who are identifiable, or who, with relative ease, could be identified by name for the dates relevant to the complaint. On the other hand, a "class" of persons is a number of individuals who can be described by characteristics for the dates relevant to the complaint but cannot necessarily be individually named.

[16] Citizens says that it intends to adduce evidence to identify dozens of individuals who can be described by reference to the Defining Characteristics, but that it is not necessary that every member of the class be named or known. It says that any person may claim membership in the class and entitlement to any remedy awarded by the Tribunal as long as the person can be described by reference to the Defining Characteristics.

[17] In support of what it describes as an open class membership, it relies on *Western Canadian Shopping Centres Inc., v. Dutton*, [2001] 2 S.C.R. 534 (“*Western*”):

While there are differences between the tests, four conditions emerge as necessary to a class action. First, the class must be capable of clear definition. Class definition is critical because it identifies the individuals entitled to notice, entitled to relief (if relief is awarded), and bound by the judgment. It is essential, therefore, that the class be defined clearly at the outset of the litigation. The definition should state objective criteria by which members of the class can be identified. While the criteria should bear a rational relationship to the common issues asserted by all class members, the criteria should not depend on the outcome of the litigation. It is not necessary that every class member be named or known. It is necessary, however, that any particular person’s claim to membership in the class be determinable by stated, objective criteria....(para. 38)

[18] Citizens did identify some persons who it says meet the Defining Characteristics. The identified “illness and/or disability” was not necessarily the same in each case, and included the following:

- i) Highly electro-hypersensitive (“EHS”)
- ii) Occupational exposure induced EHS
- iii) Angioedema
- iv) MCS and EHS
- v) Genetic cardiomyopathy/defibrillator
- vi) Unspecified medical conditions
- vii)EMF hypersensitivity

[19] Citizens also identified numerous individuals who it says are interested in joining the class and who it anticipates will be advised by their physician to avoid residing in a residence or residential complex at which a wireless Smart Meter device is operating. The identified illness/disabilities for these individuals were varied, and in some cases unspecified.

[20] Despite the identification of various illnesses/disabilities, Citizens describes the disability it relies on in this case as:

An environmental sensitivity resulting in an inability to be well while residing in a residence and/or residential complex in which a wireless smart meter has been installed and/or is operating. (the “Disability”)

[21] Citizens says that while the specific medical circumstances of each class member may vary, the medical circumstances give rise to the common Disability. In this regard, it says that a disability must be analyzed in terms of an individual’s accommodation needs rather than their specific medical circumstances. As an example, it says that persons in a wheelchair may have different medical circumstances which cause them to be in a wheelchair, but they all have a common disability in relation to the inability to access raised curb sides.

[22] Citizens says that in all cases, the disability must be characterized in terms of the impediment that it raises to accessing the public service and the resulting need for accommodation.

[23] Citizens also says that one of the medical conditions giving rise to the Disability is EHS, and relies on reports about EHS posted on the Canadian Human Rights Commission website.

[24] On the other hand, Hydro says that the complaint does not allege a breach of the *Code*. In this regard, it relies on what it says was Citizens’ failure to provide certain information requested by the Tribunal. I note, however, that Citizens did provide certain of the requested information, though it may not have been in the form, or as extensive, as anticipated by Hydro. In any event, my assessment of whether the complaint alleges a breach of the *Code* will be based on the information set out in the complaint itself. In making the assessment, the Tribunal does not consider additional information or alternative explanations asserted by a respondent: *Bailey v. B.C. (Min. of Attorney General) (No. 2)*, 2006 BCHRT 168, para. 12.

[25] Hydro says that the complaint does not allege adverse treatment of a specific set of individuals, but about the health of the province’s general population. It further says that there is no specified adverse treatment, and the matter does not come within the

jurisdiction of the *Code*. In particular, it characterizes the complaint as reflective of a health preference and a disagreement with mandatory steps imposed on Hydro under provincial legislation. It says the *Code* was not intended to facilitate political lobbying with respect to actions mandated by provincial legislation. As such, it says that the complaint should be not accepted for filing.

[26] As well, Hydro says that EHS has not been established as a disability in British Columbia or elsewhere. It also says that there is nothing to establish that those persons with “medical conditions” are suffering from anything that would constitute a disability under the *Code*.

[27] Hydro further asserts that Citizens’ description of the Disability does not constitute a disability under the *Code* since it is contingent and based on the assumption that a wireless Smart Meter has been installed. In this regard, it is dependent on a future event which may not occur. As well, Hydro says that it assumes the Disability is caused by or based on the installation and operation of the Smart Meter, which it says is not the case since the alleged, unspecified medical conditions or EHS allegedly already exists.

[28] Hydro notes that the Tribunal has held that a disability involves a state that is involuntary, has some degree of permanence, and impairs a person’s ability to carry out the normal functions of life: *Schodra v. Vancouver Axle and Frame*, 2009 BCHRT 173, para. 37. It says the complaint states that members of the class choose to avoid exposure to wireless telecommunications devices, and that an individual’s personal preference is voluntary and impermanent. As such, it says that the alleged Disability is not captured by the *Code*.

[29] In reply, Citizens says the *Act* does not require Hydro to install wireless Smart Meters; and that the class is restricted to persons who have received written advice from their physicians that, due to medical conditions, they must avoid residing in a residence at which a wireless Smart Meter device is operating. As well, it says that, at this stage of the proceeding, it is not necessary for it to tender medical evidence in support of each individual within the class, as the issue before the Tribunal is whether the complaint is appropriately brought as a representative proceeding.

[30] Citizens also says that it is not necessary that Smart Meters actually be installed in an individual's residence in order to be a member of the class. Rather, it is the written advice of the physician to avoid exposure that is relevant. As well, Citizens says that it is not necessary that a class member actually be a Hydro customer. It says that the complaint is brought so as to represent affected persons who ordinarily receive the service benefits of the utility, such as co-residents, spouses and children of Hydro clients.

[31] In this case, in order to allege a breach of the *Code*, the complaint must allege a disability, adverse treatment in respect of a service customarily available to the public, and a nexus or connection between the disability and the adverse treatment. For the following reasons, I find that the complaint has made such an allegation.

[32] First, I accept that not every person in the class must be a Hydro customer, and do not consider this to be a barrier to the representative nature of the complaint. For example, if a child who allegedly has EHS was living in a home and was allegedly adversely affected by the operation of a wireless Smart Meter, that child could properly be a member of the class despite not being the Hydro customer.

[33] Second, while Citizens may have political motivations, this does not preclude it from filing a human rights complaint. Nor does the fact that an individual may have asserted both a discrimination and privacy claim as reasons for opposing the installation of a Smart Meter. What must be determined is whether the complaint, as framed, actually alleges a breach of the *Code*.

[34] Third, I accept that the complaint, with one exception, alleges various disabilities, including EHS. The exception is the reference to "unspecified medical conditions". In my view, such an assertion is too vague to form the basis of a complaint.

[35] I also agree with Citizens that it is not necessary, at this point in the proceeding, to provide medical proof of an alleged disability. Such evidence would be required in the context of an application to dismiss the complaint, a hearing on the merits of the complaint, or at the request of the Tribunal as a preliminary matter.

[36] Fourth, I accept that the complaint has also identified adverse treatment and a connection between it and the alleged disability in the form of an inability to be well, or

becoming symptomatic, in the presence of wireless technology. One might analogize this to a person with asthma who becomes ill in a home with cats and therefore must avoid such spaces.

[37] As a result, except for the “unspecified medical conditions”, the complaint alleges a breach of the *Code*.

Is the Complaint Appropriate as a Representative Complaint

[38] In respect of the considerations set out in the second step of the *SELI* analysis, Citizens says that the class is capable of clear definition through the application of the Defining Characteristics; the group members have issues in common in that each of the members has medical circumstances giving rise to the need to be free from wireless Smart Meters in their domestic environments, and each has been effectively denied accommodation by Hydro.

[39] On the other hand, Hydro says that the complaint amounts to a list of 45 individuals who object to the installation of wireless Smart Meters in British Columbia and who take the position that they have medical conditions that could or may be impacted by the wireless Smart Meter technology. It says that no medical evidence is referenced or provided and many characteristics include unspecified medical conditions.

[40] Hydro says the Defining Characteristics cast a wider net than Citizens’ membership, and that the class is defined so broadly as to capture anyone in the Province who may allegedly suffer from any medical ailment and who may allege they have been discriminated against by the installation of Smart Meters. It also says that many of the identified individuals are not Hydro customers and many have not had a Smart Meter installed in their residence.

[41] Hydro also says that the complaint is really about an attempt to stop the installation of Smart Meters and not the need to accommodate individual medical circumstances. In this regard, it relies on various communications it has received from members of the proposed class in which, in addition to medical circumstances, other reasons are expressed for opposing the installation of the meters.

[42] In addition, Hydro says the class is not capable of clear definition: *Vorley v. British Columbia (Ministry of Solicitor General)*, 2005 BCHRT 50, para. 29. In particular, it says that the definition of the class does not bear a rational relationship to the subject matter of the complaint, and that membership is speculative and ambiguous: *Corren v. Abbotsford School Board District No. 34*, 2010 BCHRT 32, at para. 61-62. It further says that at least two members of the proposed class have written to it opposing installation of Smart Meters due to privacy issues, and not requesting accommodation or identifying any medical reason for opposing installation.

[43] As well, Hydro says that the Defining Characteristics are overly broad, and do not even apply to many of the proposed individuals in the class. It says it would require a detailed analysis by the Tribunal and Hydro to determine who, in fact, would form part of the proposed class. It says that those with undefined “medical conditions” and also those “who expect to receive medical evidence in the future” should not be allowed to form a part of the proposed class. It says that, at this point, it is impossible to accurately determine the size or scope of the proposed class, as well as Citizens’ ability to manage or represent the class.

[44] Further, Hydro says that the criteria by which individuals are included in a class should not depend on the outcome of the litigation. In this respect, it says that EHS has not been accepted as a disability by any Canadian Tribunal.

[45] Hydro also says that common issues of fact and law are not present amongst members of the proposed class, given that there are an assortment of alleged conditions and disabilities cited in the proposed class. From this, it says that it can be inferred that Hydro’s installation of Smart Meters will be alleged to impact the proposed members in a variety of ways, and that a plethora of accommodative measures may be requested.

[46] Hydro also says that even if the class was limited to those claiming to be afflicted with EHS, the complaint would still fail to contain sufficiently common issues of fact or law such that it could be appropriately pursued as a representative complaint. It says that even these proposed class members will have differing degrees of disability and their need for accommodation will differ. Each member would need to be individually assessed. It says that if the complaint were to succeed, the complaint of each member of

the class would need to be determined in the context of its individual factual matrix, defeating the purpose of proceeding with a representative complaint in the first place: *Stephen v. British Columbia (Ministry of Children and Family Development)*, 2006 BCHRT 123 at para. 27.

[47] In reply, Citizens says that it is permissible for membership of the proposed class to remain open at this stage of the proceeding. It says that once the common issues under the representative proceeding are determined, it will remain open for Hydro to challenge whether any given individual is a member of the class and entitled to relief. It also says that the need for a determination of individual issues does not undermine the propriety of a representative claim: *Hollick v. Toronto (City)*, [2001] 3 S.C.R. 158 (“Waldman”).

[48] Citizens further says that the Defining Characteristics are objective so as to allow for easy and objective determination of any given individual’s qualifications for class membership, and that membership is not speculative and ambiguous, but delineated by reference to the Defining Characteristics.

[49] In respect of an undefined medical condition, Citizens says that what brings an individual into the proposed class is the advice of a physician, not the particulars of the individual’s medical condition. As well, Citizens says that the class is not as broad as Hydro characterizes it to be, since it is limited by the criterion requiring written avoidance advice from a physician.

[50] In respect of conflicting positions regarding accommodation, Citizens says that this may constitute an argument of undue hardship to be advanced on an individual basis, but that it is not a relevant consideration in assessing whether to proceed with a representative complaint. Further, it says that the fact that there may need to be individual assessments of accommodation does not render a class unmanageable or lacking in commonality.

[51] Citizens also says that the appropriateness of the representative proceeding does not depend on the outcome of the litigation, but rather the class is defined on the basis of receipt of advice from a licensed physician, and not on the basis of EHS or any other specific illness.

[52] In regard to whether the class is consistent with the form of the complaint, Citizens says that neither the choice to avoid wireless telecommunication devices or affliction with “other medical conditions” are necessary or defining criteria of the proposed class.

[53] In regard to common issues of fact and law, Citizens says that each class member has in common the fact that he or she has received avoidance advice from a physician. Only one single accommodation request is contemplated by the complaint and that is that Hydro refrain from the installation of the wireless device at the residence of the afflicted Hydro customer.

[54] Finally, Citizens says that Hydro’s allegations of potential conflicts of interest is pure conjecture and speculation.

[55] For the following reasons, I find that the defined class is not capable of clear definition and is overbroad. I also find that a class restricted to those persons who have been diagnosed with EHS would be appropriate for a representative complaint.

[56] First, I agree with Hydro that the complaint casts too broad a net. It is simply unmanageable to have a plethora of various medical conditions that must be proven and linked to the adverse treatment. The issues and evidence respecting whether the various conditions constitute a disability, whether there is a nexus between the disability and the adverse treatment, and if so whether Hydro either has proven a *bona fide* reasonable justification for the installation of wireless Smart Meters or reasonably accommodated the disability will be of differing complexity and focus, dependent on the nature of the alleged disability.

[57] Second, while I accept that membership in a class may be open-ended, the defining characteristics must be specific enough to clearly delineate membership. I agree with Hydro that, as currently framed, any person with a medical condition, diagnosed or undiagnosed, could conceivably fall within the class. Such broad membership means that that there will be divergent issues of fact and law among the members of the class, given the types of evidence and legal arguments to be made in respect of each alleged disability, the impact (if any) of wireless Smart Meter technology on the disability and the form of resultant accommodation required, if any.

[58] I also note in this regard that the disability, or particulars of the medical condition, must be specified. A vague and medically-unsubstantiated reference by a physician to avoid wireless technology is insufficient to constitute a disability. There must be a medical diagnosis, as well as a contraindication for exposure to such technology because of its effect on the medical condition.

[59] Third, I disagree with Hydro that a class limited to those claiming to be afflicted with EHS would fail to contain common issues of fact and law. For example, the issues of whether or not EHS is a disability, and whether exposure to wireless Smart Meters adversely affects persons with EHS to a degree requiring accommodation are common issues. In any representative complaint, individual circumstances may ultimately need to be explored if a systemic breach of the *Code* is found: *Coast*, paras. 52-56.

[60] In summary, the class, as defined, is overbroad. However, a class restricted to those persons allegedly diagnosed with EHS and who have been advised to avoid exposure to wireless technology would be appropriate as a representative complaint.

Notification, Opt Out and Conflict Issues

[61] Citizens says that it is ideal, as a representative, to facilitate:

- i) Pooling individual resources;
- ii) Effective participatory governance with respect to representational matters;
- iii) Effecting communication with respect to representational matters; and
- iv) Administering the prosecution of the complaint.

