

BCSEA-SCBC IR1 to CSTS February 7, 2013 FBC AMI CPCN

20.0 Topic: Health Reference: Exhibit C9-8 7B Dr. Margaret Sears Report

20.1 Dr. Sears says “It is worth considering the exemption for pulsed signals in Safety Code 6 (page 18)...” What conclusion does she draw from that consideration?

Health Canada has acknowledged unique risks associated with short time-frame wave forms, and has a different method of calculating the dose for these pulses. This method was not used to date in materials provided by the proponent. Although the consideration narrows the margin between the anticipated and the permitted exposure, it does not result in the meter exceeding the permitted exposure limit. See also response to second 20.2 (renumbered 20.6).

“Biases can also arise from who is actually included in the comparator groups. Electromagnetic hypersensitivity is under-recognized, and there are social and cognitive barriers to individuals recognizing it within themselves (indeed, the same is true for all environmental sensitivities).” [p.6]

No question was associated with this quotation.

20.2 What is Dr. Sears’s definition of electromagnetic hypersensitivity? Does the definition focus on that symptoms being reported to be associated with EMF exposure; or symptoms that are caused by EMF exposure?

Electromagnetic hypersensitivity to be symptoms attributed to EMF exposure, that meet the applicable consensus criteria for environmental sensitivities, as listed in my letter. These include that condition has persisted for a period of time, that symptoms arise in response to exposures, that symptoms may improve when the exposure is absent, and that the response is repeatable/persistent.

These consensus criteria bridge as best as possible, the gap between the choice posed in the question above; between association and causation. It is important to note that effects may not necessarily develop or resolve instantaneously; they may take minutes, hours or even days to manifest, or to resolve upon removal of exposure. This poses difficulties in “provocation” experiments. As well, although it is not electromagnetic hypersensitivity *per se*, if EMF exposure initiates a cascade of biological effects leading to other diseases such as cancer, or to death of non-regenerative tissues, removal of the EMF source will not reverse these downstream effects.

20.3 Does Dr. Sears agree with following statement in the 2012 Supplement to Section 24 of the BioInitiative Report?

“At present it remains unclear whether EHS is actually caused by RF/EMF exposure, or rather is a self-identifying syndrome of excessive responsiveness to a variety of stimuli.” [pdf p.1422 of 1479]

It is not clear to me what that statement means, in that it is framed as a false choice. I would agree with parts. Certainly people with electromagnetic hypersensitivity have to self-identify, as there are no accepted objective tests (please note that that the Austrian doctors are making progress in this regard, with a suite of subjective and objective assessments, as described in my reference 74). It is known that if not addressed, then environmental sensitivities may develop to unrelated chemicals and to electromagnetic fields and radiation at a variety of frequencies, lending credence to “variety of stimuli” (including RF/EMF). As well, these responses are adverse (pain, dizziness, disordered thinking, etc.), so they would be considered “excessive,”

20.4 On what evidence does Dr. Sears state that “Electromagnetic hypersensitivity is under-recognized”? Is it circular to assume that EHS is under-recognized when it has not been established that EHS is caused by EMF?

All scientific research is testing a hypothesis, and the research cited (Hillert et al., described a sentence later in the paragraph) was examining responses of people who had self-identified as having electromagnetic hypersensitivity, compared with people who did not self-identify as such. Abnormalities were observed among the subjects self-identified with hypersensitivities, but some “control” subjects also exhibited increasing headache at the end of the exposure period, and the authors noted that there was a need to better characterize groups in future research. Thus, this is *not* a circular argument. It is an example of one of many potential weaknesses that have to be recognized in this type of research, that people are “counted” in the wrong group, and if enough of this happens then nothing significant is observed as a result of experimental deficiencies. It is also a direction for future research, and an example of how science progresses.

This “contamination” of control groups is a common problem in epidemiological research. Many of these weaknesses bias the research towards finding no effect.

People commonly do not recognize the reasons for slow decline in health resulting from poor air quality, just as they do not recognize electromagnetic hypersensitivity in themselves, from increasing exposures to electromagnetic phenomena. This is typically described with the frog in the slowly warming pot analogy. See also response to the second 20.2 (renumbered 20.6).

Second 20.1 (renumbered 20.5) Dr. Sears states “Based on such science, Canada banned bisphenol-A from baby bottles.” Given that Health Canada also asserts a scientific basis for Safety Code 6, does the bisphenol-A example confirm that Canadian authorities take different regulatory actions based on different conclusions regarding the science?

Just because Health Canada took very limited steps with regard to one chemical, we cannot conclude that their entire scientific assessment system, overseen by different scientists and bureaucrats, with input from totally separate industries, is scientifically impeccable. There are hundreds of endocrine disrupting chemicals, and Health Canada

has acted on this one.

Bisphenol-A is the first time Health Canada relied upon evidence of endocrine disruption at a very low dose as the basis of a regulatory action, even if the action was extremely limited. There is ample evidence of endocrine effects of EMFs, as I and others documented in materials before the BCUC. These would be expected to exhibit non-monotonic dose responses. Health Canada is clear in Safety Code 6, that the restrictions based upon high dose overt heating of tissues are considered to be protective against non-thermal (lower dose) effects. One can only hope that the next review of Safety Code 6 will address non-thermal effects, including those of short pulses.

Interpretation and weighing of scientific evidence requires a great deal of judgment, based on methodology, data compilations, as well as expertise in the topic. In the US, expert panels are convened, and in Canada the Royal Society may be asked to examine the evidence. Each group of scientists brings their own experiences to the table, to examine the body of evidence that exists (warts and all), and to make recommendations regarding regulatory limits, and further research needs.

Health Canada scientists and policy experts work within their areas – we do not see universal consistency across the ministry; indeed, they tend to “pick their battles,” and political influence in terms of program support is well documented (for example, see materials linked on the right hand side here: <http://www.deathofevidence.ca/why> This effort was organized by concerned University of Ottawa researchers and internationally recognized scientists.).

20.2 (renumbered 20.6) Dr. Sears says that in Russia “regulatory exposures regulatory exposures are a small fraction of those in Canada’s Safety Code 6.” Can Dr. Sears provide any evidence that cellphones or base stations in Russia comply with these Russian exposure standards or are any different than those in Canada in terms of RF emissions?

I have no evidence that the Russian regulators, inspectors, etc. are not diligent and competent. I have not investigated the detailed specifications of items for sale in Russia. The point is that there is no international consensus on “safe” levels, and that Canada is at the upper fringe of a wide range of permitted exposures; in other words, Canada’s permitted exposures are considered “unsafe” by other authorities.

Although I generally do not rely upon Wikipedia, I took the liberty of consulting Wikipedia on this topic (http://en.wikipedia.org/wiki/Telecommunications_in_Russia), where it states, “The access points (AP) are built in long-distance telephone exchanges (LDTEs), Russian fixed-line communication infrastructure which is present in every province. As a result, interconnecting mobile operator only needs to create “last kilometer” circuits to the regional LDTE, the requirement already imposed by its mobile license.” This is in contrast with Canada, where wireless technologies operate over a much greater proportion of distances, with concomitant higher exposures.

Commercial Energy Consumers Association of BC

Information Request #1

For Margaret E. Sears (M. Eng., PhD)

1. Exhibit C9-8, 7C –Margaret Sears CV

Research, assess and write scientific literature in a variety of fields including health and medicine, epidemiology and toxicology, chemistry, ecology, biology and chemical engineering. This includes large scientific reports, involving literature searches, data extraction, analysis and review, writing, editing, managing references and maintaining version control; both of my own work and with groups of co-authors.

Prepare and review scientific journal articles.

Lecture at the Universities of Ottawa and Toronto, and Lakehead University, and make public presentations regarding environmental health.

Conducted consultations among citizens' groups, made government committee and tribunal submissions.

Diverse laboratory and field experience in chemical engineering and applied chemistry, including occupational health and safety, and now work with a broad network of scientific experts, physicians and others on topics related to environment and health.

Medical journal guest editor.

- 1.1. Please provide a list of topics in environmental health on which Margaret Sears has made public presentations and peer reviewed studies over the last two years.

University lectures:

Evidence synthesis and scientific writing

Public health and land use

Epidemiology

Toxicology

Endocrine disruption

Pesticides

Talks to health care and other professionals:

Environmental contributors to chronic disease

Environment and child health

Environmental sensitivities in the workplace

Toxic metals in Canadians – a series of lectures and leading of discussions at a conference in Toronto

Talks for the general public:

Prevention is the cure for cancer

Emerald ash borer and tree preservation

Peer reviewed studies are all listed in the CV provided previously.