[62] Citizens says that it is vastly networked amongst a community of British Columbians opposed to Hydro's installation and operation of wireless Smart Meters. It says that it can be anticipated that it will take sufficient steps to keep the class members advised about the complaint and its status.

[63] Citizens also says there is no potential for a conflict between the members of the class and the Society, and that the complaint is in the interests of the class. The Society also notes that while it has obtained written authorization from each known member of the class, it is not a requirement that such authorization be obtained for the Tribunal to accept a representative complaint for filing.

[64] Citizens also says that, in the event the Tribunal finds there to be deficiencies in the manner in which the representative complaint is brought, then those deficiencies should be addressed by way of amendment to the complaint rather than dismissal: *Corren v. Abbotsford School Board District No. 34*, 2010 BCHRT 32.

[65] In regard to authority, Citizens says that the executed versions of the individual representative complaint forms previously filed with the Tribunal constitute a sufficient basis for determining the issue of authority.

[66] By way of the remedy, Citizens seeks the following:

1. A declaration that Hydro has discriminated against each person in the class by failing to provide each person in the class with an unconditional written commitment that it will refrain from installing and/or operating a wireless smart meter at the individual's place of residence and/or residential complex.
2. An order that Hydro cease and desist the discriminatory conduct forthwith.

[67] Citizens says that the remedy, if granted, would not result in an outcome binding on any person in the class, but would be available to any person in the class. An individual could, however, choose to opt out of the complainant or reject the remedy.

[68] Citizens says that the representative manner of proceeding provides the Tribunal with an effective means of addressing the discrimination that the members of the class have experienced when accessing Hydro's service.

[69] On the other hand, Hydro says that Citizens is neither an adequate nor appropriate representative of the class because:

- i) It has failed to communicate adequately with the Tribunal, and in doing so, has demonstrated a lack of diligence and commitment;
- ii) It has failed to notify the proposed class members of the existence of the complaint and has failed to detail or propose a method for keeping members of the proposed class informed of the progress of the complaint. In this respect, it notes that the class is not restricted to Citizens' members, and that no plans were put forward for communicating with persons who were not members of Citizens. Hydro says that where a complainant has been found to have limited its communication efforts to a small subset of the proposed group or class, the Tribunal has accordingly limited the size of the group or

class before accepting the complaint for filing: *SELI*, para. 80. 86 and *Corren*, para. 68.

- iii) Citizens has failed to notify proposed members of the class of the right to opt-out of the complaint;
- iv) There is a potential conflict between members of the class and Citizens. In this respect, it says that, given how broadly defined the class is, and the differing levels of accommodation to be considered, there will likely be conflicts amongst members in terms of strategy, goals and possible settlement. It says that Citizens' political interest in ceasing wireless Smart Meter installation everywhere is in conflict with the best interests of the individuals it purports to represent; and
- v) Citizens has failed to provide particulars of authority or establish that it has authority.

[70] In respect of the adequacy of the representative complaint, Citizens says that, at this stage of the proceeding, the "litigation plan" need only provide a reasonable framework for the issues reasonably expected to arise as the case proceeds: *Waldman*. It says that the need for a communication plan should not be strictly construed and the development and execution of such a plan should be an ongoing work in progress, analogous to the "litigation plan" referred to in *Waldman*.

[71] After considering the parties' submissions, and for the following reasons, I am persuaded that Citizens is an appropriate representative.

[72] First, in *CSWU No. 3*, the Tribunal held that the *Code* does not require that the members of a group or class authorize the filing of a representative complaint on their behalf, nor does it require the representative to canvas all members of the group or class with respect to their interest in proceeding. The Tribunal noted that:

... human rights legislation creates fundamental public policy. Discrimination is not only an offence *vis-à-vis* the individual affected, but is also an offence to society at large. Requiring every member of a group or class to authorize the filing of a representative complaint on their behalf would weaken the public policy aspect of human rights legislation by treating a representative complaint as nothing more than a consolidation of several individual complaints which the Tribunal has decided to deal with together under s. 21(6).

Requiring a representative to obtain an authorization from, or canvas, members of a vulnerable group would likely act as a deterrent to their participation in a representative complaint. Further, it would clearly not be an efficient, or in some cases even a viable, way of proceeding, for

example, where the group is large or the complaint is filed on behalf of a class. (paras. 73-74)

[73] In this case, the Society has filed written authorizations from numerous individuals. I find it has the requisite authority.

[74] As well, the Tribunal held that the nature and scope of notice and communication obligations with the group or class would depend on the individual circumstances in any complaint. The Tribunal has stated that it will not hold representatives to a standard of perfection, as to do so would undermine the ability of representative complaints to proceed, which would be contrary to the purposes of the *Code: CSWU*, para. 86. I am satisfied that Citizens has proposed a means of communication which is sufficient at this stage of the proceeding.

[75] Having said this, I accept Hydro's position that when communication efforts have been limited to a small subset of a proposed class, the Tribunal has limited the size of the class before accepting the complaint for filing. Since I have already concluded that the class is overbroad, the narrowing of the class should address this issue.

[76] I also note that in *Corren* (para. 53), the Tribunal stated that there is no obligation under the *Code* that a member of a complainant group or class be advised about the right to opt out, though the Tribunal may find it appropriate, in any given circumstance, to direct that a representative provide notice to members of the right to do so. At this stage of the proceeding, I am not persuaded that it is necessary to make such an order.

Summary

[77] In summary, I have concluded that the complaint alleges a potential breach of the *Code*, Citizens is an appropriate representative, but that the class, as currently defined, is overly broad.

[78] If Citizens wishes to amend its complaint to restrict the class to those persons allegedly diagnosed with EHS who have been advised to avoid wireless technology, then it must file such an amendment within 30 days of the date of this decision.

[79] If it does so, then the Tribunal will schedule a pre-hearing conference call to discuss any issues arising out of the amendment, including whether to invite written submissions or, alternatively, hold a hearing on the discrete issue of whether or not EHS is a disability for the purposes of the *Code*.

Enid Marion, Tribunal Member

Régie de l'énergie / Quebec Energy Board - Docket no. R-3770-2011
Authorization of an investment by Hydro-Quebec Distribution – Advanced Metering Project Phase 1

CANADA

RÉGIE DE L'ÉNERGIE / ENERGY BOARD

PROVINCE OF QUEBEC

DISTRICT OF MONTREAL

DOCKET No. R-3770-2011

AUTHORIZATION OF AN INVESTMENT BY
HYDRO-QUEBEC DISTRIBUTION –
ADVANCED METERING PROJECT
PHASE 1

HYDRO-QUEBEC
As Electricity Distributor

Petitioner

-and-

STRATEGIES ENERGETIQUES (S.É.) /
ENERGY STRATEGIES (E.S.)

ASSOCIATION QUEBÉCOISE DE LUTTE
CONTRE LA POLLUTION ATMOSPHERIQUE
(AQLPA) / QUEBEC ASSOCIATION TO FIGHT
AGAINST AIR POLLUTION

Interveners

**THE STATE OF SCIENTIFIC RESEARCH AS TO WHETHER ADVANCED METERS TRANSMITTING BY
RADIOFREQUENCIES, AS PROPOSED IN THE PRESENT CASE, MAY CONSTITUTE A RISK OF SERIOUS OR
IRREVERSIBLE DAMAGE TO HEALTH**

**EXPERT REPORT
DAVID O. CARPENTER**

Filed by :

Stratégies Énergétiques (S.É.) / Energy Strategies (E.S.)
Association québécoise de lutte contre la pollution atmosphérique /
Quebec Association to Fight Against Air Pollution (AQLPA)

April 30, 2012
Revised May 14, 2012

Exhibit SE-AQLPA-7 - Document 1.1

***The state of scientific research as to whether advanced meters transmitting by radiofrequencies, as
proposed in the present case, may constitute a risk of serious or irreversible damage to health***

Expert Report by David O. Carpenter

Filed by Stratégies Énergétiques (S.É.) / Energy Strategies (E.S.) and the AQLPA

*Régie de l'énergie / Quebec Energy Board - Docket no. R-3770-2011
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The state of scientific research as to whether advanced meters transmitting by radiofrequencies, as proposed in the present case, may constitute a risk of serious or irreversible damage to health

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EXPERT OPINION SUMMARY

It is my opinion that the state of scientific research sufficiently establishes a risk that meters transmitting by radiofrequencies as proposed in the present file by Hydro-Quebec may constitute a risk of serious as well as irreversible damage to health, through biological effects other than those resulting from heat. Some individuals or categories of individuals are more susceptible to injury than others (children, pregnant women, elderly, persons with illness, electrosensitive individuals, etc).

Such non thermal effects are reviewed in section 5 of this report.

Therefore, there is justification for examining precautionary or prudent measures that could be applied in addition to the current standards (which are based only on biological effects resulting from heat). Discussion and examples of such possible precautionary or prudent measures are provided in sections 6 and 7 of this report.

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1. THE AUTHOR

1. I am a public health physician, educated at *Harvard Medical School*.

2. My *curriculum vitae* has been filed in the present case as Exhibit C-SE-AQLPA-0060, SE-AQLPA-4, Document 3.

It indicates the various positions I held regarding public health, my participation into various international, national, state and local Committees and the Honors, Awards, Fellowships and Grants I received, as well as over 350 major publications, books and other publications.

3. My current title is *Director of the Institute for Health and the Environment* at the *University at Albany* and *Professor of Environmental Health Sciences* within the *School of Public Health*.

4. Formerly, I was the *Dean of the School of Public Health* at the *University of Albany* and the *Director of the Wadsworth Center for Laboratories and Research of the New York State Department of Health*.

5. I served as the *Executive Secretary* to the *New York State Powerlines Project* in the 1980s, a program of research that showed that children living in homes with elevated magnetic fields coming from powerlines suffered from an elevated risk of developing leukemia.

6. After this, I became the spokesperson on electromagnetic field (EMF) issues for New York during the time of my employment in the *Department of Health*.

7. I have published several reviews and have edited two books on the *Biologic Effects of Electric and Magnetic Fields*.

8. I am also a *Co-Editor* and a *Contributing Author* of the *BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF)*, www.bioinitiative.org.

The *BioInitiative Report* documents bioeffects, adverse health effects and public health conclusions about impacts of electromagnetic radiation (electromagnetic fields including extremely-low frequency ELF-EMF and radiofrequency /microwave or RF-EMF fields).

The public health chapter from this report was subsequently published in a peer-reviewed journal, *Reviews on Environmental Health*, and it and other chapters of the Report were published in the peer-reviewed journal, *Pathophysiology*.

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The BioInitiative Report's « *Preface* », « *Summary for the Public* » and *Synthesis of Conclusions* are filed in the present case as Exhibit C-SE-AQLPA-0076, SE-AQLPA-7, Doc. 5 and that Report is further discussed in section 55 of this present report. The full Report can be accessed at www.bioinitiative.org . The corresponding peer-reviewed scientific articles published in *Pathophysiology* can also be obtained at <http://www.sciencedirect.com/science/journal/09284680/16/2-3> .

9. In 2009, I was invited to present to the *President's Cancer Panel on the subject of powerline and radiofrequency fields and cancer*, and have also testified on this issue before the *United States House of Representatives*. Excerpts from the *Presidential Cancer Panel's Report* are filed in the present case as Exhibit C-SE-AQLPA-0077, SE-AQLPA-7, Doc. 6; that Report is further discussed in sections 33 and 60a of this present report.

10. In sum, I am a public health physician, professor and former public health school Dean with expertise in electrophysiology, low-frequency electromagnetic fields bioeffects, and radiofrequency (RF) and microwave (MW) radiation bioeffects.

2. THE MANDATE AND THE QUESTION SUBMITTED BY THE REGIE DE L'ENERGIE

11. My services have been retained in the present file by Interveners *Stratégies Énergétiques (S.É.) / Energy Strategies (E.S.)* and the *Association québécoise de lutte contre la pollution atmosphérique / Quebec Association to Fight Against Air Pollution (AQLPA)* to submit an expert report regarding Hydro-Quebec's Petition for authorization of its investments for Phase 1 of its Advanced Meters Project, which constitutes present Docket no. R-3770-2011 of the Quebec Regie de l'énergie (Quebec Energy Board).

12. The Quebec Energy Board, in its recent decision no. D-2012-046 of April 20, 2012, specifically asked that my report addresses « *the state of scientific research as to whether advanced meters transmitting by radiofrequencies as proposed by Hydro-Quebec in the present file may constitute a risk of serious or irreversible damage to health* ».

The Quebec Energy Board further indicated that the phrasing of its above question was a reference to the *Quebec Sustainable Development Act*, which defines the *Precautionary Principle* as follows :

6 (j) "*Precaution*": *When there are threats of serious or irreversible damage, lack of full scientific certainty must not be used as a reason for postponing the adoption of effective measures to prevent environmental degradation*

It is further recognized that the *Precautionary Principle* not only applies to Environmental degradation but also to Public Health issues, among others.

3. THE SMART METERS PROPOSED BY HYDRO-QUEBEC

13. I am informed by my clients that the smart meters proposed by Hydro-Quebec in the present file would include two antennas :

- a) a general use antenna for communication between the meter and other surrounding meters and a router using the 900-928MHz frequencies with a power emitter of 27,48 dBm.
- b) a ZigBee card with antenna for eventual communication between the meter and household appliances that would be using the 2400-2483,5 MHz frequencies with a power emitter of 21,20 dBm.

The ZigBee card with antenna would, however, remain dormant in the first years and would only eventually be activated later by Hydro-Quebec. Only the main antenna using the 902-928 MHz frequencies would be activated during the first years. The radiofrequency emissions from that antenna are hereby described as « the Agent ».

My clients inform me that the Landis+Gyr smart meters commissioned by Hydro-Quebec are about 10 cm deep and that the main emitting antenna using the 902-928 MHz frequencies is in the front and side, at 2-3 cm from the exterior of the meter. There is no other barrier preventing a person from approaching and even touching the meter, therefore being at 2-3 cm from the emitting antenna.

14. I am also informed by my clients that said antenna using the 902-928 MHz frequencies would be continuously in use, transmitting approximately 1440 to 2880 pulsed emissions per day.

15. These smart meters would therefore constantly expose persons in the immediate vicinity of the meter.

On that matter, I wish to stress that duration may be an even more potent contributing factor to RF/MW radiation bioeffects than exposure levels. Chronic, such as all-day exposure, is more likely than short and intermittent exposure, such as cell phone use, to produce harmful health effects. Although the exposure levels may be lower, the accumulated exposure over time has the potential to be greater and to cause greater harm.

16. Persons stationed close to the meters, for example when the meters are located inside the kitchen or another room of a dwelling, will receive considerably higher exposure than do others. RF wave reflection on the walls, metal appliances and furniture inside a dwelling further increase RF exposure of its occupants.

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17. I am also informed by my clients that, in most cases, exposure in front of the meters proposed by Hydro-Quebec is substantially higher than behind or on the side of the meters, due to the existence of a reflective metal plate in the back and part of the side of the meter and due to the localization of its emitting antenna.