- 1.1.1. Please provide a list of the Titles of presentations and peer reviewed studies relating directly to electromagnetic radiation and the date and venue presented.

No presentation related exclusively to electromagnetic radiation, although it is mentioned in environmental sensitivities and cancer prevention talks. Several environmental sensitivities talks were given in government offices in Ottawa and one in Halifax (Health Canada, March 2012), and two cancer prevention talks were given at the Maplesoft Centre in Ottawa, November 2012 and February 2013.

- 1.2. Please provide a complete list of the scientific journal articles professionally reviewed by Margaret Sears relating directly to health effects of electromagnetic radiation.

Peer review is generally confidential. I can confirm that I have reviewed one such journal article.

2. Exhibit C9-8, 7C – CV Margaret Sears pages 3 and 4

Sears, Margaret E., and Stephen J. Genuis. "Environmental Determinants of Chronic Disease and Medical Approaches: Recognition, Avoidance, Supportive Therapy, and Detoxification. J Environ Public Health. Article ID 356798 (2012): 1–15.

Healthy Children/Healthy Environment: Improving the Odds: Part 2

(authors in alphabetical order) Riina I. Bray, M. Janet Kasperski, Lynn M. Marshall, Margaret E. Sears. [March 31, 2011. Respectfully submitted on behalf of the Ontario College of Family Physicians to the Environmental Health Program, Health Canada.]

The Medical Perspective on Environmental Sensitivities

Margaret E. Sears

[February 2007 – prepared for the Canadian Human Rights Commission, in collaboration with the Ontario College of Family Physicians Environmental Health Committee, and other academics, physicians and architects]

Available at: http://www.chrc-ccdp.ca/research_program_recherche/esensitivities_hypersensibilitee/toc_tdm-en.asp?highlight=1

- 2.1. Please provide a copy of each report.

Provided; they are also freely available on the internet.

3. Exhibit C9-8, 7B page 3 and page 4

(Bob.Johnson@L-3com.com) replied that, “The standard sampling rate of 5 Hz means an integration time of 270 msec. So the peak hold would be the peak obtained within that sample.” He further confirmed that would be the case for the measurements made by Planetworks. Thus with “packets” between 8 ms and 125 ms, assuming a square wave of emission as depicted in Itron literature, the peak power measurement of $4 \mu\text{W}/\text{cm}^2$ at 30 cm from the meter would translate into a true peak power between $8.6 \mu\text{W}/\text{cm}^2$ (over 125 ms) and $135 \mu\text{W}/\text{cm}^2$ (over 8 ms). This measurement at 30 cm would be consistent with the statement in CSTS IR1 question 57.7 indicating a level of peak power at an undisclosed distance (presumably measured at 20 cm as indicated by FCC):

900 MHz RF Mesh Radio: $227 \mu\text{W}/\text{cm}^2$
2.4 GHz ZigBee Radio: $31 \mu\text{W}/\text{cm}^2$

- 3.1. Please confirm that the above calculation being use is:
microwatts/cm² * (integration time/packet time)

It is [measured peak] * [instrument averaging time (i.e. 270 ms)] / [packet time (i.e. 8 to 125 ms)]

- 3.1.1. Please confirm that the peak power calculation used above results in the calculated peak power density of each packet being added together.

That would only occur if there was more than one pulse during the 270 ms instrument integration/ averaging time frame. This seems unlikely (albeit not impossible) given that the meter is supposed to emit on average about one pulse per minute (60,000 ms).

- 3.1.2. Please confirm that each packet would not be transmitted simultaneously over the integration time, but would in fact be transmitted sequentially.

As stated immediately above, during the instrument integration time of 270 ms it is unlikely (albeit not impossible) to have more than one pulse from the 900 KHz band transmitter. If a “packet” is defined as a brief, continuous signal I do not understand how two could be sent at once from one transmitter. I cannot confirm or deny whether two signals - one from the network transmitter and one from the Zigbee - would be transmitted simultaneously.

- 3.1.3. Please explain why the above calculation represents a ‘true’ peak power as compared to the average peak power calculated.

Materials from Itron depict a square wave emission. If this is accurate, the energy emitted during the time of transmission ([measured power] * 270 ms), divided by the time of transmission, is by definition the peak.

- 3.1.4. Please explain why Margaret Sears believes that each of peak and average energy are relevant.

The peak is the most relevant characterization of the exposure (along with the number of “packets” over a longer timeframe, and the pattern of these pulses). It is the exposure of interest to the receiver, so should be the exposure of interest to the environment and people as well. The average energy is relevant because that is the data that has been provided; it has to be interpreted in view of the equipment and conditions of measurements. For a square wave as depicted in Itron literature, the peak and average during the transmission are the same value.

4. Exhibit C9-8, 7B Margaret Sears page 4

Regarding data reliability, it is concerning that measurements of Itron emissions do not fall off according to the inverse square law - a fundamental law of physics. Scientific procedures for thorough baseline characterization, minimization of interference, replication, and calculation of statistical variation were not presented. When simple, standard measurements do not conform to a fundamental law of physics, it is more probable that the measurements or assumptions are at fault than physics. The explanation regarding background noise is a weak explanation of the observations closest to the meters.

- 4.1. Would Margaret Sears agree that in the absence of background noise, smart meter emissions would be lower than Itron measured if the measurements were being conducted accurately?

If all else is equal, background noise will increase the measured level.

- 4.2. Is Margaret Sears implying that Itron is claiming that the discrepancy lies with physics?

I do not believe Itron is claiming to have discovered new universal laws of nature. Measurements by Planetnetworks close to the meter did not fall off according to the inverse square law, and the explanation of this was unclear. Reflections were not investigated or quantified, but the simple mathematical model presented by Exponent for reflection would still result in an inverse square decrease in radiation.

- 4.3. Does Margaret Sears agree that the ability to replicate studies is a key determinant in the validity of testing?

Replication of studies is of course important. I would caution that replication is not a trivial endeavor when dealing with complex research, particularly with living systems, the environment, and complicated equipment that may be different between manufacturers or models, and that was set up in different environments by different researchers. Frankly, no two studies are identical. Personally, I have spent significant time in laboratories attempting to replicate results of others, only to realize that while their results were valid within their experimental framework, but that the methods description (or inherited equipment) missed an important aspect that I did not initially incorporate. (When accounted for and fixed, I managed to replicate and improve upon others’ work.) Unexpected factors are common – for example, a researcher attempting to replicate some of my work was unable to do so until he realized that a coal fired power

plant that had not been operating in the summer during my research, was then emitting sulphur dioxide that interfered with our air pollution measuring device.

When attempting research with people who exhibit electromagnetic hypersensitivities, they may be sensitive to other unmeasured aspects of the environment, such as air quality in the research facility, or even materials in the experimental room.

Some studies seize an opportunity, such as the Buchner and Edgar study of Rimbach. These can only be replicated in different settings. Another example is that the window of opportunity for case-control and cohort studies of cellphone exposure has passed.

5. Exhibit C9-8 7B Margaret Sears page 5

I work with an internationally prominent group that conducts systematic reviews of medical literature. These reviews follow strict protocols to search the medical literature thoroughly, and to assess critically primary research studies, in order to answer carefully-refined research questions. Researchers, writers and medical journal editors are eager to improve design and reporting of research in order to improve reliability, transparency and ultimately patient and public health. The Enhancing the Quality and Transparency of Health Research (EQUATOR) Network facilitates development and provides access to reporting guidelines (<http://www.equator-network.org>).

5.1. Please confirm that the group with which Margaret Sears works is the EQUATOR Network referenced two sentences below.

No.

5.1.1. If not, please identify the group being referenced.

I work with several groups and institutions, as indicated in my CV. I wrote the letter for the BCUC independently.

With reference to the “internationally prominent group” I am a Senior Clinical Research Associate (part time) with Dr. David Moher’s group in Clinical Epidemiology at the Ottawa Health Research Institute (Centre for Practice-Changing Research). Dr. Moher has been a leader for decades in clinical research methodology. You will see this association upon examination of my list of peer-reviewed publications and reports provided in my CV.

5.1.2. Does EQUATOR or the group being referenced have a code of conduct or similar professional obligations to which Margaret Sears is bound?

5.1.2.1. If so, please provide a copy.

Common requirements for projects are for confidentiality, particularly when working with patient data or on sensitive topics (e.g. patented medications). Our work is judged by our immediate peers during each project, internally for contract renewal (I have worked with Dr. Moher for many years), externally by funders such as the Agency for Health Quality Research, and by peer reviewers of publications.

5.2. Please clarify the manner in which Margaret Sears works with the group referenced.

My title is “Senior Clinical Research Associate.” I work part time, depending upon need; I have been involved in many aspects of work, from proposal writing to data extraction, scientific analysis, writing and editing of systematic reviews. As such, I am listed among authors of several large systematic review reports and peer-review publications (please see my CV).