My clients have provided me with the following table which would represent the maximal power density at 1 m of a meter at various angles on an horizontal plane viewed from above (0° being the front of the meter and 180° being the back of the meter). My clients inform me this table has been translated from the one submitted on page 11 of Hydro-Quebec's report (by Mr. François Robichaud) filed as Hydro-Quebec's Exhibit B-0116, HQD-7, Document 7 (answer to commitment 35) in the present case :

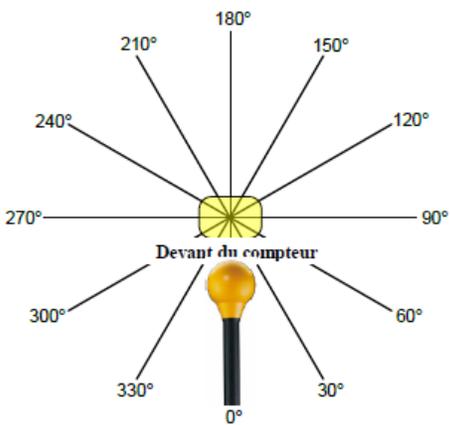
Horizontal plan (View from above) 0° being in front of the meter Meter is at center Measurement device is shown at 0°	Angle (Degree)	Frequency	Maximal power density (at 1 m from meter)
	0°	902,901 MHz	(Highest) 54 680 μW/m ²
	30°	920,604 MHz	38 500 μW/m ²
	60°	912,201 MHz	23 130 μW/m ²
	90°	907,406 MHz	10 090 μW/m ²
	120°	913,396 MHz	5 490 μW/m ²
	150°	908,296 MHz	3 550 μW/m ²
	180°	918,498 MHz	2 010 μW/m ²
	210°	911,257 MHz	4 090 μW/m ²
	240°	925,098 MHz	879,2 μW/m ²
	270°	926,906 MHz	(Lowest) 518,3 μW/m ²
	300°	922,095 MHz	9 540 μW/m ²
	330°	910,088 MHz	26 800 μW/m ²
	360°	912,793 MHz	46 720 μW/m ²

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My clients also inform me of the following similar table contained on page 14 of a report made by YRH (Yves R. Hamel and associates) for Hydro-Quebec and filed as the first part of Exhibit B-0113, HQD-7, Document 4 (answer to commitment 45) in the present case :

Horizontal plan (View from above) 0° being in front of the meter Meter is at center with electrical box behind Measurement device is shown at 0°	Angle (Degree)	Power density (Maximal during transmission) (at 1 m from meter)	Power density (Average during 6 minute observation) (at 1 m from meter)
	0°	(Highest) 55 370 $\mu\text{W}/\text{m}^2$	(Highest) 63,870 $\mu\text{W}/\text{m}^2$
	30°	38 800 $\mu\text{W}/\text{m}^2$	46,850 $\mu\text{W}/\text{m}^2$
	60°	20 440 $\mu\text{W}/\text{m}^2$	28,920 $\mu\text{W}/\text{m}^2$
	90°	5 658 $\mu\text{W}/\text{m}^2$	7,074 $\mu\text{W}/\text{m}^2$
	120°	1 366 $\mu\text{W}/\text{m}^2$	1,706 $\mu\text{W}/\text{m}^2$
	150°	1 633 $\mu\text{W}/\text{m}^2$	1,541 $\mu\text{W}/\text{m}^2$
	180°	3 802 $\mu\text{W}/\text{m}^2$	5,107 $\mu\text{W}/\text{m}^2$
	210°	2 493 $\mu\text{W}/\text{m}^2$	2,864 $\mu\text{W}/\text{m}^2$
	240°	(Lowest) 947 $\mu\text{W}/\text{m}^2$	(Lowest) 0,980 $\mu\text{W}/\text{m}^2$
	270°	1 478 $\mu\text{W}/\text{m}^2$	2,017 $\mu\text{W}/\text{m}^2$
	300°	13 040 $\mu\text{W}/\text{m}^2$	17,630 $\mu\text{W}/\text{m}^2$
	330°	42 330 $\mu\text{W}/\text{m}^2$	57,550 $\mu\text{W}/\text{m}^2$

18. I am also informed by my clients that their witness, Mr. Stephane Belainsky, had made the following observations in his amended report filed as Exhibit SE-AQLPA-0029, SE-AQLPA-2, Document 2 :

- The exterior meters (6 subjects measured, being visits nos. 2, 3, 4, 5, 6 and 7) had a power density averaging in time **42,2 $\mu\text{W}/\text{m}^2$** (taken at 1 m in front of the meter), with peaks averaging **6695 $\mu\text{W}/\text{m}^2$** . These averages do not include an unexplained atypical measurement of one meter (visit no. 1) which had a power density averaging in time 2400 $\mu\text{W}/\text{m}^2$, with a peak of 49800 $\mu\text{W}/\text{m}^2$; a re-measurement of that same meter at a later date (visit no. 1A) however showed a closer to normal power density averaging in time 88 $\mu\text{W}/\text{m}^2$, with a peak of 8484 $\mu\text{W}/\text{m}^2$.
- The interior meters facing occupants (two subjects measured, being visits nos. 8 and 10) had a power density averaging in time had a power density averaging in time **136 $\mu\text{W}/\text{m}^2$** (taken at 1 m in front of the meter), with peaks averaging **19 142 $\mu\text{W}/\text{m}^2$** .
- An additional measurement (visit no. 9) in a children's playroom, **at 3 m behind** a group of 53 meters (located in an adjacent meter room) showed a power density averaging in time **66 $\mu\text{W}/\text{m}^2$** , with a peak of **3198 $\mu\text{W}/\text{m}^2$** .

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I am also informed by my clients that on page 28 of Hydro-Quebec's report (by Mr. François Robichaud) filed as Hydro-Quebec's Exhibit B-0116, HQD-7, Document 7 (answer to commitment 35), measurements taken at 1 m from a residential meter average a power density of **48,64 $\mu\text{W}/\text{m}^2$** , and between **30,76 $\mu\text{W}/\text{m}^2$ and 32,96 $\mu\text{W}/\text{m}^2$** in the case of commercial-institutional-industrial (CII) meters. These measurements are in the same range as those provided above in Mr. Belinsky's report.

My clients inform me that, on page 20 of Hydro-Quebec's report (by Mr. François Robichaud) filed as Hydro-Quebec's Exhibit B-0116, HQD-7, Document 7 (answer to commitment 35), measurements taken inside meter rooms show power densities (which I presume are taken at 1 m) averaging 577,83 $\mu\text{W}/\text{m}^2$, 995,33 $\mu\text{W}/\text{m}^2$, 1053,6 $\mu\text{W}/\text{m}^2$ and 1794,0 $\mu\text{W}/\text{m}^2$. I am informed by my clients that that same report shows on pages 24-27 that, at various locations one meter away outside these rooms, average power densities were measured at 154,40 $\mu\text{W}/\text{m}^2$, 62,35 $\mu\text{W}/\text{m}^2$, 9,95 $\mu\text{W}/\text{m}^2$, 13,69 $\mu\text{W}/\text{m}^2$, 20,59 $\mu\text{W}/\text{m}^2$, 11,28 $\mu\text{W}/\text{m}^2$, 26,15 $\mu\text{W}/\text{m}^2$; the construction materials forming these rooms and their configuration vary and may explain these variations in power densities measured.

19. These results therefore show that :

- Average power densities measured at 1 m from exterior meters do not exceed the exterior-threshold of 1 000 $\mu\text{W}/\text{m}^2$ recommended in the *BioInitiative Report*, which is later described in the present report (save for one atypically high result on one meter which later was re-measured and gave a result below the threshold). We do not have any measurements however at a lesser distance from the meter and are informed that a person may approach and even touch the meter, thus could be located as close at 2-3 cm from the meter.
- Inside meter rooms, average power densities far exceed the interior-threshold of 100 $\mu\text{W}/\text{m}^2$ recommended in the *BioInitiative Report* later described in the present report ; it is however expected that these rooms will not normally be accessed by the public. In one case, the average power density at one meter away from such room is shown to exceed the interior-threshold of 100 $\mu\text{W}/\text{m}^2$ but, in the other cases measured, it is inferior to that interior-threshold.
- More problematic, however, are meters situated inside occupied rooms and facing their occupants (meters in a kitchen, etc.), where measurements show the average power density exceeds the interior-threshold of 100 $\mu\text{W}/\text{m}^2$ at 1 m from the meter. We must also keep in mind that we do not have any results at a lesser distance.

- All the above results are less than the recommended threshold of 6 000 000 $\mu\text{W}/\text{m}^2$ of both FCC and Health Canada. These measurements were however all taken at 1 m or more from the antenna; we do not have any measurements at a lesser distance.

It is to be noted that, at very close distance (inside the interior field from the antenna), extrapolation is not easily feasible from measurements taken at further distance. A real measurement is preferable.

4. STRUCTURE OF THE ANSWER TO THE QUESTION SUBMITTED BY THE REGIE DE L'ENERGIE

20. As indicated above, the Quebec Energy Board has asked me to report on « *the state of scientific research as to whether advanced meters transmitting by radiofrequencies as proposed by Hydro-Quebec in the present file may constitute a risk of serious or irreversible damage to health* ».

21. The answer to this question depends on the level of power density to which the subjects are exposed (itself being dependent on the distance between the source of emission and the subject and the interior or exterior location) and the duration of exposure, and may also vary with other characteristics of the exposure as well as the characteristics of the subjects (adults vs. children, etc.) as indicated in sections 5 and 6 of the present report. The specific characteristics of the advanced meters proposed by Hydro-Quebec in the present file, as communicated to me, were indicated in section 3 of the present report and are further commented in section 7.

Most importantly, the answer to this question depends on whether or not it is recognized that there are sufficient scientific indications of the possibility that radiofrequencies (RF) electromagnetic fields exposure may cause biological and health effects other than those resulting from heat. The scientific community is divided on this issue.

22. In section 5 of the present Report, we enumerate a number of epidemiological and laboratory research linking RF electromagnetic fields exposure with various non-thermal biological effects and their conclusions as well as several meta-analysis of the scientific literature on the subject.

23. In section 6 of the present Report, we elaborate on the lack of unanimity of the scientific community on these non-thermal biological effects and on the emerging notion that Precautionary or Prudent Measures might be appropriate as a means of managing that scientific lack of unanimity, without modifying the existing standards at the moment.

5. EPIDEMIOLOGICAL AND LABORATORY RESEARCH LINKING RF ELECTROMAGNETIC FIELDS EXPOSURE WITH VARIOUS NON-THERMAL BIOLOGICAL EFFECTS

24. It is generally accepted within the relevant scientific community and has been established beyond any reasonable doubt that adverse human health effects occur at far lower levels of RF/MW radiation exposure than those that cause measureable heating, particularly where the wavelength approaches body-part size and thus maximizes absorption, where the wavelength has resonance with the water molecule, where there is a more complex, modulated wave, where there is chronic exposure duration, and where exposed persons lack the capacity voluntarily to remove themselves from the radiation sources. It must, however, be acknowledged that biological effects do not necessarily constitute human health hazards.

25. Some effects are known to occur at several hundred thousand times below the FCC public exposure guidelines and the similar guidelines of Health Canada's Safety Code no. 6 (of 6 000 000 $\mu\text{W}/\text{m}^2$ for the 902-928 MHz bandwidth) which are set based on the assumption, which we believe is incorrect, that there are no adverse health effects at exposures that do not cause easily measureable heating.

It is further to be noted that FCC guidelines also only apply to 30-minute public exposures and Health Canada's Safety Code no. 6 only applies to 6-minute public exposures; they are however being used to infer safety at durations >30 minutes (FCC) and durations >6 minutes (Health Canada's Safety Code no. 6).

26. Exposure to high-frequency RF and MW radiation have been linked to a variety of adverse health outcomes. Some of the many adverse effects reported to be associated with and/or caused by RF/MW radiation include cancer, neurologic, endocrine, immune, cardiac, reproductive and other effects.

27. Studies of isolated cells have shown that RF/MW exposures may cause changes in cell membrane function, cell communication, metabolism, activation of proto-oncogenes, and can trigger the production of stress proteins at exposure levels below the above FCC and Health Canada guidelines. Resulting effects in cellular studies include DNA breaks and chromosome aberrations, cell death including death of brain neurons, increased free radical production, activation of the endogenous opioid system, cell stress and premature aging.

28. Human studies of comparable RF/MW radiation parameters show changes in brain function including memory loss, retarded learning, performance impairment in children, headaches and neurodegenerative conditions, melatonin suppression and sleep disorders, fatigue, hormonal imbalances, immune dysregulation such as allergic and inflammatory responses, cardiac and blood pressure problems, genotoxic effects like miscarriage, cancers such as childhood and adult leukemia, childhood and adult brain tumors, and more.

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29. There is consistent evidence for increased incidence of cancer and other adverse effects in individuals who live near to high-power short-wave, AM, FM and TV transmission towers. This is particularly relevant because, like WI-FI and smart meters, radio and TV transmission towers give continuous, whole-body radiation, not just radiation to the head.

30. In addition, it is to be noted that, should the 2,4 GHz ZigBee antennas of the proposed Hydro-Quebec Landis+Gyr meters be activated in the future, their wavelength, at ~ 12.2 cm or ~ 4.8 inches, would be more absorbable by children's and adults' bodies and brains than radio or TV wavelengths. The harmfulness of such radiation therefore likely exceeds that of radio or TV towers. The 2.4 GHz frequency is similar to that used by a microwave oven. Such frequency was chosen for the oven because of its wavelength and harmonic resonance with the water molecule, to ensure the most efficient absorption by living tissues and effective heating by way of the agitation of water at the molecular level.

31. Like second-hand smoke, EMF and RF/MW radiation involve complex mixtures, where different frequencies, intensities, durations of exposure(s), modulation, waveforms and other factors are known to produce variable effects, often more harmful with greater complexity. Decades of scientific study have produced substantial evidence that EMF and RF/MW radiation may be considered neurotoxic, carcinogenic and genotoxic. Sources of fields and radiation include but are not limited to: power lines, navigational radar, cell phones, cordless phones [or Digitally Encoded Cordless Transmission Devices (D.E.C.T.) phones], cell towers, smart meters and their grids or infrastructure, "smart" boards, meters and grids, WiMax and wireless internet (WI-FI).

32. The RF/MW radiation and low-frequency EMF science that currently exists includes hundreds of studies dating back to the 1920s. On the basis of this vast body of literature, many public health experts, myself included, believe that it is likely society will face markedly increased incidence of neurotoxic effects, neurodegenerative diseases, cancers and genotoxicity in the future, resulting from the extreme and mostly involuntary exposure to RF/MW radiation and EMFs.

33. In public health science, it is generally accepted that vulnerable subgroups exist within any human population. This is also recognized specifically for RF/MW radiation and fields. These groups include children, pregnant women, the elderly, those with preexisting illnesses and/or impairments and some individuals who show electrical hypersensitivity. Children are more vulnerable to RF/MW radiation because of the susceptibility of their developing nervous systems. RF/MW radiation penetrates children's brains more than adult's because children's skulls are thinner, their brains smaller, and their brain tissue is more conductive than those of adults, and since it has a higher water content and ion concentrations. The Presidential Cancer Panel found in 2010 that children « are at special risk due to their smaller body mass and rapid physical development, both of which magnify their vulnerability to known carcinogens, including

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radiation » (pages vii and 98). http://deainfo.nci.nih.gov/advisory/pcp/annualReports/pcp08-09rpt/PCP_Report_08-09_508.pdf . Excerpts from the *Presidential Cancer Panel's Report* are filed in the present case as Exhibit C-SE-AQLPA-0077, SE-AQLPA-7, Doc. 6. It is further discussed in sections 9 and 60a of this present report. Furthermore, should the ZigBee antenna of the proposed Hydro-Quebec Landis+Gyr meters be activated, absorption of RF/MW energy in tissues of the head of children would even be greater due to the similarity between the wavelength at 2.4 GHz size and the children's head.

34. There is also abundant literature showing that some individuals, described as electrosensitive, may encounter symptoms more intense than other individuals.

35. FCC public RF/MW radiation exposure guidelines (and the similar Health Canada Safety Code no. 6 guidelines) are based on the height, weight and stature of a 6-foot tall man, not children or adults of smaller stature. The guidelines do not take into account the unique susceptibility of growing children to RF/MW radiation exposures. Since children are growing, their rate of cellular activity and division is more rapid, and they are at more risk for DNA damage and subsequent cancers. Growth and development of the central nervous system is still occurring well into the teenage years, such that the neurological impairments predictable by the extant science may have great impact upon development, cognition, learning, and behavior.

36. Prenatal EMF exposure has been identified as a risk factor for childhood leukemia and brain cancer, and is associated with miscarriage. Children are largely unable to remove themselves from exposures to harmful substances in their environments. Their exposure is involuntary.

37. When a smart meter is in operation inside a dwelling, persons in the immediate vicinity have no choice but to allow the meter to expose them to microwave radiation that is much higher than exists naturally on Earth.

38. The evidence for harm from RF radiation as a cause of cancer and other diseases continues to grow. And when we focus on MW radiation, particularly pulse-modulated radiation, on long, non-intermittent duration and on more vulnerable subgroups such as children, we see that the cancer outcome is being firmly established.

Amongst the epidemiologic studies showing cancer outcomes, the following are particularly strong.

This first list is of studies where the whole body is exposed to RF radiation.

- a. Dode AC, Leao M, Tejo FdeAF, Gomes ACR, Dode DC, Dode MC, Moreira CW, Condessa VA, Albinatti C and Calaffa WT. *Mortality by neoplasia and cellular*

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telephone base stations in the Belo Horizonte municipality, Minas Gerais State, Brazil. Sci Total Environ 409: 3649-3665:2011, <http://www.sciencedirect.com/science/article/pii/S0048969711005754> and <http://www.ncbi.nlm.nih.gov/pubmed/21741680?dopt=Abstract>. This study shows higher rates of cancer (neoplasia) mortality in people living close to cell phone towers than for people living further away. It is filed in the present case as Exhibit C-SE-AQLPA-0078, SE-AQLPA-7, Doc. 7.

- b. Oberfeld G. Environmental Epidemiology Study of Cancer Incidence in the Municipalities of Hausmannstatten & Vasoldsberg (Austria), 2008. This government-commissioned study found significantly increased cancer risk relative to a lower-exposure reference category, 23x higher for breast cancer and 121x higher for brain tumors, with strong exposure-effect relations. The full 111-page report is available in German at <http://www.hese-project.org/hese-uk/en/papers/hausmannstatten2008.pdf>. We file, as Exhibit C-SE-AQLPA-0079, SE-AQLPA-7, Doc. 8, a brief English summary of this report published at http://www.hese-project.org/hese-uk/en/niemr/hausmannstatten_summary.pdf.
- c. Michelozzi P, Capon A, Kirchmayer U, Forastiere F, Biggeri A, Barca A and Perucci CA. Adult and childhood leukemia near a high-power radiostation in Rome, Italy. Am J Epidemiol. 155: 1098-1103: 2002 <http://aje.oxfordjournals.org/content/155/12/1096.full.pdf> . The authors show that there is a significant elevation of childhood leukemia among residents living near to Vatican Radio, and that the risk declines with distance away from the transmitter (OR 2.2, 1.0-4.1). This article is filed in the present case as Exhibit C-SE-AQLPA-0080, SE-AQLPA-7, Doc. 9.
- d. Ha M, Im H, Lee M, Kim HJ, Kim BC, Gimm YM and Pack JK. Radiofrequency radiation exposure from AM radio transmitters and childhood leukemia and brain cancer. Am J Epidemiol 166: 270-279: 2007 <http://aje.oxfordjournals.org/content/166/3/270.full.pdf+html> . Leukemia and brain cancer in children in Korea were investigated in relation to residence within 2 km of AM radio transmitters. There was a significant elevation in rates of leukemia but not of brain cancer (OR 2.15, 1.00-4.67). This article is filed in the present case as Exhibit C-SE-AQLPA-0081, SE-AQLPA-7, Doc. 10.
- e. Park SK, Ha M, Im HJ. Ecological study on residences in the vicinity of AM radio broadcasting towers and cancer death: preliminary observations in Korea. Int Arch Occup Environ Health. 2004 Aug;77(6):387-94. This study found higher mortality areas for all cancers and leukemia in some age groups in the area near the AM towers.

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- f. Dolk H, Shaddick G, Walls P, Grundy C, Thakrar B, Kleinschmidt I, Elliot P. Cancer Incidence near radio and television transmitters in Great Britain. I – Sutton-Colfield transmitter, and II. AI high-power transmitters. Am J Epidemiol 1997; 145(1):1-9 and 10-17. In the first study, there was a statistically significant increase in cancer; in the second, a small but significant increase in adult leukemia.
- g. Hocking B, Gordon IR, Grain HL, Harfield GE. Cancer incidence and mortality and proximity to TV towers. Medical J of Australia. 165:601-605. At extremely low exposure levels, there was an association between increased childhood leukemia incidence and mortality and proximity to TV towers.
- h. Grayson JK. Radiation exposure, socioeconomic status, and brain tumor risk in the US Air Force: A nested case-control study. Am J Epidemiol 1996; 143:480-6. This study found an association between exposure to ELF and RF/MW radiation and brain tumors.
- i. Szmigielski S. Cancer morbidity in subjects occupationally exposed to high frequency (radiofrequency and microwave) electromagnetic radiation. Sci Total Environ 1996;180:9-17. <http://www.ncbi.nlm.nih.gov/pubmed/8717316> and <http://www.sciencedirect.com/science/article/pii/0048969795049150> This study showed huge increases in leukemia and Non-Hodgkin's lymphomas.
- j. Eger H, Hsagen KU, Lucas B, Vogel P and Voit H. The influence of being physically near to a cell phone transmission mast on the incidence of cancer. Umwelt-Medizin-Gesellschaft 17, 4; 1-7 : 2004. <http://blog.cat/gallery/17983/17983-97698.pdf> Over the period 1994-2004 individuals living within 400 meters of a cell phone tower had three times rates of cancer compared to those living further away.

39. The strongest evidence for harm from RF radiation comes from studies of individuals using cell phone for prolonged periods of time, which gives a localized exposure to the ipsilateral brain (ipsilateral designating the side of the head where the cell phone is being used), auditory nerve and parotid gland in the cheek.

- a. Hardell L, Carlberg M, Soderqvist F and Mild KH. Meta-analysis of long-term mobile phone use and the association with brain tumours. Internat J Oncology 12 : 1097-1103. In ten studies of glioma, cell phone use for more than ten year gave an OR of 1.2 (95%CI=0.8-1.9). For ipsilateral cell phone use for more than 10 year the OR = 2.0 (1.2-3.4). There was also a significant relation for acoustic neuroma and ipsilateral cell phone use for ten years or more, but no relation for meningioma.
- b. Levis AG, Minicuci N, Ricci P, Gennaro V and Gabisa S. Mobile phones and head tumours. The discrepancies in cause-effect relationships in the epidemiological

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studies – how do they arise? Environ Health 2011, 10,59. When studies that were blinded, free from errors and bias were considered cell phone use for more than ten years resulted in a near doubling in ipsilateral glioma and acoustic neuroma.

- c. Myung SK, Ju W, McDonnell DD, Lee YJ, Ksazinet G, Cheng CT and Moskowitz JM. Mobile phone use and risk of tumors: A meta-Analysis. J Clin Oncology 10.1200/JCO.2008.21.6366. Reviewed 465 publications that reported on 12344 cases of cancer and 25572 controls. Risk of developing brain cancer was OR+1.8 for more than ten years use.
- d. The INTERPHONE Study Group. Internatl J Epidemiology 2010; 1-20. Brain tumour risk in relation to mobile telephone use: results of the INTERPHONE international case-control study. While ever vs. never using a cell phone did not increase risk of brain cancer, there was a significant OR= 2.18 for use for ten or more years, OR=1.82 for use for 1640 hours or more and OR=1.31 for more than 270 calls, all for glioma.

It is to be noted that a certain controversy surrounded the publication and interpretation of the Interphone results. At first, the scientific community had difficulty in obtaining all the data from the study in order to peer-review the interpretation submitted by its coordinators. **Scientists associated with the BioInitiative Group even had to publicly request those data from the Interphone Group so they could be peer-reviewed (http://www.bioinitiative.org/freeaccess/documents/final_bio_to_interphone.pdf).** The data was later obtained. The coordinators of the Group however dismissed their own results showing a correlation between exposure and non thermal health effects, arguing various bias affected the credibility of their results. The Interphone Group therefore, in its publication, concluded that the results were not significant and did not attach part of their data to their publication. The BioInitiative Group disagreed with the limited interpretation of their own results published by the InterPhone Group (http://www.bioinitiative.org/freeaccess/press_release/docs/Interphone.pdf).

The WHO's *International Agency for Research on Cancer Monograph Working Group* itself affirmed, in the *Lancet Oncology*, that: « *Although both the INTERPHONE study and the Swedish pooled analysis are susceptible to bias—due to recall error and selection for participation—the Working Group concluded that the findings could not be dismissed as reflecting bias alone, and that a causal interpretation between mobile phone RF-EMF exposure and glioma is possible. A similar conclusion was drawn from these two studies for acoustic neuroma, although the case numbers were substantially smaller than for glioma. Additionally, a study from Japan found some evidence of an increased risk for acoustic neuroma*

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associated with ipsilateral mobile phone use. »
 (<http://www.wirelesswatchblog.org/wp-content/uploads/2011/06/Lancet-June-2011-11.pdf>)

Furthermore, Morgan and als stressed that the Interphone study design led to underestimate the health effects of RF. This comment, which I endorsed with many other colleagues, was already filed as Exhibit C-SE-AQLPA-0048, SE-AQLPA-5, Document 15.

39a. These results globally indicate that while localized RF radiation may cause local cancer, leukemia is the cancer of greatest concern with whole body exposure.

40. Additional studies show neurologic, immune, endocrine, reproductive and cardiac, adverse health effects from low-dose, chronic exposure to RF/MW radiation in humans:

- a. Volkow ND, Tomasi D, Wange GJ, Vaska P, Fowler JS, Teland F, Alexoff D, Logan J and Wong C. Effects of cell phone radiofrequency signal exposure on brain glucose metabolism. JAMA 305 : 808-814 : 2011. In healthy participants and compared with no exposure, 50-minute cell phone exposure was associated with increased brain glucose metabolism in the region closest to the antenna. This shows direct effects of RF radiation on the brain with cell phone use.
- b. McCarty DE, Carrubba S, Chesson AL, Frilor C, Gonzalex-Toledo E and Marino AA. Electromagnetic hypersensitivity : Evidence for a novel nuerological syndrome. Internat J Neurosci 121 : 670-676 : 2011. In a female physician who is electrosensitive, blinded application of EMFs triggered temporal pain, headache, muscle twitching and skipped heartbeats within 100 s of field application. This study was already filed in the present case as Exhibit C-SE-AQLPA-0037, SE-AQLPA-5, Doc. 5.
- c. Papageorgiou CC, Hountala CD, Maganioti AE, Kyprianou MA, Rabavilas AD, Papadimitriou GN, Capsalis CN. Effects of WI-FI signals on the p300 component of event-related potentials during an auditory hayling task. J Integr Neurosci 2011 Jun;10(2):189-202. This study concludes that WI-FI exposure may exert gender-related alterations on neural activity.
- d. Altpeter ES, Roosli M et al. Effect of Short-wave magnetic fields on sleep quality and melatonin cycle in humans: The Schwarzenburg shut-down study. Bioelectromagnetics 27:142-150, 2006. Sleep quality improved and melatonin excretion increased when the transmitter was shut down.

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- e. Abelin T et al. Sleep disturbances in the vicinity of the short-wave broadcast transmitter Schwarzenburg. *Somnologie* 9:203-209, 2005. There is strong evidence of a causal relationship between operation of a short-wave radio transmitter and sleep disturbances in the surrounding population.
- f. Hutter HP et al. Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations. *Occup Environ Med* 2006;63:307-313, 2006. There was a significant relation of some symptoms, especially headaches, to measured power density, as well as effects on wellbeing and performance.
- g. Preece AW, Georgious AG, Duunn EJ, Farrow SC. *Occup Environ Med* 2007 64:402-8. Compared to control village, there were highly significant differences in the reporting of migraine, headache and dizziness military and cell phone antenna systems.
- h. Robertson HA et al. Low-frequency pulsed electromagnetic field exposure can alter neuroprocessing in humans *J. R. Soc. Interface* (2010) 7, 467–473 doi:10.1098/rsif.2009.0205. A functional magnetic resonance imaging study demonstrated how the neuromodulation effect of extremely low-frequency magnetic fields influences the processing of acute thermal pain. The study concludes that magnetoreception may be more common than presently thought. This study was already filed in the present case as Exhibit C-SE-AQLPA-0043, SE-AQLPA-5, Document 10.
- i. Buchner K, Eger, H. Changes of clinically important neurotransmitters under the influence of modulated RF fields – a long-term study under real-life conditions. *Umwelt-Medizin-Gesellschaft* 24(1):44-57, 2011. There is clear evidence of health-relevant effects, including increase in adrenaline/noradrenaline, subsequent decrease in dopamine from a new MWemitting base station. During counterregulation, trace amine PEA decreased and remained decreased. Clinically documented increases in sleep problems, cephalgia, vertigo, concentration problems and allergies followed the onset of new microwave transmissions.
- j. Eliyahu I, Luria R, Hareuveny R, Margaliot M, Neiran N and Shani G. Effects of radiofrequency radiation emitted by cellular telephones on the cognitive functions of humans. *Bioelectromagnetics* 27: 119-126: 2006. A total of 36 human subjects were exposed to PM MW and were tested on four distinct cognitive tasks. Exposure to the left side of the brain slows left-hand response time in three of the four tasks.
- k. Barth A, Winker R, Ponocny-Seliger E, Mayrhofer W, Ponocny I, Sauter C and Vana N. *Occup Environ Med* 65: 342-345: 2008. A meta-analysis for

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neurobehavioural effects due to electromagnetic field exposure emitted by GSM mobile phones. The authors looked at 19 studies of cognitive function in cell phone users, and found in the meta-analysis that there is evidence for a decreased reaction time, altered working memory and increased number of errors in exposed persons.