5.3. Please identify the relevant reporting guidelines for conducting systematic reviews of health literature related to electromagnetic radiation and provide a copy of each.

It is important to note that a “systematic review” addresses a carefully scoped question. It would not simply be of a general topic such as “health literature related to electromagnetic radiation.” Reporting guidelines apply to study design, not to topic. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) would be applicable to trials or interventional studies, while MOOSE (Meta-analysis of Observational Studies in Epidemiology) is applicable to observational studies. The publications discussing these are supplied.

5.4. Is it fair to say that appropriate answers to research questions relating to weighing the validity of differing medical opinions requires: A) a thorough search of the medical literature, B) critical scientific assessment and C) accurate and representative reporting of all the relevant evidence without bias by the researcher, writer or medical journal editor?

5.4.1. If not, please explain why and give examples.

I have to emphasize, I was not asked for, nor given the time or resources to conduct a full systematic review of a large number of research questions.

The first, most important aspect is the definition of your research question. I set out several, focused, incremental lines of evidence, from non-living systems to human studies.

Search strategies vary widely depending upon the existing literature for the particular question. Some can be answered using recent reviews. Sometimes significant findings that were not the central purpose of a study, are nestled in the results (indeed, that is how science progresses!). An example is the observation of increased headache among individuals who did not self-identify as being electromagnetically hypersensitive. These “gems” are very important.

I would emphasize the critical scientific assessment aspect, and agree insofar as your statement goes. However there is no absolute truth available within these sorts of very complex scientific studies, particularly when features of the strongest scientific study designs are in fact weak (e.g. exposure characterization, case criteria, objective

measures). Until scientists agree on the most important parameters to measure, and how to measure them, systematic reviewers come up against “apples and oranges” comparisons and have difficulties weighing the evidence within the tight constraints of that methodology. An important consideration for epidemiological studies relevant to the BCUC is the inevitable bias towards the mean, or “no effect.”

Without diminishing the importance of all of the things you list, there are some sets of research that are fundamentally flawed, and with my limited time, rather than spend time dissecting flaws I focused on the most valid, clearest studies.

History is full of examples where the prevailing evidence / professional opinion delayed action, but finally was overturned. For example, autism was considered to be caused by bad parenting (generations of parents were shunned and suffered this dreadful guilt, on top of dealing with a disabled child). Tobacco and lead were alleged to be safe enough, decades after incontrovertible proof existed in the medical literature. Public health actions were long delayed in this regard. Lead is a prime example of Health Canada lagging behind the evidence to this day. While the US has reduced their action level for child blood lead, Health Canada is still reconsidering their blood lead level of concern of 10 µg/dL, in light of evidence published in 2005 showing permanent harm to children’s brains with blood lead levels below 2 µg/dL (Lanphear, et al. “Low-level Environmental Lead Exposure and Children’s Intellectual Function: An International Pooled Analysis.” *Environ Health Perspect* 113, no. 7 (July 2005): 894–899.), as well as extensive evidence that lead contributes to many chronic diseases.

A key feature of the lead and tobacco research, that may be a bellwether for electromagnetic research, is that as researchers investigate lower and lower exposure levels, they continue to find harm. Indeed, for child blood lead levels, the *incremental* harm below 7.5 µg/dL was greater than at levels above 7.5 µg/dL (Lanphear et al, 2005).

5.5. Is it fair to say that in assessing relevant literature, the critiquing of studies should be conducted equitably and the results reported evenly to produce unbiased answers?

5.5.1. If not, please explain why not and give examples.

I do not know what is meant by “equitable” critiquing of studies or “even” reporting. Science is not a democracy. If you are conducting a systematic review (which is an exercise that would vastly exceed the few weeks timeframe to respond to this request), it is important to establish many things prospectively (up front). Some examples would include the research question being investigated, search methods, study inclusion/exclusion criteria, and data extraction and assessment methods. It might be that studies from a certain group of researchers have a feature that excludes them according to the selection criteria. As long as the selection criteria are soundly scientifically based, this would be valid, as long as it was clearly reported. For example, if a selection criterion was exposure during a certain time period when a certain technology or chemical product was prevalent, it would be valid to exclude a cumulative study over a different timeframe because many of the cohort members would not have experienced the exposure of

interest. In the case of my letter, which is *not* a systematic review, I reviewed more studies than cited, but selected illustrative studies that I considered to be of sound design and reporting, regarding relevant frequencies, answering particular questions.

- 5.6. Is it fair to say that a question regarding the weight of medical literature should appropriately expect an unbiased response from a professional experienced in conducting literature reviews?

I was not asked for a weight of evidence analysis over a broad range of research questions, and provided neither time nor resources to conduct one. Such an activity would be vast in scope, requiring a research team over many months. Given the state of this science, a simplistic, democratic weight of evidence approach would arguably be misleading, and a review “considering signals that should not be ignored, and may even inform further research” is more appropriate. This was my goal.

In order to assist the BCUC, I looked at recent, large summary reports such as the UK review and the BioInitiative Report, as well as original peer-reviewed research, much of which was mentioned in the large summary reports. These reports are very large, so with insufficient time to thoroughly substantiate either report, I relied upon the primary studies cited in my letter.

There are three possible hypotheses presently under consideration. With my knowledge and experience I find that the hypothesis that *radiofrequencies at “non-thermal” exposures cause “no effect”* does not hold up. In support of the *“some kind of effect”* hypothesis, there are many studies at various levels of complexity and in systems ranging from the simplest *in vitro* studies, to animal studies, and human experimental and epidemiology studies. There are indeed several studies supporting the third, *“serious effects”* hypothesis, and for this reason many groups of scientists and doctors have published declarations, medical groups have moved on to diagnosis, treatment and urging precaution among all levels of government, society and walks of life, and a large group of scientists produced the BioInitiative Report.

6. Exhibit C-9-8 7B Margaret Sears Page 5

Work in environmental health as well as systematic reviews illuminates many potential pitfalls when assessing medical evidence, some of which are important to understanding the controversies regarding radiofrequency effects on health.

7. Does Margaret Sears consider herself an expert in identifying and estimating bias in analyzing individual medical and scientific reports?

Yes.

- 7.1. If so, has Margaret Sears assessed each report she reviews for possible bias before relying upon the results.

All studies have weaknesses and strengths, and this is always top of my mind when I am reading them. In the process of writing my letter, I chose the best quality studies I could find, that reported data on exposure to radiofrequencies close to the range of the meter and the zigbee devices, that most directly (rather than tangentially, although such evidence may be supportive) demonstrated the point being made.

- 7.2. Please provide a complete list of the reports Margaret Sears has reviewed and assessed for bias that are cited in her evidence.

Please see the reference list. Many others were considered as well, but a systematic list was not maintained due to lack of time/resources.

- 7.3. Please identify the bias that Margaret Sears has noted in the evidence she has cited.

In order to identify bias in a particular study, you need knowledge of the “absolute truth.” I have written at length regarding potential sources of epidemiological bias. I did not cite reports where I saw shortcomings in the research that would have curtailed potential discernment of significance, or where I suspected that an observed effect might have been the result of something other than the radiofrequency exposure.

8. Exhibit C-9-8 7B Margaret Sears Page 5

Provocation studies of electromagnetic hypersensitivity have particular difficulties and limitations, recently reviewed by Tuengler et al. They recommended objective measures distinguishing electromagnetic hypersensitive participants from others.⁶

- 8.1. Please provide the report (reference 6) Tuengler A, Von Klitzing L. Hypothesis on how to measure electromagnetic hypersensitivity. *Electromagnetic Biology and Medicine*. 2013 Jan 9; 1301091306100007.

Done.

9. Exhibit C9-8 7B Margaret Sears Page 6

Biases may arise from definition of comparator groups. For example, Danish cell phone studies that post-date the International Agency for Research on Cancer (IARC) determination that radiofrequencies used in cell phone communication are a Type 2B (possible) human carcinogen, were referenced in the Exponent report and Planetworks materials. These studies did not overturn the IARC determination for a few reasons, including that a narrow and marginally relevant age range of cases were used in the research, that would result in exposure misclassification (Bioinitiative Report p 835).⁷

- 9.1. Please provide a copy of the BioInitiative Report and file with the commission.
- 9.2. Please specify the paragraph(s) to which Margaret Sears is referring and clarify if she is referencing the cohort study and the updates.