- i. Augner C, Hacker GW, Oberfeld G, Florian M, Hitzl W, Hutter J and Pauser G. Effects of exposure to base station signals on salivary cortisol, alphaamylase and immunoglobulin A. *Biomed Environ Scie* 23: 199-207: 2010. This was a human experimental study with exposure to PM MW radiation wherein immune indicators were monitored after five 50-minute sessions. The researchers found dose-dependent changes in cortisol and alpha-amylase.
- m. Avendano C, Mata A, Sanchez Sarimiento CA and Doncel GF. Use of laptop computers connected to internet through WI-FI decreases human sperm motility and increases sperm DNA fragmentation. *Fert Steril*, 2012, In press. In this study human sperm were exposed to WI-FI from a laptop, and were found to show reduced motility after a 4-hour exposure. The results are consistent with other publications (see Agarwal et al., *Fert Steril* 89: 124-128: 2008) that reported that those who use cell phone regularly have reduced sperm count.
- n. Baste V, Riise T and Moen BE (2008) *Int J Epidemiol* 23: 369-377: 2008. Radiofrequency electromagnetic fields: male infertility and sex ratio of offspring. This is a study of Norwegian Navy personnel chronically exposed to RF fields on the job. The rates of infertility were related to level of exposure in a dose-dependent fashion.

41. Many cellular and animal studies, of which the following are but a few, support conclusions of cancer, genotoxicity, neurotoxicity and other health outcomes from RF/MW radiation.

- a. Sinha R. Chronic non-thermal exposure of modulated 2450 MHz microwave radiation alters thyroid hormones and behavior of male rats. *Int. J. Radiation Biol.* 84:6:505-513, 2008. This study concluded that the radiation was sufficient to alter the levels of thyroid hormone as well as emotional reactivity compared to controls.
- b. Nittby H, Grafstrom G, Tian DP, Malmgren L, Brun A, Persson BRR, Salfor LG and Eberhardt J. *Bioelectromagnetics* 29: 219-232: 2008. This study showed cognitive impairment in rats after long-term exposure to PM MW radiation. This study of rats shows that after 2 hours per week for 55 weeks there was impaired memory for objects in exposed as compared to sham animals.

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- c. Kimmel S et al. Electromagnetic radiation: Influences on honeybees (*Apis mellifera*). A significant difference between non-exposed and fully irradiated bees was the result of the influence of high-frequency PM RF/MW radiation.
 - d. Panagopoulos DJ et al. Bioeffects of mobile telephony radiation in relation to its intensity or distance from the antenna. *Int. J Radiat Biol*, 86;(5):345-357, 2010. The PM MW radiations at 900 and 1800 MHz decreased the reproductive capacity by cell death induction, with an increased bioactivity “window” at 10 $\mu\text{W}/\text{cm}^2$, and still evident down to 1 $\mu\text{W}/\text{cm}^2$.
 - e. Everaert J, Bauwens D. A possible effect of electromagnetic radiation from mobile phone base stations on the number of breeding house sparrow (*passer domesticus*). *Electromagnetic Biology and Medicine*, 26:63-72, 2007. Long-term exposure to higher-level low-intensity PM MW radiation negatively affects the abundance or behavior of House Sparrows in the wild.
 - f. Magras I, Xenos T. RF Radiation-Induced Changes in the Prenatal Development of Mice. *Bioelectromagnetics* 18:455-461, 1997. Near almost 100 TV and FM broadcast transmitters, with exposure levels between 0.168 $\mu\text{W}/\text{cm}^2$ and 1.053 $\mu\text{W}/\text{cm}^2$, found in the more exposed groups testicular damage and decreasing size of litters to irreversible infertility.
 - g. Balmori A. Electromagnetic pollution from phone masts. Effects on wildlife, *Pathophysiology* 2009. This large review of wildlife effects concludes, “pulsed telephony microwave radiation can produce effects on nervous, cardiovascular, immune and reproductive systems,” including damage to the nervous system by altering EEG and changes to the blood-brain barrier, disruption of the circadian rhythms (sleep-wake) by interfering with the pineal gland and hormonal imbalances, changes in heart rate and blood pressure, impairment of health and immunity towards pathogens, weakness, exhaustion, growth problems, problems in building the nest or impaired fertility, embryonic development, hatching percentage, genetic and developmental problems, problems of locomotion, promotion of tumors and more.
- 42.** Exposure thresholds for harmful effects are lowered in human populations and individuals when duration is increased.
- 43.** While nearly all the lower frequency bands have already been allocated by public authorities in developed countries for specific types of radio transmissions, and transmission of ever more information content on any given channel requires greater bandwidth, each new deployment undermines further the integrity of the population’s health. Engineers who design these systems have no training that would qualify them to consider the effects on biologic

systems, which is why public health scientists need to be called in to policymaking prior to contracting and deployment, not after the fact.

44. The following studies explain the mechanisms of interaction between RF/MW radiation and biologic systems at the cellular level.

- a. The cell membrane recognition process -- which includes signal transduction and 'heat-shock protein' release -- was first discerned by Litovitz and his co-workers at Catholic University of America in the mid-1990s.

Below are a few references that make the point.

- i. Litovitz, T., C. Montrose, et al. (1994). "Superimposing spatially coherent electromagnetic noise inhibits field induced abnormalities in developing chick embryos." *Bioelectromagnetics* 15(2): 105-113.
- ii. DiCarlo, A., J. Farrell, et al. (1998). "A simple experiment to study electromagnetic field effects: Protection induced by short term exposures to 60 Hz magnetic fields." *Bioelectromagnetics* 19(8): 498-500.
- iii. Penafiel, L., T. Litovitz, et al. (1997). "Role of modulation on the effect of microwaves on ornithine decarboxylase activity in L929 cells." *Bioelectromagnetics* 18(2): 132-141.
- iv. Dicarlo, A. L., Michael T. Hargis, L. Miguel Penafiel, Theodore A. Litovitz, A. (1999). "Short-term magnetic field exposures (60Hz) induce protection against ultraviolet radiation damage." *International journal of radiation biology* 75(12): 1541-1549.
- v. Litovitz, T., C. Montrose, et al. (1990). "Amplitude windows and transiently augmented transcription from exposure to electromagnetic fields." *Bioelectromagnetics* 11(4): 297-312.
- vi. Litovitz, T., M. Penafiel, et al. (1997). "The role of temporal sensing in bioelectromagnetic effects." *Bioelectromagnetics* 18(5): 388-395.
- vii. Litovitz, T., L. Penafiel, et al. (1997). "Role of modulation in the effect of microwaves on ornithine decarboxylase activity in L929 cells." *Bioelectromagnetics* 18: 132-141.]

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- viii. Litovitz, T., D. Krause, et al. (1993). "The role of coherence time in the effect of microwaves on ornithine decarboxylase activity." *Bioelectromagnetics* 14(5): 395-403.
- b. Cell membrane reaction is lipid peroxidation.
- i. Serban, M. and V. Ni (1994). "Lipid peroxidation and change of plasma lipids in acute ischemic stroke." *Romanian journal of internal medicine= Revue roumaine de médecine interne* 32(1): 51.
 - ii. Vileno, B., S. Jeney, et al. (2010). "Evidence of lipid peroxidation and protein phosphorylation in cells upon oxidative stress photogenerated by fullerenols." *Biophysical chemistry*.
 - iii. Maaroufi, K., E. Save, et al. (2011). "Oxidative stress and prevention of the adaptive response to chronic iron overload in the brain of young adult rats exposed to a 150 kilohertz electromagnetic field." *Neuroscience*.
 - iv. Nelson, S. K., S. K. Bose, et al. (1994). "The toxicity of high-dose superoxide dismutase suggests that superoxide can both initiate and terminate lipid peroxidation in the reperfused heart." *Free Radical Biology and Medicine* 16(2): 195-200.
 - v. Alvarez, J. G. and B. T. Storey (1989). "Role of glutathione peroxidase in protecting mammalian spermatozoa from loss of motility caused by spontaneous lipid peroxidation." *Gamete research* 23(1): 77-90.
 - vi. Devasagayam, T., K. Bloor, et al. (2003). "Methods for estimating lipid peroxidation: An analysis of merits and demerits." *Indian journal of biochemistry & biophysics* 40(5): 300-308.
- c. Free-Radical Damage :
- i. Ozgur, E., G. Güler, et al. (2010). "Mobile phone radiation-induced free radical damage in the liver is inhibited by the antioxidants n-acetyl cysteine and epigallocatechin-gallate." *International journal of radiation biology*(00): 1-11.
 - ii. Gutteridge, J. and X. C. Fu (1981). "Enhancement of bleomyciniron free radical damage to DNA by antioxidants and their inhibition of lipid peroxidation." *FEBS letters* 123(1): 71.

d. mRNA :

- i. Yan, J. G., M. Agresti, et al. (2009). "Qualitative Effect on mRNAs of Injury-Associated Proteins by Cell Phone Like Radiation in Rat Facial Nerves. *Electromagnetic Biology and Medicine* 28(4): 383-390.
- ii. Yan, J. G., M. Agresti, et al. (2008). "Upregulation of specific mRNA levels in rat brain after cell phone exposure." *Electromagnetic Biology and Medicine* 27(2): 147-154.
- iii. Simbürger, E., A. Stang, et al. (1997). "Expression of connexin43 mRNA in adult rodent brain." *Histochemistry and cell biology* 107(2): 127-137.
- iv. Chen, J., H. C. He, et al. (2010). "Effects of Pulsed Electromagnetic Fields on the mRNA Expression of RANK and CAII in Ovariectomized Rat Osteoclast-Like Cell." *Connective Tissue Research* 51(1): 1-7.

e. Epigenetic changes.... environmentally induced genetic change:

- i. Migliore, L. and F. Copped (2009). "Genetics, environmental factors and the emerging role of epigenetics in neurodegenerative diseases." *Mutation Research/Fundamental and Molecular Mechanisms of Mutagenesis* 667(1-2): 82-97.

f. Micronuclei formation :

- i. Tice, R. R., G. G. Hook, et al. (2002). "Genotoxicity of radiofrequency signals. I. Investigation of DNA damage and micronuclei induction in cultured human blood cells." *Bioelectromagnetics*, 23(2): 113-126.
- ii. Lerchl, A. (2009). "Comments on "Radiofrequency electromagnetic fields (UMTS, 1,950 MHz) induce genotoxic effects in vitro in human fibroblasts but not in lymphocytes" by Schwarz et al. (*Int Arch Occup Environ Health* 2008: doi: 10.1007/s00420-008-0305-5)." *Int Arch Occup Environ Health* 82(2): 275-278.
- iii. Vijayalaxmi and T. J. Prihoda (2009). "Genetic damage in mammalian somatic cells exposed to extremely low frequency electro-magnetic fields: a meta-analysis of data from 87 publications (1990-2007)." *Int J Radiat Biol* 85(3): 196-213.

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- iv. Sannino, A., M. Sarti, et al. (2009). "Induction of adaptive response in human blood lymphocytes exposed to radiofrequency radiation." *Radiat Res* 171(6): 735-742.

g. DNA repair disruption :

- i. Brusick, D., R. Albertini, et al. (1998). "Genotoxicity of radiofrequency radiation. DNA/Genetox Expert Panel." *Environ Mol Mutagen* 32(1): 1-16.
<http://www.ncbi.nlm.nih.gov/pubmed/9707093> and
[http://onlinelibrary.wiley.com/doi/10.1002/\(SICI\)1098-2280\(1998\)32:1%3C1::AID-EM1%3E3.0.CO;2-Q/abstract;jsessionid=426C74204A95D2EAD8182A0C624B7C3F.d03t04](http://onlinelibrary.wiley.com/doi/10.1002/(SICI)1098-2280(1998)32:1%3C1::AID-EM1%3E3.0.CO;2-Q/abstract;jsessionid=426C74204A95D2EAD8182A0C624B7C3F.d03t04)
- ii. Belyaev, I. Y., E. Markova, et al. (2009). "Microwaves from UMTS/GSM mobile phones induce long-lasting inhibition of 53BP1/gamma-H2AX DNA repair foci in human lymphocytes." *Bioelectromagnetics* 30(2): 129-141.
- iii. Sun, L. X., K. Yao, et al. (2006). "[Effect of acute exposure to microwave from mobile phone on DNA damage and repair of cultured human lens epithelial cells in vitro]." *Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi* 24(8): 465-467.

h. Immune response suppression :

- i. Lyle, D. B., P. Schechter, et al. (1983). "Suppression of Tlymphocyte cytotoxicity following exposure to sinusoidally amplitude-modulated fields." *Bioelectromagnetics* 4(3): 281-292.
- ii. Elekes, E., G. Thuroczy, et al. (1996). "Effect on the immune system of mice exposed chronically to 50 Hz amplitude-modulated 2.45 GHz microwaves." *Bioelectromagnetics* 17(3): 246-248.
- iii. Dabala, D., D. Surcel, et al. (2008). "Oxidative and Immune Response in Experimental Exposure to Electromagnetic Fields." *Electromagnetic field, health and environment: proceedings of EHE'07*: 105.
- iv. Surcel, D., D. Dabala, et al. (2009). "Free Radicals, Lipid Peroxidation and Immune Response in Experimental Exposure to Electromagnetic Fields." *Epidemiology* 20(6): S118.

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45. As indicated above, the Quebec Energy Board has asked me to indicate if these research show that RF exposure « *may constitute a risk of serious or irreversible damage to health* ».

The above non-thermal biological effects do indeed constitute a risk serious damage to health.

Furthermore, such damage may be irreversible or reversible only with difficulty. For example, cancer may be reversible if treated early, but its treatment may be extremely invasive on the patient and is not always successful. Treatment for brain cancer may leave permanent neurologic impairment, even if the patient survives. Persistent headache and loss of attention may result in impaired learning in children, with life-long consequences. Neurological impairments such as Alzheimer are not reversible and their progression may only be slowed down in certain cases.

6. THE DIVISION WITHIN THE SCIENTIFIC COMMUNITY AND THE EVOLUTION TOWARDS PRECAUTION AND PRUDENCE

46. The scientific community is divided in its acceptance of the numerous research findings like the above showing a link between RF exposure and non-thermal health effects.

In section 6.1, I will discuss this division within the scientific community and how it affects the standard setting organizations.

In section 6.2, I will examine the recent evolution of various organizations towards the adoption precautionary measures, as a manner of taking into account scientific uncertainty even as the standards on RF exposure remain unchanged at the moment.

6.1 The division within the scientific community

47. The numerous research findings showing a link between RF exposure and non-thermal health effects, as those enumerated above in section 5, are denied by those who believe that RF/MW exposures that do not cause measureable heating cannot have biological effects.

48. Many in the physics and engineering communities indeed assume that RF fields are not supposed to affect biological systems other than by heating, because they do not have sufficient energy to break chemical bonds and create charged particles (ions). Electromagnetic fields at frequencies equal or higher than ultraviolet light (such as x-rays and gamma rays, with short wavelengths and high frequencies) are classified as ionizing radiation because they have sufficient energy to create charged particles (ions) by breaking chemical bonds and cause direct damage to DNA, resulting in mutations. It is well accepted that ionizing radiation can cause nonthermal biological effects including genetic mutations and cancer. Nonionizing radiation on the other hand (with long wavelengths and low frequencies, which includes visible light as well as RF and other frequency bands with common applications) is assumed to have only thermal effects. However this view has been shown to not be correct by studies since the 1970s by an accumulation of epidemiological and laboratory research which had clearly demonstrated biological effects and, indeed, human health hazards, at RF/MW exposures that do not have sufficient energy to directly break chemical bonds.