The original Danish studies were published before the IARC determination; only updates were possible following IARC. The first paragraph on p 835 states, “One would also expect considerable misclassification of mobile phone use both among subscribers and the reference population since no new subscribers were included in the exposed cohort after 1995.” In other words, all people who started using mobile telephones and cellphones after 1995 are considered “unexposed.” (This is the narrow age range to which I referred.) Further short paragraphs on the same page expand on this topic.

9.3. Please provide the context in which any individual study could have ‘overturned’ the IARC determination.

This would have been highly unusual; I expect that proof of previous scientific error or misrepresentation would have been necessary, as studies upon which IARC relied showed strong findings and were carried out by long-standing researchers, including some upon whose work the IARC had previously acted. It certainly could not occur unless the Danish researchers had rigorously addressed the problems of exposure ascertainment (a difficult undertaking).

9.4. Please confirm if Margaret Sears is stating that the Danish report and updates are not valid reference material due to bias in comparator groups, and should therefore be discounted as to their credibility.

9.4.1. If so, please provide a fulsome rationale for this determination.

The Danish cohort studies were bound to find little if anything, because the “exposed” group consisted of people with a private cellphone in 1995. Following 1995, doubtless the control (“unexposed”) group largely transitioned in reality to “exposed,” resulting in a meaningless comparison. Indeed, the 1995 cohort did not include corporate subscribers, expected to be among the highest users, so was biased with exposure misclassification at the outset, and the comparison just got worse from there on in as more people got cellphones. Supposed methodological strengths pointed out in a BMJ editorial, that the study relied upon national databases so did not have to contend with questionnaires, are directly linked to the fact that the supposed “unexposed” control group was never asked about cellphone use. Without a questionnaire, it is impossible to gather information about transition to phone use, or the about the usual side of phone use (tumours have been seen on the same side / ipsilateral use). I cannot imagine how this fundamental methodological flaw could be overcome, and would not give weight to these studies.

It is now too late in the rollout of wireless technologies to initiate further case-control or cohort studies with cell phones, because of the dwindling potential candidates for unexposed/control groups; attention is now being focused on tumour registries. This is another area of potential medical evidence fraught with potential pitfalls, but this is beyond the present scope of discussion.

There are other much better designed studies from Denmark, referenced in my letter, demonstrating adverse effects of early life exposures.

9.4.2. Please identify any opposing viewpoints on the validity of the Danish studies.

I did not rigorously search for these, but as noted there was an editorial published in the British Medical Journal that highlighted the positive aspects of using data from registries versus questionnaires.

9.4.3. In referencing the BioInitiative Report critique, is Margaret Sears implying that the BioInitiative Report provides a thorough and unbiased assessment of the validity of the Danish studies.

I also read the discussion of the Danish, Hardell and Interphone studies in the UK review.

Please see response above regarding my reliance upon the BioInitiative report in my letter regarding the BCUC hearing. The IARC determination is the one, single point on which I referenced the BioInitiative Report. I did so because the chapter was authored by Dr. Hardell *et al.*, who authored studies upon which the IARC committee relied when determining that radiofrequency radiation is a Type 2B carcinogen. He is very familiar with the IARC process and the evaluation of the various studies. I did not comment on the individual studies; rather I transmitted the most recent communication on this topic, from an authoritative source intimately involved with the science and the process at IARC.

10. Exhibit C9-8 7B Margaret Sears Page 6

Electromagnetic hypersensitivity is under-recognized, and there are social and cognitive barriers to individuals recognizing it within themselves (indeed, the same is true for all environmental sensitivities). With no objective tests and infrequent application of allocation screening (e.g. a lengthy questionnaire, and medical examination and testing to rule out other diagnoses), many researchers depend upon self-report for group allocation. Studying headache associated with using cell phones, Hillert *et al.* noted, “The higher prevalence of headache in the non-symptom group towards the end of RF exposure justifies further investigation of possible physiological correlates. The current study indicates a need to better characterize study participants in mobile phone exposure studies and differences between symptom and non-symptom groups.”¹⁰

10.1. Is Margaret Sears stating as a scientific fact that ‘electromagnetic hypersensitivity is a physical condition, disease or syndrome?’

Yes

10.1.1. Please explain what medical condition ‘electromagnetic hypersensitivity’ references and provide the factual basis on which the statement is made.

Please see response to question 20.2, p 1.

10.2. Is Margaret Sears stating as a scientific fact that ‘electromagnetic hypersensitivity is under-recognized’?

10.2.1. Please define 'under-recognized' and explain by whom 'electromagnetic hypersensitivity is under-recognized.

Electromagnetic hypersensitivity is not recognized by all of the people experiencing it, or by all others in society. Please also see responses to question 20 at the beginning of this document.

10.3. Would Margaret Sears agree that objective tests are best method of determining the existence of a syndrome or disease?

That is clinically preferable. Entire areas of medicine, however, are based on subjective reporting of pain, or psychological distress for example.

10.4. Please provide the relevant studies for objectively verifying EHS.

EHS will not be entirely an objective diagnosis, any more than disability from arthritis is. Please see the Austrian doctors' document, provided.

11. Exhibit Exhibit C-9-8 7B Page 7

Another undeniable bias comes from vested interests. Huss *et al.* reported in 2007 that industry-funded studies into health effects of radiofrequency radiation should take sponsorship into account, as although most studies (68%) reported significant biological effects, studies solely funded by the industry were almost ten times more likely to report no significant problems.¹⁵ Funding bias had not changed substantially in 2010 when the

11.1. Could study size or quality be other possible causes for the contrasting ratio between reporting differences?

These are good possibilities, which were examined in the cited article. Huss et al report, "The association [between funding and results] was robust and little affected by potential confounding factors such as sample size, study design, or quality."

11.2. Is it possible for research bias to work in the opposite direction? Ie. Those studies without industry funding are pre-disposed for any reason to find biological effects where none exist?

11.2.1. If not, please explain why not.

It is plausible, but in environmental health topics it is much easier to conduct an experiment that shows no effect than one that clearly demonstrates an effect. Huss et al. found that the highest quality reporting was exhibited by studies with mixed funding sources, while those that did not report funding were of the lowest reporting quality.

11.3. Please identify all other factors, other than bias, that could rationally account for the discrepancy cited.

We may have a semantic difficulty here. Epidemiology attempts to estimate the absolute truth for all members of the group of concern (e.g. every person on earth, or every man, woman and child in a community with a new cell phone tower in the village square). In epidemiology “bias” arises from factors that cause the observed effect and distribution to be different from this average-of-everyone, which is obviously not knowable. In epidemiology, “bias” is not necessarily equated with malfeasance; rather, consideration of sources of bias is an attempt to estimate/assess where your population estimates might fall with respect to the (unknowable) global truths, that you are attempting to estimate. Huss et al. examined other sources of epidemiological bias, including the number of reported outcomes, study size, study design, and aspects of study quality including randomization, blinding, statistical analysis and exposure.

Studies of electromagnetic hypersensitivity aim to examine a phenomenon in the statistical bell-curve “tails” – the outer reaches of the ranges of responses. Design and analysis are key features for this sort of study.

12. Exhibit C9-8 7B Margaret Sears Page 10

Weight of Evidence: Thousands of scientific studies examine effects of electromagnetic phenomena on living creatures. Every study has strengths and weaknesses that are inherent to study design, arise from resource limitations, may be simply poor reporting of the research, or perhaps reflect ineptitude. It is not simple to apply all of these studies to real life complexities of human exposure to radiofrequency radiation; there is no single, perfect method to synthesize such diverse medical evidence. Various national and

- 12.1. Would Margaret Sears agree that assessing the weight of evidence is a very large undertaking that requires expertise, judgement, experience and resources to conduct appropriately?

Certainly assessing weight of evidence can be a large undertaking, but the size depends upon the scope of the research question. Our group at the OHRI conducts “rapid reviews” of very narrowly scoped questions. On the other hand, it can be very onerous to examine a large number of related issues, consider all research sources and study designs, and formally conduct a complete review involving expert panels and consultation. However, there are other sorts of examination of a topic, that are not as onerous but can be very helpful. The health effects of radiofrequency radiation is not a well standardized area of research; such standardization/protocol/consensus diagnostic criteria and measures, etc. would be very helpful for “sorting” evidence in order to weigh it. It can also be valid to look at existing systematic reviews, and among well conducted and reported studies for signals of potential harm. Some of these studies, such as the before/after study of the Bavarian village (Buchner and Eger 2011, ref 62) that had a cellphone tower installed in the village square, seize an opportunity and can be uniquely informative.

13. Exhibit C9-8 7B Margaret Sears Page 12

BioInitiative2012⁷ (1479 pages) is a collection of chapters largely prepared by scientific researchers who have published in their respective fields of expertise. The basic thrust is that there is much greater certainty now than there was five years ago that radiofrequency radiation has adverse effects on health, and that prudent prevention is highly justified; indeed the authors contend over-due.

- 13.1. Please confirm that the scientific researchers included in BioInitiative 2012 are not necessarily representative of the broad base of quality scientific researchers studying in the field of electromagnetic radiation.

This seems a rather leading question. The BioInitiative researchers have volunteered considerable time and expertise, to attempt to relay what they consider to be important messages for public health. Many “9 to 5” researchers would not do this. The authors include long-standing and highly regarded academics at major institutions. In my opinion, the ways in which these researchers stand out from the crowd is to their credit.

- 13.2. Please provide Margaret Sears’ assessment of the credentials of Cindy Sage.

I have not worked with Cindy Sage and am not privy to her CV.

- 13.3. Has Margaret Sears assessed the BioInitiative Report for bias?

Please note, I cited this report on one small point, and highlighted this monumental effort as an indication of extreme concern on the part of a large number of knowledgeable and experienced researchers. See above for discussion of “bias.” Generally bias assessment is conducted on primary studies.

- 13.3.1. If not, why not?

It was not necessary for way in which I cited it. We don’t have methods for formal assessment of such an overview report. If we did, it would be daunting - with thousands of references, with almost 1500 pages, should I attempt some such effort it would vastly exceed the time and resources available during the few weeks for preparation of my letter.

14. Exhibit C-9-8 7B Page 14

Hundreds of studies over decades have reported DNA damage, as well as other effects of various “non-thermal” electromagnetic exposures. With uncertainties in experimental and equipment design (poorly reported in publications) some findings were not replicated (often in ostensibly superior equipment), or ascribed to (micro-) thermal effects.¹⁸ Nevertheless, there are strong signals of significant effects.

- 14.1. Does Margaret Sears believe that the BioInitiative Report has none of these problems.

I do not understand this question, as this section and reference 18 refers to difficulties interpreting individual original research studies, while the BioInitiative Report is a series of review articles.

15. Exhibit C-9-8 7B page 16

The bottom line of the current research is that exposure to doses of the radiofrequencies to be used by the proposed meters at levels much lower than present guidelines, can have biological effects on multiple systems. Furthermore, the young and those with co-morbidities are at heightened risk. Although the proposed exposure levels are less than with other technologies such as cell phones, pulsed signals are not comparable to

No question was associated with this quotation

16. Exhibit C9-8 7B page 18

Recognition of electromagnetic hypersensitivity as an important issue is reflected in many committed, hard working groups of individuals whose experiences have convinced them that this is an important issue, including interveners in this present proceeding. Although doubtless not a complete list, the following are some more examples.

- 16.1. Please provide a list of relevant health and other organizations that do not recognize electromagnetic hypersensitivity as an important issue.

I have not surveyed health organizations on this topic.

17. Exhibit C9-8 7C, Margaret Sears CV

Lecture at the Universities of Ottawa and Toronto, and Lakehead University, and make public presentations regarding environmental health.

- 17.1. Please describe the state of Wi-Fi services at the Universities of Ottawa and Toronto and Lakehead University and whether or not they are expanding or being eliminated.

Wireless access is available in some places at all universities; I am unaware of its state of flux. It was introduced at Lakehead University more recently than elsewhere, following installation of a new president (<http://magazine.lakeheadu.ca/2011/spring/change-agent/>).

- 17.2. Please provide copies of any presentations Margaret Sears has made to the Universities regarding RF radiation on the campus.

N/A

- 17.3. Please indicate whether or not the offices in Margaret Sears departments have any wireless equipment installed in them.

There is no wireless equipment in the location where I generally work, apart from the aforementioned cell phone that is often turned off. In the research institutes, all computers have wired access to the internet and there is wifi for the convenience of visitors.

17.4. Please indicate whether or not Margaret Sears has a cell phone and whether or not her colleagues in the department have cell phones.

As mentioned, I own a cell phone, that was purchased when the only affordable internet access was dialup. It provided a way for family, friends and colleagues to get in touch, to tell me to hang up the landline phone so we could talk. Many but not all colleagues have cellphones.

17.5. Please indicate whether or not Margaret Sears has knowledge of any RF studies regarding the campus at the universities and please provide copies of any such studies if they exist.

I have no knowledge of studies of health effects of students exposed to environmental RF situated on these campuses. (I assume that RF used for surgical ablation is not the subject of this question.) A pubmed search of (wifi or radiofrequency) AND (Lakehead or Toronto or Ottawa) AND university, yielded 89 articles. These were on medical interventions (e.g. radiofrequency ablation of tumours) and review articles.

17.6. Please provide a description of an activity Margaret Sears has participated in with respect to RF policy at the universities and or the provincial level

I have not specifically, uniquely addressed RF policies at universities or the provincial level, and am unsure what is meant by “an activity.”

FortisBC Inc.

7.0 Reference: Exhibit C9-8 – Comments from Margaret Sears

7.1 Has Dr. Sears previously submitted evidence and/or testified before courts or regulatory tribunals in Canada or the United States? If so, please submit a list that includes the date the evidence was submitted, the name of the matter/docket under which the evidence was submitted, and the name of the court/regulatory tribunal.

Yes. I submitted affidavits with respect to class action suits on the part of Canadian Veterans and others suffering ill health after being exposed to herbicides at CFB Galetown, as you note below.

7.2 Did Dr. Sears submit evidence in 2008 to the New Brunswick Court of Queen's Bench in *Bryson v. Canada (Attorney General)*, 2009 NBQB 204 in relation to potential health effects of herbicides and pesticides?

Yes

7.2.1

Please confirm that S.J. McNally, Justice of the New Brunswick Court of Queen's Bench held the following with respect to Dr. Sears:

“¶ 16 By her affidavits, Dr. Sears purports to offer expert opinion evidence relating to the fields of epidemiology, toxicology, immunology and endocrinology. Dr. Sears has a Ph.D. in chemical engineering which she acquired in 1985. The evidence filed on this motion establishes that Dr. Sears:

- a. has acquired no academic qualifications or degrees in the fields of epidemiology, toxicology, immunology or endocrinology;
- b. does not have a degree in medicine;
- c. did no work or study in the fields of epidemiology, toxicology, immunology or endocrinology as part of her undergraduate or graduate studies;
- d. has not taken any academic course in oncology, immunology or endocrinology;
- e. advised a Senate Standing Committee in December 2002 that she was not an expert in toxicology;
- f. has published no articles on the subjects of oncology, immunology or endocrinology in a peer reviewed academic journal.

¶ 17 Dr. Sears did conduct research and produced copies of various articles and papers prepared by other authors that related to these medical or scientific fields and she attached them to her affidavits filed in these proceedings. Dr. Sears has significant experience in this type of work and has conducted medical research in the past in conjunction with or under the direction of medical professionals. However, she has no specific expertise in the fields of epidemiology, toxicology, immunology and endocrinology. Upon review of the materials filed in this motion, neither Dr. Sears nor the plaintiffs have established that she possesses the requisite knowledge or qualifications to adopt or comment on the views expressed in the articles and publications of the other researchers or authors that

she has attached to her affidavits. In such circumstances, her affidavits and opinions do not meet the test of admissibility for expert opinion evidence. Accordingly, they are not admissible in these proceedings and are struck from the record.”

7.3 11 in *R. v. Canada*, 2009 SKQB 509 in relation to potential health effects of herbicides and pesticides?

Did Dr. Sears submit evidence in 2009 to the Queen’s Bench for Saskatchewan?

Yes

7.3.1

Please confirm that Zarzeczny J., Justice of the Queen’s Bench for Saskatchewan held the following with respect to Dr. Sears:

¶ 55 Dr. Sears, except for the latter qualification, does not have any academic qualifications or degrees in these various fields nor a general or specialist degree in medicine.

...

¶ 57 As one of the respondents observed, Dr. Sears’ affidavit, although it reflects a noble effort at objectivity, nevertheless frequently reflects opinions, if not of Dr. Sears herself, those of others who have authored these studies, etc. Although some of these might well be qualified as experts to provide opinion evidence as expressed in the reports, studies and papers which they have authored or in which they have participated as referred to by Dr. Sears, — Dr. Sears cannot be so qualified. I agree.

I have not compared all of the text above in detail, but generally this is consistent with my memory.

7.4 Other than as described in CSTS IR 7.2 and 7.3, has Dr. Sears ever been disqualified from acting as an expert witness before courts or regulatory tribunals in Canada or the United States?