Medical and biological research findings showing nonionizing radiation having non-thermal biological effects are therefore are therefore considered an anomaly under conventional theory.

As mentioned in the research listed in section 5, the evidence for increased risk of brain tumors, acoustic neuromas and parotid gland tumors in individuals who have used a cell phone

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for 10 years or more is consistent, and the tumors occur only on the side of the head where the phone is used. There is also strong and consistent evidence for increased risk of leukemia in individuals who live near to high power AM radio transmission towers.

These demonstrated non-thermal biological effects of RF exposure are however not supposed to exist under conventional physics theory.

49. Standards setting organizations aimed at regulating RF exposure have for a long time been dominated by physicists and engineers, often with close ties with the industry, with few input from biological and medical science. As mentioned later in section 6.2, this has only been recently been evolving.

Standards setting organizations also often explicitly take into account the economic impacts of the standards when faced with scientific uncertainty.

Both because of their training and because of their ties with the industry, members of most of these organizations have been reluctant to take the above biological findings into account into the exposure limits they set. At present, the exposure limits set by FCC and Health Canada as well as those set by various other standard setting organizations are based solely on biological effects resulting from heat.

Furthermore, these limits are based on the incorrect biological assumption that body temperatures must increase at least 1°C to lead to potential biological impacts and the impacts of absorbing RF within the band of the electromagnetic spectrum that smart meters use would only be limited to behavioral disruption. These limits do not take into account the scientific research that show tissue heating may result in many adverse health effects other than “behavioral disruption”. These limits also do not take into account the accepted biological fact that every enzyme system in the body is exquisitely sensitive to temperature and may increase activity by even a fraction of a degree increase in temperature. What is defined as “nonthermal” effect is therefore partly a function of our ability to measure the temperature increase.

50. To understand the seriousness of this Agent of PM RF/MW radiation in interaction with populations and individuals, we need to consider some basic facts in addition to the many relevant and reliable studies above. Shortwave, AM, FM, TV, smart meters and cell phone frequencies are harmful to human health even when at low intensity if exposure is continuous or prolonged.

There are only a few of the many studies of RF/MW radiation infrastructure such as base stations that fail to show adverse effects.

51. Standards setting organizations have until now generally refused to accept epidemiological and laboratory research findings linking RF electromagnetic fields exposure with various non-thermal biological effects, as being inconclusive and requiring further research.

The difficulty stems from the fact that, although links have been demonstrated repeatedly between RF electromagnetic fields exposure and non-thermal biological effects, there is *a lack of a comprehensive biological theory explaining why these effects take place*, and therefore *causality* cannot, at the present time, be demonstrated with certainty.

Also in some cases, experimental results could not be duplicated; in some cases attempts to duplicate results showed negative results or variations in the results. A 126-page list of scientific articles on the subject, which was already filed as Exhibit C-SE-AQLPA-0039, SE-AQLPA-5, Doc. 6, illustrates this, by identifying with the letter P those studies that correlated non thermal health incidences with radiation exposure and with the letter N those that not find such correlation. Several of the scientific articles and reports quoted in the present report also comment both on research showing positive results and on research showing negative results.

The coexistence of positive and negative findings is a normal part of the research process; they both indicate that biological systems are complex and that different variables need to be isolated in order to fully understand these systems. Research is still needed in order to determine to what extent non-thermal biological effects may vary with frequency, with modulation and depend on the pulsed (instead of continuous) character of RF emissions. Emissions from smart meters are pulsed and a recent study by Mc Carty et al has shown that certain symptoms may be caused primarily by field transitions (off-on, on-off) rather than the presence of the field itself (This research was already filed as Exhibit C-SE-AQLPA-0037 and is mentioned in section 5 of the present report). There also may be variance between the levels of reaction of different subjects for reasons that still remain to be explained. This is what the research process is about. **In biology and medicine there is nothing that is 100 % proven; our understanding of various illnesses such as cancer and Alzheimer for example is still largely incomplete. We rely on statistical significance and weight of evidence and, therefore, on judgment, when drawing conclusions about health effects.**

Standard setting organizations have so far however generally been reluctant to take into account biological findings showing positive results.

52. For instance, the FCC-appointed guideline-setting Commission, ASTM-IEEE, in 1991 referred in its conclusions to RF/MW radiation, the Agent, as a 'Hazard,' specifically setting a 'Hazard Threshold.'

It had however been discovered that, even amongst the 120 studies chosen by the Committee to prove the validity of its Hazard Threshold, there were 15 studies that concluded adverse effects at levels lower than the Hazard Threshold, thus disproving its validity. Three of these

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studies actually showed adverse effects at less than 10 percent of the Hazard Threshold. FCC did not take those into consideration when setting its guidelines.

53. Industry also largely controls the funding of research in this matter, which represents an additional difficulty.

Anke Huss, Matthias Egger, Kerstin Hug, Karin Huwiler-Müntener and Martin Röösl, in Source of Funding and Results of Studies of Health Effects of Mobile Phone Use: Systematic Review of Experimental Studies, Environmental Health Perspectives Vol.115 No. 1 January 2007 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1797826/pdf/ehp0115-000001.pdf> addressed the concern as to whether the source of funding of studies of the effects of low-level radiofrequency radiation was associated with the results of studies. They conducted a systematic review of studies of controlled exposure to radiofrequency radiation with health-related outcomes (electroencephalogram, cognitive or cardiovascular function, hormone levels, symptoms, and subjective well-being). They examined that studies funded exclusively by industry were least likely to report a statistically significant result: The odds ratio was 0.11 (95% confidence interval, 0.02–0.78), compared with studies funded by public agencies or charities. This finding was not materially altered in analyses adjusted for the number of outcomes reported, study quality, and other factors. They arrived at the following conclusion :

The National Radiological Protection Board (NRPB 2004) reviewed studies of health effects from radiofrequency (RF) fields and concluded that “scientific evidence regarding effects of RF field exposure from mobile phones on human brain activity and cognitive function ... has included results both supporting and against the hypothesis of an effect.” We found that the source of funding explains some of the heterogeneity in the results from different studies. The association was robust and little affected by potential confounding factors such as sample size, study design, or quality.

They recommend that the interpretation of results from studies of health effects of radiofrequency radiation should take sponsorship into account.

In 2012, the *Union of Concerned Scientists (UCS)* also has published a major report stressing the influence industry sponsors may have in influencing research subjects, research protocols and study design, withholding publication of results or preventing continuation of studies.

6.2 The evolution towards Precaution and Prudence

54. In 2007, the *BioInitiative Report*, to which I participated, was aimed at « *restoring the balance* », by providing a more comprehensive review of the scientific research available, including those research that demonstrated a link between RF exposure and non-thermal biological effects, research that standard setting organizations were failing to properly take into account.

55. Generally speaking, standards setting organizations have not modified their standards on RF exposure subsequent to the *BioInitiative Report* and have expressed the view it was inconclusive. Earlier criticisms of the *BioInitiative Report* have also reproached this review to place too much emphasis on the research that showed positive results and less on those that showed negative results (See: **COMAR Technical Information Statement**, http://www.emfandhealth.com/12265_COMAR_2009.pdf) - We answer to this criticism by referring to the context that the *BioInitiative report* was aimed at « *restoring the balance* » on these research.

What we have seen however in the past few years is an evolution of decision makers towards the application of the *Precautionary Principle*, as a manner of integrating scientific research that links RF exposure to non thermal biological effects, without modifying the standards at the moment.

This evolution towards the application of the *Precautionary Principle* intervenes as further research results continue to become available that confirm these links RF exposure to non thermal biological effects.

These new research were helped in part by the review of earlier scientific literature provided by the *BioInitiative report*.

As mentioned earlier, the public health chapter from the *BioInitiative report* was subsequently published in a peer-reviewed journal, *Reviews on Environmental Health*, and it and other chapters of the *Report* were published in the peer-reviewed journal, *Pathophysiology*. The *BioInitiative Report's* « *Preface* », « *Summary for the Public* » and *Synthesis of Conclusions* are filed in the present case as Exhibit C-SE-AQLPA-0076, SE-AQLPA-7, Doc. 5 and that Report is further discussed in section 8 of this present report. The full Report can be accessed at www.bioinitiative.org. The corresponding peer-reviewed scientific articles published in *Pathophysiology* can also be obtained at <http://www.sciencedirect.com/science/journal/09284680/16/2-3>.

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Furthermore, new meta-analysis strengthen the observations that links between RF exposure and non thermal biological effects do exist. Among others, we mentioned in section 5 the following :

- a. Hardell L, Carlberg M, Soderqvist F and Mild KH. Meta-analysis of long-term mobile phone use and the association with brain tumours. *Internat J Oncology* 12 : 1097-1103. In ten studies of glioma, cell phone use for more than ten year gave an OR of 1.2 (95%CI=0.8-1.9). For ipsilateral cell phone use for more than 10 year the OR = 2.0 (1.2-3.4). There was also a significant relation for acoustic neuroma and ipsilateral cell phone use for ten years or more, but no relation for meningioma.
- b. Myung SK, Ju W, McDonnell DD, Lee YJ, Ksazinet G, Cheng CT and Moskowitz JM. Mobile phone use and risk of tumors : A meta-Analysis. *J Clin Oncology* 10.1200/JCO.2008.21.6366. Reviewed 465 publications that reported on 12344 cases of cancer and 25572 controls. Risk of developing brain cancer was OR+1.8 for more than ten years use.
- c. Barth A, Winker R, Ponocny-Seliger E, Mayrhofer W, Ponocny I, Sauter C and Vana N. *Occup Environ Med* 65: 342-345: 2008. A meta-analysis for neurobehavioural effects due to electromagnetic field exposure emitted by GSM mobile phones. The authors looked at 19 studies of cognitive function in cell phone users, and found in the meta-analysis that there is evidence for a decreased reaction time, altered working memory and increased number of errors in exposed persons.
- d. Vijayalaxmi and T. J. Prihoda (2009). "Genetic damage in mammalian somatic cells exposed to extremely low frequency electro-magnetic fields: a meta-analysis of data from 87 publications (1990-2007)." *Int J Radiat Biol* 85(3): 196-213.

56. Medical and biological experts have started to become more present in various international or national organizations aimed at issuing standards or recommendations.

Standard organizations are starting to become more aware as to the need of ensuring independence of their committee members as well as public representation.

As Maisch (2001) mentioned in *Radiofrequency/Microwave Radiation and the International Agency for Research on Cancer (IARC). The problem of conflict of interest & commercial influence in WHO agencies and the need for public interest representation*, http://www.next-up.org/pdf/who_conflict.pdf , « the IARC requirements (pre 2005) for handling conflict of interest were revised and made more transparent as a direct result of a series of critical articles published in *The Lancet Oncology* and *The Lancet* in 2003 that questioned the credibility of the IARC. Among a number of concerns, the articles highlighted concerns about “the inappropriate

*influence of invited specialists who had links to industry". As a result of the concerns, The Lancet introduced the Policy Watch section that summarized the key findings of every IARC Monograph meeting up to 12 months before the corresponding Monograph was published. As a result of this 'surveillance' of the IARC Monograph process, by 2005 IARC had revised its conflict of interest policy in line with the Lancet's Policy Watch (Collingridge, D., Increased transparency in IARC Monograph programme, *The Lancet Oncology*, Vol. 6, October 2005. [http://www.thelancet.com/journals/lanonc/article/PIIS1470-2045\(05\)70364-8/fulltext](http://www.thelancet.com/journals/lanonc/article/PIIS1470-2045(05)70364-8/fulltext) , Accessed May 3, 2011.). »*

Maisch however contended that inappropriate influence of invited specialists who had links to industry in IARC meetings was still a major issue that needed to be addressed. In his article, he specifically mentioned Dr. Michel Plante of Hydro-Quebec as one of those problematic invited participants that had links with the industry.

57. As early as of 1990, the US Environmental Protection Agency ("EPA") had determined RF/MW radiation a "probable carcinogen".

During that period, reputed author Paul Brodeur created a stir by the publication of a series of articles alleging a cover-up of serious human health effects.

58. In 2011 the World Health Organization's International Agency for Research on Cancer (WHO-IARC) identified RF radiation as a possible human carcinogen.

59. The *American Academy of Environmental Medicine* recently issued a position paper on « Electromagnetic and radiofrequency field effect on human health » and made the following specific recommendations :

- a. An immediate caution on smart meter installation due to potentially harmful RF exposure.
- b. Accommodation for health considerations regarding EMF and RF exposure, including exposure to wireless smart meter technology.
- c. Recognition that electromagnetic hypersensitivity is a growing problem worldwide and
- d. Use of safer technology, including for smart meters, such as hard-wiring, fiber optics or other non-harmful methods of data transmission.

A summarized statement resolved by the *American Academy of Environmental Medicine* was already filed in the present case as Exhibit C-SE-AQLPA-0045, SE-AQLPA-5, Document 12.

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60. Although the existing standards are not being changed, the Parliamentary Assemblies of the European Community and of the Council of Europe both have issued recommendations in favor of a more cautious approach towards RF exposure, referring to the *BioInitiative Report*.

60a. In 2010, the 2008-2009 Annual Report of the U.S. President's Cancer Panel stated that :

Sharp controversy exists in the scientific community as to possible adverse health effects from exposure to low frequency electromagnetic energy. The use of cell phones and other wireless technology is of great concern, particularly since these devices are being used regularly by ever larger and younger segments of the population. At this time, there is no evidence to support a link between cell phone use and cancer. However, the research on cancer and other disease risk among long-term and heavy users of contemporary wireless devices is extremely limited. Similarly, current and potential harms from extremely low frequency radiation are unclear and require further study. (Executive Summary, page iv, Underlined by us)

More generally, the President's Cancer Panel affirmed that:

The prevailing regulatory approach in the United States is reactionary rather than precautionary. That is, instead of taking preventive action when uncertainty exists about the potential harm a chemical or other environmental contaminant may cause, a hazard must be incontrovertibly demonstrated before action to ameliorate it is initiated. [...]

U.S. regulation of environmental contaminants is rendered ineffective by five major problems: (1) inadequate funding and insufficient staffing, (2) fragmented and overlapping authorities coupled with uneven and decentralized enforcement, (3) excessive regulatory complexity, (4) weak laws and regulations, and (5) undue industry influence. Too often, these factors, either singly or in combination, result in agency dysfunction and a lack of will to identify and remove hazards. (Executive Summary, page iii, Underlined by us)

Industry has exploited regulatory weaknesses, such as government's reactionary (rather than precautionary) approach to regulation. (Executive Summary, page viii, Underlined by us)

The President's Cancer Panel issued a call for precautionary action :

At this time, we do not know how much environmental exposures influence cancer risk and related immune and endocrine dysfunction.