No

My status as a scientist has changed considerably since these considerations. I have since been established as a Canadian medical researcher in epidemiology, having received funding from the Canadian Institutes for Health Research (Canada’s highly competitive, premier health research funder), as the principle investigator (primary scientist) for a scoping review regarding toxic elements. I have participated in several other substantial works in epidemiology, that were published by the US Agency for Health Research Quality and in peer-reviewed journals. I have lectured at three universities in topics regarding environmental health, including evidence synthesis, epidemiology, toxicology and public health, at undergraduate and graduate levels. I have given Grand Rounds on Environmental Health to Ottawa pediatricians; and have worked on several large environmental health review projects with academically-affiliated clinician researchers. I am a research scientist at the Children’s Hospital of Eastern Ontario and the Ottawa Health Research Institute.

If so, please submit a list that includes the date of the disqualification, the name of the matter/docket under which the evidence was submitted, and the name of the court/regulatory tribunal.

N/A

7.5 Please confirm that Dr. Sears' academic degrees are in chemical engineering.

Chemical engineering and applied chemistry. Doctoral degrees are not so designated.

7.5.1

Please confirm what department of McGill University granted Dr. Sears' degrees in chemical engineering and her Ph.D.

Chemical engineering; PhD experimental work was carried out in the microbiology laboratories at the National Research Council in Ottawa.

7.5.2 Please confirm that Dr. Sears has acquired no academic qualifications or degrees in the fields of medicine.

Not formal course-work, although I am a Canadian medical researcher who has won funding for medical research from Canada's premier funder, have authored many peer-reviewed medical papers, have been a guest editor for two special medical journal issues, have been instructing at the undergraduate and graduate levels in environmental health and public health, and have been invited to give Research Rounds and Grand Rounds at the Children's Hospital of Eastern Ontario, to all of the pediatricians in Ottawa, among other things. Insofar as "academic qualifications" ensue from activities rather than courses passed, I definitely have qualifications.

7.5.3 Please confirm that Dr. Sears is not a physician and has never had clinical experience with patients.

Confirmed, not a physician.

7.6 On p. 3 of Dr. Sears' report at Exhibit C9-8 Attachment 7B ("Dr. Sears' Report") she says the 3 GHz Zigbee "in-home feature has in some jurisdictions become mandatory". Please provide a list of the jurisdictions that have made this feature mandatory.

I did not compile such a list, but several news reports note this. One example is, "100 Million Smart Meters with integrated HAN Gateways" notes that in the UK the government requires that smart meters be deployed with integrated HAN gateways, and that in-home displays be deployed concurrently. This article is available here: http://www.globalsmartgridfederation.org/news_20120613_100MillionSmartMeterswithintegratedHANGateways.html

7.7 At p. 4 of her report, Dr. Sears states:

“It is worth considering the exemption for pulsed signals in Safety Code 6 (page 18), ‘For exposures to pulsed RF fields in the range of 0.1 to 300,000 MHz, peak pulse power densities are limited by the use of time averaging and the limit on peak electric field, with one exception: the total incident energy density during any one-tenth second period within the averaging time shall not exceed one-fifth of the total energy density permitted during the entire averaging time for a continuous field(9).’ With this criterion, peak power is not averaged over extensive quiet periods, and duty cycle is irrelevant.”

Does peak power from the “total incident energy density during any one-tenth second period within the averaging time” from the advanced meter “exceed one-fifth of the total energy density permitted during the entire averaging time for a continuous field”?

Not according to the data in hand. The point is that there are other ways of considering exposure.

7.7.1 If not, how does peak RF power from the FortisBC advanced meter compare to the limit by the use of time averaging?

7.8 On p. 4 of her report, Dr. Sears states:

“In this letter, I am attempting to maintain focus on frequencies closer to the emissions from the proposed Itron meters.”

Based on what scientific evidence does Dr. Sears exclude RF fields at other frequencies from the analysis?

This was an attempt to maintain focus, rather than including all literature on EMFs in general, that I expected would be criticized (and rightly so) for not being relevant.

7.9 On p. 4 of her report, Dr. Sears states:

“Regarding data reliability, it is concerning that measurements of Itron emissions do not fall off according to the inverse square law - a fundamental law of physics. Scientific procedures for thorough baseline characterization, minimization of interference, replication, and calculation of statistical variation were not presented. When simple, standard measurements do not conform to a fundamental law of physics, it is more probable that the measurements or assumptions are at fault than physics. The explanation regarding background noise is a weak explanation of the observations closest to the meters.”

Please confirm if Dr. Sears is aware of different propagation models, such as those that describe RF signal propagation near reflecting surfaces.

Yes, I am. They are mentioned in the Exponent report appendix, and in the implementation document for Safety Code 6.

7.9.1 If Dr. Sears is aware of different propagation models, could these explain the results?

It is possible if more than one of the models discussed was applied to the results at different distances. This is bad practice, defeating the purpose of mathematical modeling. Reflecting surfaces are accounted for by multiplying by a constant factor (2.56). This does not affect the inverse square relationship; it merely adjusts the exposure upwards.

On p. 4 of her report, Dr. Sears states:

“Indeed, the comparisons showing that the transmissions are vanishingly low power might leave one wondering how the equipment could work at all – i.e. be “heard” by receivers.”

Please confirm if Dr. Sears is familiar with the information and communication theory.

Yes. This admittedly rather generic statement was to put into perspective the reality that the signals must be of sufficient strength to reach the intended receiver; the depiction of vanishingly low exposure is merely a consequence of averaging, not of the strength of the signal actually during transmission.

7.10.1 What is the signal gain after frequency hopping and/or direct sequence spread spectrum demodulation?

This depends upon the signal and the frequency spread.

7.10.2 What is the noise gain after similar demodulation?

This depends upon the type of noise.

7.10.11 On p. 4 of her report, Dr. Sears states:

“For example, while everything at a temperature above absolute zero emits blackbody radiation (e.g. the earth and people), predominately of interest in this regard is higher frequency infra- red radiation, as seen using “night vision” goggles; for lower radiofrequencies we are of appropriate size to act as an antenna, as is well known by those who have been frustrated while adjusting a “bunny-ears” antenna for television reception.”

What is the RF component (300 GHz or lower) of blackbody radiation?

This depends upon the temperature of the black body. At room temperature the majority is infrared. The comment re. “bunny ears” is not relevant in the context of blackbody radiation; it was meant as a reference to ambient radiation in our modern environment.

7.10.12 On pp. 20-21 of her report, Dr. Sears states:

“If, however, bursts of radiofrequency radiation with complex wave forms have other biological effects, this averaging would be obscuring a hazard.”

If absolutely no averaging is used, what does the electric and magnetic field look like as a function of time at the surface of the body?

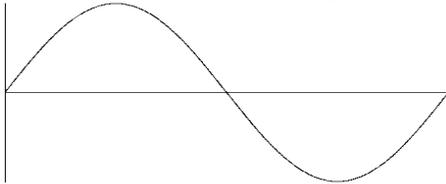
Fields fluctuate according to the frequency and amplitude, and the distance from the source (near-versus far-field). This was not the point of my comment, which was to highlight from another point of view the limited consideration of only thermal effects, of exposures that are averaged over much longer periods than the exposure itself, of Safety Code 6.

7.12.1 How many times per second does the electric field magnitude change from 0 to a positive value and back?

If by “positive” you mean “non-zero,” then twice the frequency. If you mean “zero to positive to zero” then the same as the frequency.

7.12.2 How many times per second does the power density at the surface body change from 0 to a positive value and back?

Non-zero at twice the frequency, if the horizontal straight line represents zero.



7.12.3 If averaging should be used to “smooth” 900 million power density oscillations per second, what scientific basis for averaging time does Dr. Sears propose as an alternative?

Whether the frequency of non-zero oscillations is 900 or 1800 million times per second, I propose that the duration of the actual transmission should be the “averaging time,” rather than averaging over a much longer period during much of which nothing is happening. The exposure perceived by the telecommunications device is the same as the exposure experienced by people. If the signal strength was one six-hundredth of the design strength (10 ms / 6000 s), I doubt that it would work.

7.13 On p. 10 of her report, Dr. Sears states:

“The scientific consensus alluded to in the Exponent report is not reflected in exposure limits in various jurisdictions. According to a compilation for the Israeli government (referenced by Planetworks), Canada is among the least protective countries (Table1).”

Does the exposure from the FortisBC advanced meters exceed the exposure limits in the listed jurisdictions?

7.13.1 What are averaging times assumed in these exposure limits?

This was not provided in the document referenced. Generally averaging times are much longer than the pulse duration (6 minutes in Canada and the USA for the public, 30 minutes for occupational exposures).

7.13.2 Please provide the comprehensive reviews or RF research that support each standard cited in the above compilation that has exposure limits below Safety Code 6.

Please see the resources available from the World Health Organization, here: <http://www.who.int/docstore/peh-emf/EMFStandards/who-0102/Worldmap5.htm>
Standards documents are all linked to the countries.

7.14 On p. 13 of Dr. Sears' Report she says that "when modulated or discontinuous signals, or cell phones that are transmitting speech, are compared with continuous radiation, effects are generally more pronounced with the irregular signals than with unmodulated radiation".
Please confirm if Dr. Sears' position is that the "brief microwave pulses or 'packets'" emitted by the FortisBC advanced meters are comparable to either modulated or unmodulated radiation?

Modulated radiation

7.15 On p. 13 of Dr. Sears' Report she says that there are "many examples" of modulated radiation having more pronounced effects than unmodulated radiation. Please provide a list of studies that demonstrate that modulated radiation has more pronounced effects than unmodulated radiation.

This issue was reviewed in 2011. (Juutilainen, Jukka, Anne Höytö, Timo Kumlin, and Jonne Naarala. "Review of Possible Modulation-dependent Biological Effects of Radiofrequency Fields." *Bioelectromagnetics* 32, no. 7 (2011): 511–534. doi:10.1002/bem.20652). The abstract states, "While the majority of recent studies have reported no modulation-specific effects, there are a few interesting exceptions indicating that there may be specific effects from amplitude-modulated RF fields on the human central nervous system. These findings warrant follow-up studies." The reason for the no-difference finding for the majority of studies noted in the abstract, is that they included a large number of studies that discerned no effect. If you look at only the studies that discerned an effect, many of them found different effects for different signal types.

7.16 On p. 14 of her report, Dr. Sears states:
"DNA damage, measured as single-strand or double-strand breaks, or with assays such as comet assay, have clear implications for cancer. A recent review of this area identifies DNA as a "fractal antenna" that has potential to be the basis of new standards for radiation exposure."
What is the conductivity of DNA?

This is an interesting question. Please refer to Dr. Blank's work, as he is the expert in this domain. To answer your simple question, conductivity of the DNA molecule itself varies greatly depending upon hydration, the sequence, and mismatches. (for example: Maeda, Yaku, Akisumi Okamoto, Yasuhiro Hoshiba, Takayuki Tsukamoto, Yasuyuki Ishikawa,

and Noriyuki Kurita. “Effect of Hydration on Electrical Conductivity of DNA Duplex: Green’s Function Study Combined with DFT.” *Computational Materials Science* 53, no. 1 (February 2012): 314–320. doi:10.1016/j.commatsci.2011.09.020.)

7.16.1 What is the contrast in conductivity between DNA and surrounding media?

I do not know what is meant by “surrounding media.” The DNA molecule itself is surrounded by proteins and by water that has characteristics distinct from plain liquid water in a glass. This has been extensively addressed in other information before the BCUC.

7.16.2 Please confirm if Dr. Sears is familiar with the Chu-Wheeler theory.

This pertains to properties of small antennae. I defer to Dr. Blank, the author of this report, who was also asked these questions

7.16.3 What is the minimum Q of the antenna of the DNA molecule?

I defer to Dr. Blank, the author of this report, who was also asked these questions

7.16.4 For such values of Q, what would be the expected bandwidth of the fractal antenna?

I defer to Dr. Blank, the author of this report, who was also asked these questions.

7.16.5 What tuning circuitry is available to DNA molecules to shift the resonance frequency to react to different exposure frequencies?

I defer to Dr. Blank, the author of this report, who was also asked these questions.

7.17 On p. 20 of Dr. Sears’ Report she summarises her comments on Safety Code 6 and Health Canada. Is Dr. Sears suggesting by those statements that Health Canada has not considered the research on possible health effects of RF not related to tissue heating? If so, please fully explain the basis for suggesting what information Health Canada has or has not considered in setting its Safety Code 6 limits for exposure to RF.

No. Please also see response to 7.17.7.

7.17.1 Please review and submit a copy of Health Canada’s document *Research on Radiofrequency Energy and Health*. The document is available at: <http://www.hc-sc.gc.ca/ewh-semt/radiation/cons/radiofreq/research-recherche-eng.php>

7.17.2 Please confirm Health Canada states the following in that document: “For more than two decades, Health Canada has conducted its own research on the biological effects of radiofrequency (RF) energy. This research has increased the scientific knowledge regarding the intensity of RF energy in our environment and has helped to establish the human exposure threshold where potentially adverse health effects can occur. This important information, along with other Canadian and international studies, form the basis for establishing safety standards for RF energy that protects the health of Canadians.” (Reference: paragraph 1)

Yes. There are a mere 17 publications listed for Health Canada’s team of researchers, since 1983 (30 years).

7.17.3 A copy of Health Canada’s response dated June 19, 2008 to a petition filed by Dr. M. Havas *Request that first generation DECT phones be banned in Canada* has been requested in IR 1.9.3 to Dr. Maret. The document is available at http://www.oag-bvg.gc.ca/internet/english/pet_253_e_31629.html . In that document Health Canada provides insight into its processes for on-going study of RF fields and its continuous program of literature surveillance. Had Dr. Sears reviewed that document before making the statements in her report regarding Safety Code 6 and its authors?

I was aware of this petition, as well as similar claims made in the Safety Code 6 document itself, and similar claims with regard to pesticide registration. Along with other Canadian scientists and physicians, I am first author of a discussion of Health Canada’s use of extrapolation factors in risk assessment and how the methodology is flawed and not protective of public health in, “Comments on the Pest Management Regulatory Agency’s Use of Uncertainty and Safety Factors in the Human Health Risk Assessment of Pesticides,” that is provided.

7.17.4 Dr. Sears suggests that Health Canada has followed an approach that is counter to the precautionary principles. Please confirm that in its response to the petition by Dr. M. Havas, Health Canada states the following:

“All science-based EMF guidelines, including Safety Code 6, intrinsically use the precautionary principle in the design of exposure limits, in that the uncertainties in measurements and application of safety margins are incorporated in their specification. Safety Code 6 is based upon a review of all relevant scientific studies utilizing a weight-of-evidence basis.” (Reference: Answer to Questions 1 & 3)

Health Canada states this, but if the Precautionary Principle was applied rigorously, Canada would not have high permitted exposure limits in comparison with other countries.

One example of Canadians’ rejection of Health Canada’s putting into practice of the Precautionary Principle has to do with pesticides. Provincial and local restrictions of non-

agriculture pesticide uses, are protecting a majority of Canadians from pesticides that are registered by Health Canada.

The use of “uncertainty” (more accurately “extrapolation”) factors is not appropriate or scientifically defensible when low dose effects are different from high dose effects, and particularly when there is the potential for cumulative effects, as discussed in “Comments on the Pest Management Regulatory Agency’s Use of Uncertainty and Safety Factors in the Human Health Risk Assessment of Pesticides.”

Please see also response to 7.17.6.

7.17.5 Please confirm that in Safety Code 6 (2009), Health Canada states at p. 7:

“The exposure limits specified in Safety Code 6 have been established based upon a thorough evaluation of the scientific literature related to the thermal and possible non-thermal effects of RF energy on biological systems. Health Canada scientists consider all peer-reviewed scientific studies, on an ongoing basis, and employ a weight-of-evidence approach when evaluating the possible health risks of RF energy.”

7.17.6 Please confirm that in Safety Code 6 (2009), Health Canada states at p. 9:

“The scientific literature with respect to possible biological effects of RF energy has been monitored by Health Canada scientists on an ongoing basis since the last version of Safety Code 6 was published in 1999. During this time, a significant number of new studies have evaluated the potential for acute and chronic RF energy exposures to elicit possible effects on a wide range of biological endpoints including: human cancers (epidemiology); rodent lifetime mortality; tumor initiation, promotion and co-promotion; mutagenicity and DNA damage; EEG activity; memory, behaviour and cognitive functions; gene and protein expression; cardiovascular function; immune response; reproductive outcomes; and perceived electromagnetic hypersensitivity (EHS) among others. Numerous authoritative reviews have summarized this literature. Despite the advent of thousands of additional research studies on RF energy and health, the predominant adverse health effects associated with RF energy exposures in the frequency range from 3 kHz to 300 GHz still relate to the occurrence of tissue heating and excitable tissue stimulation from short-term (acute) exposures. At present, there is no scientific basis for the premise of chronic and/or cumulative health risks from RF energy at levels below the limits outlined in Safety Code 6. Proposed effects from RF energy exposures in the frequency range between 100 kHz and 300 GHz, at levels below the threshold to produce thermal effects, have been reviewed. At present, these effects have not been scientifically established, nor are their implications for human health sufficiently well understood. Additionally, a lack of evidence of causality, biological plausibility and reproducibility greatly weaken the support for the hypothesis for such effects. Thus, these proposed outcomes do not provide a

credible foundation for making science-based recommendations for limiting human exposures to low-intensity RF energy.” (underlining added)

Your selected quotations are in the Safety Code 6 document.