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Environmental contamination varies greatly by type and magnitude across the nation, and the lifetime effects of exposure to combinations of chemicals and other agents are largely unstudied. Similarly, the cancer impact of exposures during key “windows of vulnerability” such as the prenatal period, early life, and puberty are not well understood. Nonetheless, while these diverse effects often are difficult to quantify with existing technologies and research methods, in a great many instances, **we know enough to act.**

The Nation Needs a Comprehensive, Cohesive Policy Agenda Regarding Environmental Contaminants and Protection of Human Health.

Environmental health, including cancer risk, has been largely excluded from overall national policy on protecting and improving the health of Americans. It is more effective to prevent disease than to treat it, but cancer prevention efforts have focused narrowly on smoking, other lifestyle behaviors, and chemopreventive interventions. **Scientific evidence on individual and multiple environmental exposure effects on disease initiation and outcomes, and consequent health system and societal costs, are not being adequately integrated into national policy decisions and strategies for disease prevention, health care access, and health system reform.**

Children Are at Special Risk for Cancer Due to Environmental Contaminants and Should Be Protected.

Opportunities for eliminating or minimizing cancer-causing and cancer-promoting environmental exposures must be acted upon to protect all Americans, but especially children. They are at special risk due to their smaller body mass and rapid physical development, both of which magnify their vulnerability to known or suspected carcinogens, including radiation. Numerous environmental contaminants can cross the placental barrier; to a disturbing extent, babies are born “pre-polluted.” Children also can be harmed by genetic or other damage resulting from environmental exposures sustained by the mother (and in some cases, the father). **There is a critical lack of knowledge and appreciation of environmental threats to children’s health and a severe shortage of researchers and clinicians trained in children’s environmental health.**

Continued Epidemiologic and Other Environmental Cancer Research Is Needed.

[...] Meaningful measurement and assessment of the cancer risk associated with many environmental exposures are hampered by a lack of accurate

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measurement tools and methodologies. This is particularly true regarding cumulative exposure to specific established or possible carcinogens, gene-environment interactions, emerging technologies, and the effects of multiple agent exposures. [...]

Support for large, longitudinal studies to clarify the nature and magnitude of cancer risk attributable to environmental contaminants must continue.

The capacity to collect biologic samples at the inception of studies is essential; even if current technologies do not allow these samples to be fully utilized at this time, it must be assumed that such technologies will evolve and enable use of collected biosamples to provide essential study baseline data. Personal health data privacy issues that currently limit research access to data and biosamples will need to be addressed. (Executive Summary, page vi-viii, Underlined by us)

The principal recommendations of the *President's Cancer Panel* are consequently the following :

1. *A precautionary, prevention-oriented approach should replace current reactionary approaches to environmental contaminants in which human harm must be proven before action is taken to reduce or eliminate exposure.*

11. *Public health messages should be developed and disseminated to raise awareness of environmental risks and encourage people to reduce or eliminate exposures whenever possible.*

S1. *It is vitally important to recognize that children are far more susceptible to damage from environmental carcinogens and endocrine-disrupting compounds than adults.*

S3. *Adults and children can reduce their exposure to electromagnetic energy by wearing a headset when using a cell phone, texting instead of calling, and keeping calls brief.*

S7. *Each person can become an active voice in his or her community. To a greater than many realize, individuals have the power to affect public policy by letting policymakers know that they strongly support environmental cancer research and measures that will reduce or remove from the environment toxics that are known or suspected carcinogens [...].*

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The *President's Cancer Panel* also recommends additional funding for research and further development of scientific tools and methods :

5. [...] Methods for long-term monitoring and quantification of electromagnetic energy exposures related to cell phones and wireless technologies are urgently needed given the escalating use of these devices by larger and younger segments of the population and the higher radiofrequencies newer devices produce.

Excerpts from the *Presidential Cancer Panel's Report* are filed in the present case as Exhibit C-SE-AQLPA-0077, SE-AQLPA-7, Doc. 6; that Report was further discussed in sections 9 and 33 of this present report.

61. The World Health Organization's International Agency for Research on Cancer (WHO-IARC)'s 2011 classification of RF radiation as a possible human carcinogen itself opens the door to a more prudent approach even when the existing standards are met.

62. Other national or local organizations have also recommended prudence in various countries.

As an example, Health Canada, although it did not change its standards solely based on health effects, has recommended prudence in RF exposure in the following terms in a memo issued in October 2011 (http://www.hc-sc.gc.ca/ahc-asc/media/advisories-avis/2011/2011_131-eng.php), even when its own existing standards are met :

The International Agency for Research on Cancer's (IARC) recent classification of RF energy as "possibly carcinogenic to humans" is an acknowledgement that limited data exists that suggests RF energy might cause cancer. At present, the scientific evidence is far from conclusive and more research is required.

Health Canada reminds cell phone users that they can take practical measures to reduce RF exposure. The department also encourages parents to reduce their children's RF exposure from cell phones since children are typically more sensitive to a variety of environmental agents. As well, there is currently a lack of scientific information regarding the potential health impacts of cell phones on children.

What consumers can do:

- Limit the length of cell phone calls
- Replace cell phone calls with text messages or use "hands-free" devices
- Encourage children under the age of 18 to limit their cell phone usage

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62a. On April 25, 2012, the British independent Advisory Group on Non-ionising Radiation (AGNIR), commissioned by the British Health Protection Agency (HPA) arrived at the conclusion that there was still no « *convincing evidence* » that RF field exposures below guideline levels cause health effects in adults or children. Nevertheless, the British Health Protection Agency (HPA) notes that « *AGNIR considers there are still limitations to the published research that preclude a definitive judgment. In particular, AGNIR refers to possible effects on the electroencephalogram (recorded electrical signals from the brain) that have been reported at exposure levels similar to the highest ones that can occur when using mobile phones. AGNIR cautions that these effects have not been conclusively established, and considers it is unclear whether they would have any health consequences.* ».

The British Health Protection Agency (HPA) also notes that « *AGNIR concludes that, although some positive findings have been reported in a few studies, overall the evidence does not suggest that using mobile phones causes brain tumours or any other type of cancer. The data, however, are essentially restricted to periods of less than 15 years from first exposure because mobile phones have only been in widespread use for that long. AGNIR considers it will be important to continue monitoring the evidence over the coming years, including that from national brain tumour trends, which have so far given no indication of any risk* » in AGNIR's view.

The British Health Protection Agency (HPA) reminds that a previous UK's Independent Expert Group on Mobile Phones (IEGMP) recommended a precautionary approach to mobile phone technologies (the Stewart Report), a recommendation that HPA had accepted. HPA concludes on April 25, 2012 that « *the continuing possibility of: (a) biological effects, although not apparently harmful, occurring at exposure levels within the ICNIRP guidelines, and (b) the limited information regarding cancer effects in the long term, together support continuation of the UK's long-standing precautionary approach to mobile phones. While technology has developed substantially over the ten years since the IEGMP report, the principles behind the IEGMP recommendations should continue to be observed. Excessive use of mobile phones by children should be discouraged, while adults should make their own choices as to whether they wish to reduce their exposures, but be enabled to do this from an informed position.// Measures that could be taken to reduce exposures were described in the IEGMP report and in the subsequent Mobile Phones and Health 2004 report, but the technology continues to develop, which alters the options available. Moving the phone away from the body, as when texting, results in very much lower exposures than if a phone is held to the head. Also, the use of the more recent 3G mode of transmission instead of the older 2G mode will produce much lower exposures. Other options to reduce exposure include using hands-free kits, keeping calls short, making calls where the network signals.* »

The British Health Protection Agency (HPA)'s April 25, 2012 statement is available at http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1317133825459.

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The initial IEGMP Report (Stewart Report) is available at : www.iegmp.org.uk.

The AGNIR Report of 2012 which led the British *Health Protection Agency (HPA)*'s to nevertheless maintain a precautionary approach is available at : http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1317133827077 .

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63. In the *BioInitiative Report*, we had recommended, as a precautionary or prudent measure, to limit RF exposure to a maximal power density of 1000 $\mu\text{W}/\text{m}^2$ outside and 100 $\mu\text{W}/\text{m}^2$ inside, even though there is no certainty of a complete absence of risk even under these limits, pending further research. These limits were therefore a reasonable assessment, given the possible risks already identified by current research.

Meeting these precautionary or prudent limits may be accomplished even as the existing standards remain unchanged for the moment. As further discussed, precautionary or prudent measures are, by definition, additional to existing standards as a means for managing scientific uncertainty or as interim measures during the process that could lead, in the future, in changing the standards.

These recommendations are the result of several scientific observations including those mentioned in the following graphs :

Cell Phone Frequency Studies Reporting Bioeffects and Adverse Health Effects Below FCC Safety Limits (Power Density)

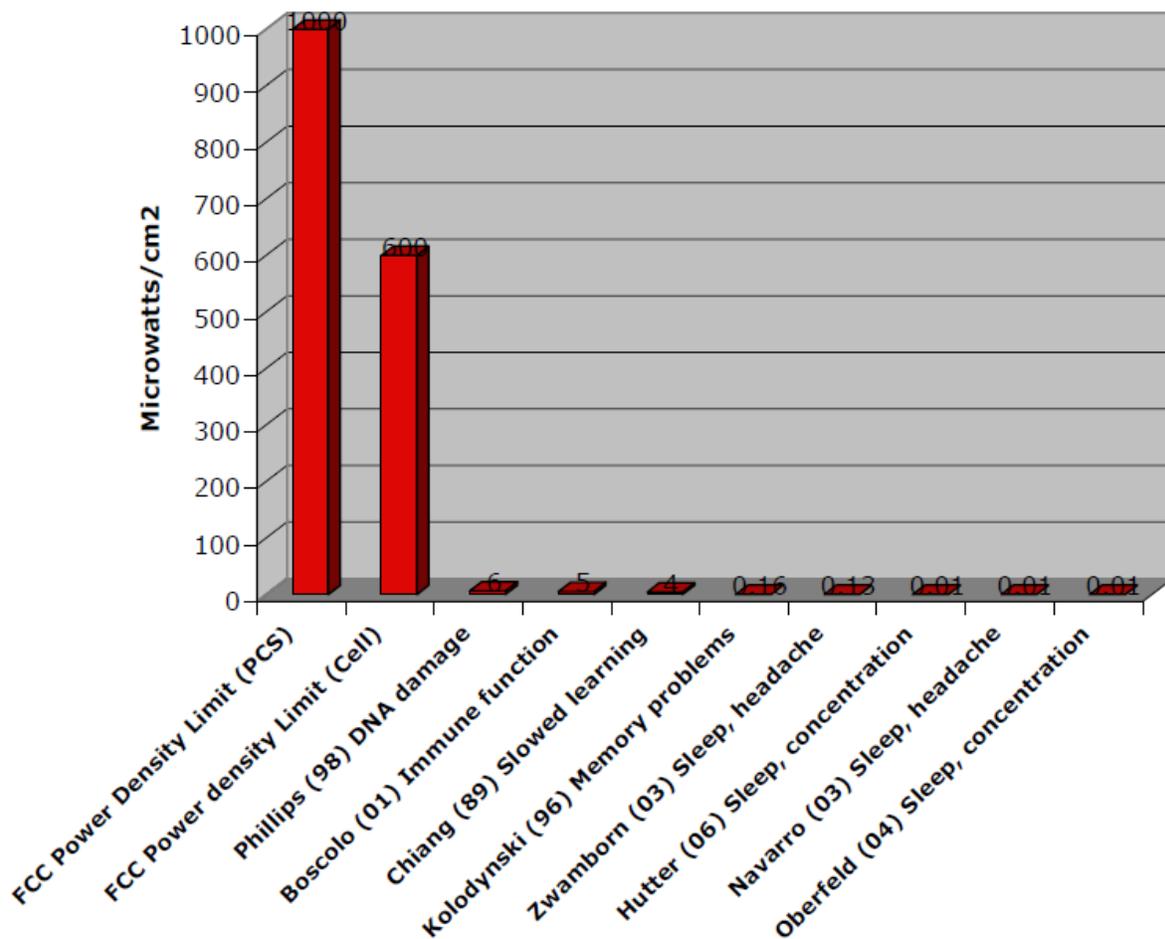


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The state of scientific research as to whether advanced meters transmitting by radiofrequencies, as proposed in the present case, may constitute a risk of serious or irreversible damage to health

Expert Report by David O. Carpenter

Filed by Stratégies Énergétiques (S.É.) / Energy Strategies (E.S.) and the AQLPA

SAR Studies at Cell Phone Frequencies Reporting Bioeffects and Adverse Health Effects Below FCC Safety Limits