What you omitted from p 7 is, “The exposure limits in Safety Code 6 are based upon the lowest exposure level at which *scientifically-established* human health hazards occur.” (emphasis added)

The Precautionary Principle has been framed in various ways, including: 1) taking action to avert potential public harm when harm is suspected but there is not full scientific certainty; or 2) placing the onus for proof of safety on the proponent. The noted quotation from Safety Code 6 makes it clear that Health Canada has done neither of these, as although some may debate the certainty of biological effects of radiofrequency radiation at lower doses, Health Canada is only relying upon an effect for which there is full scientific certainty, as confirmed every time someone puts their food in a microwave oven. Neither is Health Canada asking for proof of safety. Health Canada’s supposed application of the Precautionary Principle is limited to use of “uncertainty” factors. Please see response immediately above. Neither of the potential actions in the face of potential harm without full scientific uncertainty are evident in Health Canada’s approach.

7.17.7 Please confirm that the text quoted above from Health Canada’s Safety Code 6 indicates that Health Canada has in fact considered the research studies on possible RF bio-effects unrelated to tissue heating, and has concluded that such effects have not been scientifically established and that the studies do not provide a credible foundation for making science- based recommendations to reduce the Safety Code 6 exposure limits.
If not confirmed, please explain.

Health Canada claims that studies have been examined, but provides no report detailing these considerations. Indeed, Health Canada has not even listed all of the studies considered in formulating Safety Code 6, much less the review methods such as search methods, inclusion/exclusion criteria, the data extracted, weighting methods or criteria, and experts / expert panels. Unlike some other endeavours of Health Canada and Environment Canada, such as the Chemical Management Plan, there was no opportunity for the public to review the full scientific report and to provide feedback. In dealings with Health Canada regarding pesticides, it was made clear to me that “ongoing monitoring” of the literature was not done in a cumulative fashion. If a single study came to light that in and of itself would give clear cause to overturn a pesticide registration (or by extension radiation exposure revision), then action might be taken. Furthermore, when asked, Health Canada was unable to supply a list of studies that had been considered regarding a particular chemical. The accrual of scientific evidence with successive and complementary studies is not captured in Health Canada’s “ongoing monitoring.”

7.18 Please confirm which of the works referenced in Dr. Sears Report involve studies of the effects of exposure to advanced meters.

I am not aware of peer-reviewed studies of health effects of “advanced” meters *per se*. These are needed; ideally data would be collected before installation in an area and the population would be followed afterwards. I chose studies of radiofrequencies similar to those emitted by smart meters.

7.19 On p. 6 of Dr. Sears’ Report, she refers to the BioInitiative Report (2012). Please refer to the Public Utility Commission of Texas (PUCT) staff *Report on Health and Radiofrequency Electromagnetic Fields from Advanced Meters* dated December 12, 2012. The report may be found at http://www.puc.texas.gov/industry/electric/reports/smartmeter/SmartMeter_RF_EMF_Health_12-14-2012.pdf . Please confirm that the PUCT staff report states the following on p. 17:

“The ‘BioInitiative Report’ is an example of a report that received notoriety despite being viewed negatively by the research community. ... The report is often cited by opponents of wireless technology, but it was widely criticized by government research agencies and subject matter experts in Australia, Belgium, the European Commission, France, Germany, and the Netherlands. It was also criticized by EPRI and the IEEE. The overall opinion of these institutions was that the report had many shortcomings. Some of the stated criticisms were that the report:

- Provided views that were not consistent with the consensus of science;
- Recommended safety limits that were not supported by the weight of scientific evidence;
- Included selection bias in several research areas;
- Lacked objectivity and balance; and
- Suffered from uneven editing quality.”

I did not rely upon Texan utilities staff in my letter. Please see my response regarding the BioInitiative report above (question 20.2, above).

7.20 At pp. 6-7 of her report, Dr. Sears says that “Epidemiological studies are unlikely to find a correlation between ongoing radiofrequency exposure and symptoms of electromagnetic hypersensitivity because people with sensitivities avoid exposures that provoke symptoms” and criticizes “Cohort study on the effects of everyday life radio frequency electromagnetic field exposure on non-specific systems and tinnitus” by Frei, Mohler, Braun-Fahrlander, Frohlich, Neubauer and Roosli (abstract available at <http://www.ncbi.nlm.nih.gov/pubmed/21982030>). Please confirm that this study took into account exposure to both far-field exposure (which would be unavoidable) and reports of near-field exposure in reaching the conclusion.

This study examined both types of exposure, *but in separate analyses* based on: 1) distance from towers for far field; and 2) phone use for near field exposures. Phone use

was estimated using self-report, and access to phone records for some participants (there was no access to business phone records – a major source of exposure uncertainty). Health outcomes were assessed using a questionnaire. There was also a very low response rate (37% for the first questionnaire), which is a potential source of bias.

7.21 At p. 13 of her report, Dr. Sears says: “There are many examples, but this was recently demonstrated as more pronounced effects on slow-wave and rapid-eye-movement sleep in rats exposed to 900 MHz modulated signals, compared with unmodulated, or sham exposures”. She cites “Non-thermal continuous and modulated electromagnetic radiation fields effects on sleep EEG of rats” by Mohammed, Frahmy, Radwan and Elsayed (available at www.sciencedirect.com/science/article/pii/S2090123212000343). Please confirm that this study actually concluded that there was no significant effect on slow-wave sleep:

“In the present study the exposure of the animals to 900 MHz RFR either continuous or modulated at 8 and 16 Hz resulted in non- significant changes of all EEG bands during SWS. However, significant changes have been recorded during REM sleep especially with modulated electromagnetic radiation fields. This result denotes that the REM sleep is more sensitive to changes due to electromagnetic radiation exposure than SWS”

The observed changes during SWS (slow wave sleep) did not quite reach statistical significance at a confidence level of 0.05, in this study with only 10 animals per group.

7.22 At p. 14 of her report, Dr. Sears says that the study “The effects of microwave emissions on sperm motility in rats” by Yan, Agresti, Bruce, Granlund, and Matloub, exposed rats to “3 hours daily cell phone exposure” (abstract available at <http://www.ncbi.nlm.nih.gov/pubmed/17628553>). Please confirm that the study exposed 31 rats to six hours of daily exposure, not three.

Confirmed, two 3-h periods. Thank you for this correction.

7.23 At p. 14 of her report, Dr. Sears says that the study “The effects of microwave emitted by cellular phones on ovarian follicles in rats” by Gul, Celebi and Ugras (abstract available at <http://www.ncbi.nlm.nih.gov/pubmed/19241083>) exposed rats to “cell phone radiation 15 minutes daily”. Please confirm that the study actually exposed rats to cell phone radiation for 24 hours per day, with the phone being in “talk” mode twice daily for 15 minutes each time.

Although this interpretation is suggested by the abstract, this is not correct. The methods indicate, “The phones were placed just under and in contact with the cage, for 11 h and 45 min in standby and 15 min in speech mode. The total amount of exposure time 12 h/day.”

7.24 At p. 15 of her report, Dr. Sears states that the study “Mobile phone emission modulates event-related desynchronization of alpha rhythms and cognitive-motor performance in health humans” by Vecchio, Buffo, Sergio, Iacoviello, Rossini and Babiloni (abstract available at <http://www.ncbi.nlm.nih.gov/pubmed/21873111>) found “decreased cortical activity and decreased reaction time in healthy volunteers”. Please confirm that:

7.24.1 the study found enhanced cortical neural effects and faster reaction times;

Consistent with my writing, the study found “Power decrease of high-frequency alpha rhythms (less cortical activation) after real exposure” and a shorter reaction time on a “go/no go” task. A faster reaction time is not necessarily desirable, as it may be associated with impulsivity.

and

7.24.2 the study found that the results occurred only in the “acutely exposed brain hemisphere”.

This quotation is not in the above-noted paper, and the results that were highlighted are more global – activity noted over the entire scalp, and reaction time (that would not be associated with only a small region of the brain).

7.24.3 the study at footnote 55 found only that the “localized” area of the brain exposed to the radiation was effected.

The study by Volkow et al. does not use the term “localized” in the results or conclusions sections. The effect, an increased rate of glucose metabolism, was clearly related to the radiation exposure, as it was greatest in the region closest to the antenna, and fell off further away, as the radiation was absorbed by the closest regions.

7.25 Please provide any evidence that proves that FortisBC’s advanced meters do not comply with Health Canada Safety Code 6 (2009).