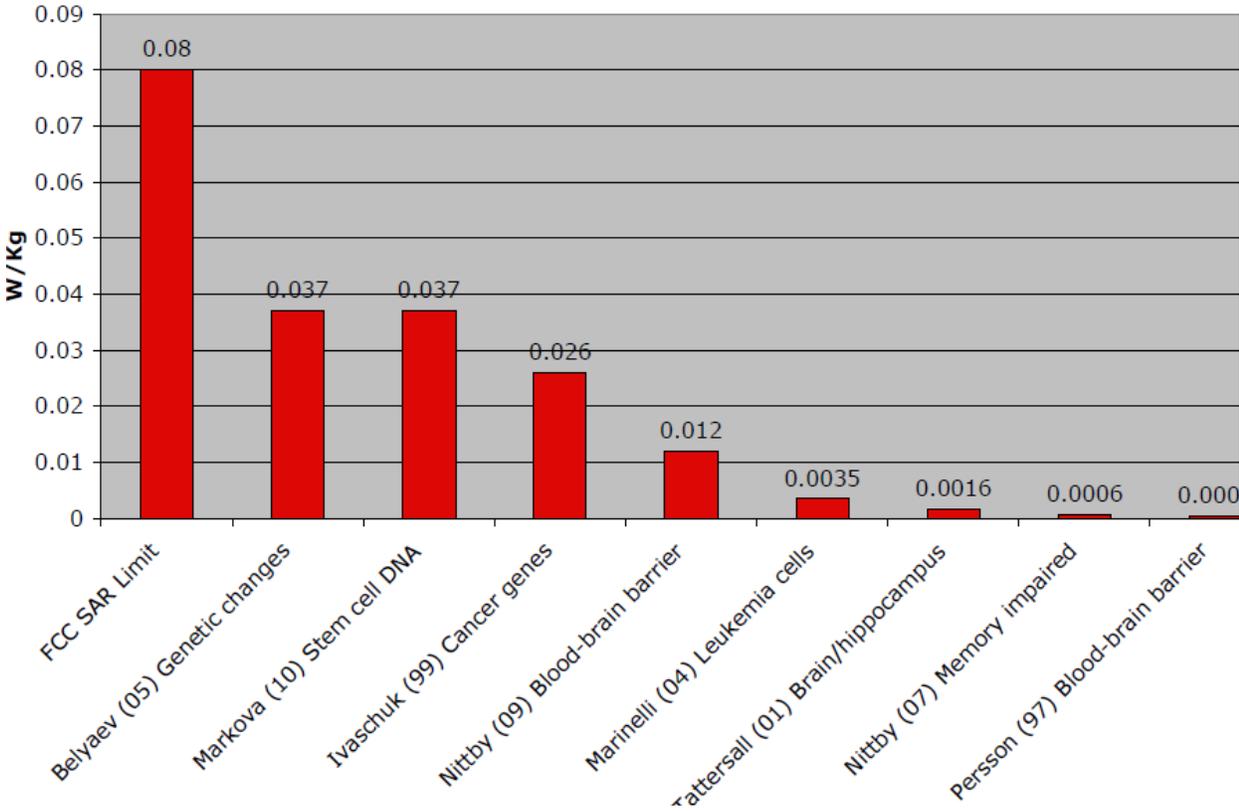
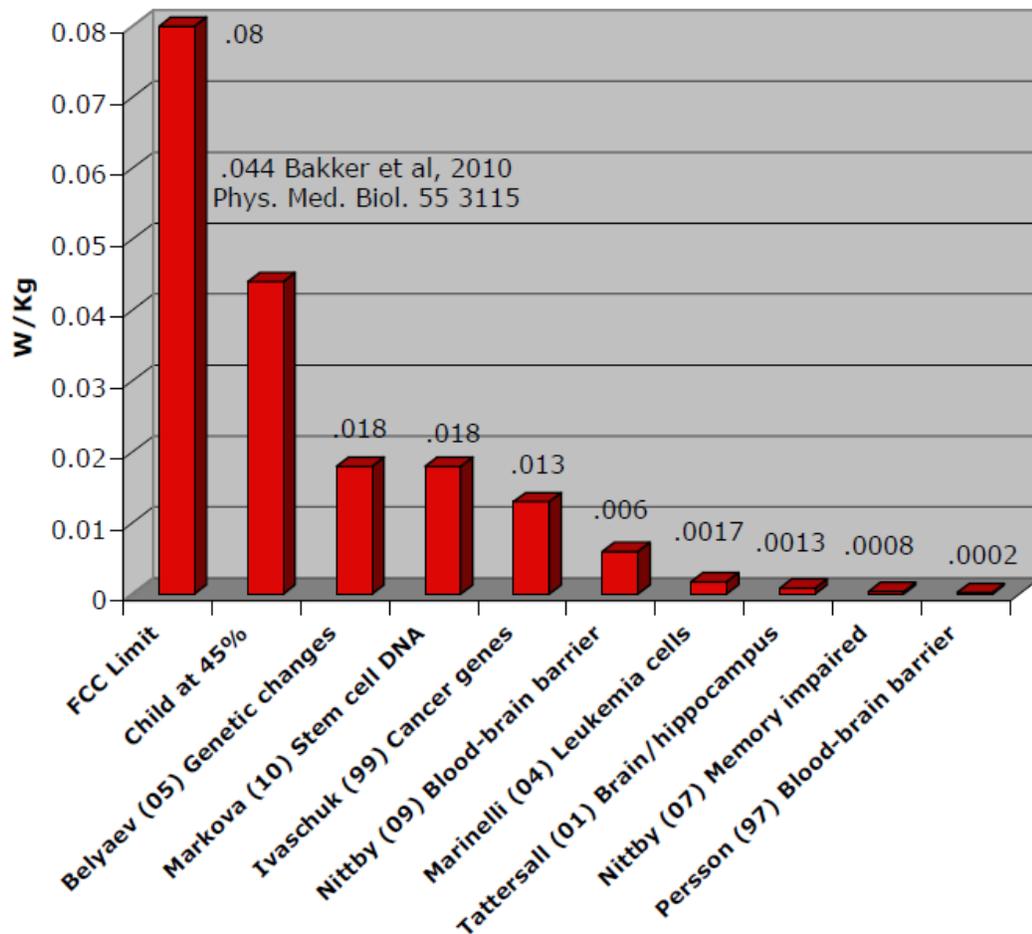


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SAR Studies at Cell Phone Frequencies Reporting Bioeffects and Adverse Health Effects (Children absorb 45% more RF)



64. In the history of public health, there are numerous examples of the serious consequences that were incurred as a result of officials' omission to take proper precautionary measures after initial scientific observations showed early warning. See a major review in : Late lessons from early warnings: the precautionary principle 1896-2000, published by the EEA (European Environment Agency), http://www.eea.europa.eu/publications/environmental_issue_report_2001_22.

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65. In its *Draft Precautionary Framework for Public Health Protection* of 2003 (http://www.who.int/peh-emf/meetings/archive/Precaution_Draft_2May.pdf), the World Health Organization insists (on page 4) that precautionary measures are not aimed at becoming a substitute for standard setting. Standards must be set on scientific certainty or consensus, while precautionary measures manage uncertainty.

According to the *Draft Precautionary Framework* of the World Health Organization (which refers, on this, to the European Commission Communication on “The Precautionary Principle”, February 2000, http://europa.eu.int/eur-lex/en/com/cnc/2000/com2000_0001en01.pdf), when an uncertainty or a risk is identified, the option selected as a precautionary measure should be a) proportional to the desired level of protection, b) non-discriminatory in its application, c) consistent with the measures already adopted in similar circumstances or using similar approaches, d) based on an examination of the potential benefits and costs of action or lack of action (including where appropriate and feasible, an economic cost/benefit analysis), e) subject of review, in the light of subsequent scientific data and f) when possible, assign responsibilities for collecting such new scientific data.

The *Draft Precautionary Framework* of the World Health Organization is filed as an annex to the present report (Exhibit C-SE-AQLPA-0066, SE-AQLPA-7, Document 2).

66. In its March 2000 *Backgrounder on Electromagnetic Fields and Public Health* (http://www.who.int/docstore/peh-emf/publications/facts_press/EMF-Precaution.htm), the World Health Organization had also developed the notion that precautionary measures are of a different nature than standards, the former being a form of uncertainty or risk management. In addition to the notion of Precautionary Principles, it accepted the lesser notion of Prudent Avoidance, being defined as taking simple, easily achievable and low cost avoidance measures, even in the absence of a demonstrable risk. On the Precautionary Principle itself, the Backgrounder also referred to the February 2000 European Commission guidelines mentioned above.

The World Health Organization *Backgrounder on Electromagnetic Fields and Public Health* is filed as an annex to the present report (Exhibit C-SE-AQLPA-0067, SE-AQLPA-7, Document 3).

67. In 2003, the Canadian government issued a *Framework for the application of precaution in science-based decision making about risk* (<http://www.pco-bcp.gc.ca/docs/information/publications/precaution/Precaution-eng.pdf>), which referred to similar principles.

The *Framework* identified five *General Principles of Application of Precaution* :

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- ❑ The application of precaution is a legitimate and distinctive decision-making approach within risk management
- ❑ It is legitimate that decisions be guided by society's chosen level of protection against risk.
- ❑ Sound scientific information and its evaluation must be the basis for applying precaution; the scientific information base and responsibility for producing it may shift as knowledge evolves.
- ❑ Mechanisms should exist for re-evaluating the basis for decisions and for providing a transparent process for further consideration.
- ❑ A high degree of transparency, clear accountability and meaningful public involvement are appropriate.

According to this document, the *Precautionary Measures* should be designed around 5 principles :

- ❑ Precautionary measures should be subject to reconsideration, on the basis of the evolution of science, technology and society's chosen level of protection.
- ❑ Precautionary measures should be proportional to the potential severity of the risk being addressed and to society's chosen level of protection.
- ❑ Precautionary measures should be non-discriminatory and consistent with measures taken in similar circumstances.
- ❑ Precautionary measures should be cost-effective, with the goal of generating (i) an overall net benefit for society at least cost, and (ii) efficiency in the choice of measures.
- ❑ Where more than one option reasonably meets the above characteristics, then the least trade-restrictive measure should be applied.

The Canadian government *Framework for the application of precaution in science-based decision making about risk* is filed as an annex to the present report (Exhibit C-SE-AQLPA-0068, SE-AQLPA-7, Document 4).

67a. In application of the Precautionary Principle, in November 2009, an International Scientific Panel on Electromagnetic Field Health Risks issued the following resolution in Seletun, Norway (the Seletun resolution) :

The Seletun Scientific Panel takes note of international scientific reviews, resolutions and recommendations documenting scientific and public health evidence on EMF exposures;

The Seletun Scientific Panel notes that complete “consistency” of study findings is not to be expected, and it should not be interpreted as a necessary precondition for a consensus linking EMF exposure to health impacts. “Consistency in nature does not require that all or even a majority of studies find the same effect. If all studies of lead showed the same relationship between variables, one would be startled, perhaps justifiably suspicious” (Needleman HL. Making models of real world events: the use and abuse of inference. Neurotoxicol Teratol 1995;17: 241-2; discussion 249-51);

The Seletun Scientific Panel acknowledges that some, but not all, of these exposures support preventative and precautionary action, and the need for more stringent public health limits;

The Panel takes note of international scientific resolutions and expressions of concern including the Salzburg, Catania, Freiburger Appeal, Helsinki, Irish Doctors (IDEA), Benevento, Venice, London, and Porto Alegre Resolutions (2000-2009);

The Panel is guided by previously recommended target limits for EMF exposure in the BioInitiative Report (2007) and the London Resolution (2009);

The Panel urges governments to adopt an explicit statement that —the standard for judging and acting on the scientific evidence shall be based on prudent public health planning principles rather than scientific certainty of effect (causal evidence). Actions are warranted based on limited or weak scientific evidence, or a sufficiency of evidence – rather than a conclusive scientific evidence (causation or scientific certainty) where the consequence of doing nothing in the short term may cause irreparable public health harm, where the populations potentially at risk are very large, where there are alternatives without similar risks, or where the exposures are largely involuntary;

The Seletun Scientific Panel urges governments to make explicit that the burden of proof of safety rests with the producers and providers of EMF-producing technologies, not with the users and consumers. [...]

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EMF exposures should be reduced now rather than waiting for proof of harm before acting. This recommendation is in keeping with traditional public health principles, and is justified now given abundant evidence that biological effects and adverse health effects are occurring at exposure levels many orders of magnitude below existing public safety standards around the world; [...]

It is established that the combined effects of chemical toxins and EMF together is greater than either exposure alone;

The Panel encourages 'auto-off switches' for mobiles (cells) and PDAs that automatically turn off the device when placed in a holster;

The Panel strongly discourages the technology that allows one mobile (cell) phone to act as a repeater for other phones within the general area. This can increase exposures to EMF that are unknown to the person whose phone is 'piggy-backed' upon without their knowledge or permission;

The Panel recommends the use of telephone lines (land-lines) or fiber optic cables for SmartGrid type energy conservation infrastructure.

Utilities should choose options that do not create new, community-wide exposures from wireless components of SmartGrid-type projects. Future health risks from prolonged or repetitive wireless exposures of SmartGrid-type systems may be avoided by using telephone lines or fiber-optic cable. The Panel endorses energy conservation but not at the risk of exposing hundreds of millions of families in their homes to a new, involuntary source of wireless radiofrequency radiation.

(Seletun Resolution, already filed as Exhibit C-SE-AQLPA-0044, SE-AQLPA-5, Doc. 11 and as Exhibit C-ACEFO-0027).

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7. PRECAUTIONARY AND PRUDENT MEASURES THAT MAY BE APPLICABLE IN THE CONTEXT OF THE PRESENT CASE

68. As mentioned in section 3, results on Hydro-Quebec's Landis+Gyr proposed meters have showed the following :

- Average power densities measured at 1 m from exterior meters do not exceed the exterior-threshold of $1\,000\ \mu\text{W}/\text{m}^2$ recommended in the *BioInitiative Report*, which is later described in the present report (save for one atypically high result on one meter which later was re-measured and gave a result below the threshold). We do not have any measurements however at a lesser distance from the meter and are informed that a person may approach and even touch the meter, thus could be located as close at 2-3 cm from the meter.
- Inside meter rooms, average power densities far exceed the interior-threshold of $100\ \mu\text{W}/\text{m}^2$ recommended in the *BioInitiative Report* later described in the present report ; it is however expected that these rooms will not normally be accessed by the public. In one case, the average power density at one meter way from such room is shown to exceed the interior-threshold of $100\ \mu\text{W}/\text{m}^2$ but, in the other cases measured, is inferior to that interior-threshold.
- More problematic however are meters situated inside occupied rooms and facing its occupants (meters in a kitchen, etc.), where measurements show the average power density exceeds the interior-threshold of $100\ \mu\text{W}/\text{m}^2$ at 1 m from the meter. We must also keep in mind that we do not have any results at a lesser distance.
- All the above results are inferior to the recommended threshold of $6\,000\,000\ \mu\text{W}/\text{m}^2$ of both FCC and Health Canada. These measurements were however all taken at 1 m or more from the antenna; we do not have any measurements at a lesser distance.

69. One of the precautionary or prudent measures that could be examined in the present case would consist in using hard wired technology instead of wireless communication in deploying the smart meters. (California Council on Science and Technology's report issued in 2011 under the title "Health Impacts of Radiofrequency from Smart Meters" also envisioned the possibility of deployment of hard-wired smart meters throughout California, but only as a retrofit option to be considered if requirements evolve at a later date. To that, I had answered it would be easier and less costly to install hard-wired smart meters to begin with). It is however not the purpose of my present report to determine if, in view of the costs and benefits of deploying hard-wired smart meters and in view of the extent of the problems identified in the previous section, such option would be appropriate in accordance with the previously-stated guidelines on Precautionary and Prudent Measures.

Alternate precautionary or prudent measures to be examined could also include, among others :

- Deploying hard-wired technology at least in the most problematic cases, such as when the meters are situated inside a residence, facing its occupants or when the more fragile population is involved (children, pregnant women, elderly, persons with illness, etc).
- Moving to the outside those problematic interior meters (or at least moving the antenna outside if feasible).
- Positioning the meters and antennas in order to ensure a proper safety distance, so that both the maximal exposure standards and the *BioInitiative* prudent maximal exposure recommendations are complied with (both inside and outside). As seen earlier, the principal problem to be resolved is with interior meters facing occupants.

As a further alternative, an opting out option may also be considered. But, in some cases, such an option will not resolve the issue, such as when a person is exposed to RF emissions from a meter not his own. An example of this situation occurs when meters from several different clients are collocated inside the apartment of one of them.

Here again, I stress that it is not the purpose of my present report to determine if, in view of their costs and benefits, the above measures would be appropriate in accordance with the previously-stated guidelines on Precautionary and Prudent Measures.

8. CONCLUSIONS

70. It is consequently my opinion that the state of scientific research sufficiently establishes a risk that meters transmitting by radiofrequencies as proposed in the present file by Hydro-Quebec may constitute a risk of serious as well as irreversible damage to health, through biological effects other than those resulting from heat. Some individuals or categories of individuals are more susceptible to injury than others (children, pregnant women, elderly, persons with illness, etc).

Such non thermal effects are reviewed in section 5 of this report.

Therefore, there is justification for examining precautionary or prudent measures that could be applied in addition to the current standards (which are based only on biological effects resulting from heat). Discussion and examples of such possible precautionary or prudent measures are provided in sections 6 and 7 of this report.

Dated this 14th day of May, 2012



DR. DAVID O. CARPENTER, M.D.
Director, Institute for Health and the Environment
University at Albany