



**Auditor General Environmental Petitions
and Government of Canada Replies regarding
Radiofrequency/microwave Radiation
Related to Health Canada's *Safety Code 6***

**Canadians for Safe Technology (C4ST)
May 24, 2020**

Auditor General Environmental Petitions and Government of Canada Replies Regarding Radiofrequency/microwave Radiation Related to Health Canada's *Safety Code 6*

Safety Code 6 (2015): <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/safety-code-6-health-canada-radiofrequency-exposure-guidelines-environmental-workplace-health-health-canada.html>
Safety Code 6 (2015) Rationale included here as an Addendum.

Summaries of the petition requests, written by the Office of the Auditor General of Canada (AGEP) staff, for the more recent petitions, can be found at: https://www.oag-bvg.gc.ca/internet/English/pet_fs_e_929.html

Full petitions for #229 to 398 B, inclusive and the replies to #407 were obtained through a request to the AGEP Office.

Other petitions, up to December 2020, are from Canadians for Safe Technology files: <http://c4st.org/>

Itemized by Marg Friesen 24 May 2020 – Draft.

#	AGE Petition #	Petition Title /Comments	Date	Page numbers-as received from the Office of the AGEP /# pages
1	229 Individual from Ontario	Installation of cellular towers in Simcoe, Ontario	12 December 2007	00001-00004
	REPLY Minister of the Environment- John Baird		27 March 2008	00005
	REPLY Minister of Health – Tony Clement		15-4-2008	00006
	REPOSNE: Health Canada		18-4-2008	0007-00010
	REPLY: Minister of Industry- Jim Prentice		18 April 2008	00011-00013
2	230 Individual – probably Ontario	Impact of cellular phone transmitters on human health	28 Nov 2007	00014-00024
	REPLY: Minister of Health – Tony Clement		15 April 2008	00025-00028
	Minister Industry Canada – Jim Prentice		18 April 2008	00029-00032
3	230 B – follow-up	Follow-up petition on the impact of cellular phone transmitters on human health	27 June 2008	00033-00036
	REPLY: Minister of Health - Tony Clement		29 October 2008	00037
	RESPONSE: Health Canada		11 November 2008	00038-00041
	REPLY: Ministry of Industry- Jim Prentice		15 December 2008	00042-00047
4	235 - Individual, Ontario	Health risks posed by electromagnetic radiation exposure from cellular towers	3 January 2008	00048-00065

		[Simcoe, Ontario]		
	REPLY: Minister Health Canada – Tony Clement	NOTE: PAGE 101 – MM WAVES	14-05-2008	000066-00119
	REPY: Minister of Industry – Jim Prentice		14 May 2008	00120-00126
5	235 B (follow-up) Individual, Ontario	Follow-up petition on the health risks posed by electromagnetic radiation (235 B)	20 June 2008	00127-00144
	REPLY: Minister of Health – Leona Aglukkaq		4 Nov 2008	00145-00151
	REPLY: Industry Canada - Tony Clement		15-12-2008	00152-00153
6	235 C (follow-up) Individual, Ontario	Follow-up petition on the health risks posed by electromagnetic radiation (235 C)	2 Feb 2009 16 Sept 2009	000154-00185
	REPLY: Leona Aglukkaq		22 June 2009	000186-
	RESPONSE: Health Canada		26 June 2009	00187-000192
7	247 – individual, Toronto, Ontario?	Environmental health impact of electromagnetic radiation	22 May 2008	00199
	REPLY Health Canada: Tony Clement	[Rogers]	26 Sept 2008	00200
	Health Canada RESPONSE		3 Oct 2008	00201-00207
	REPLY Industry Canada – Tony Clement		15-12-2008	00208-00211
8	253 Magda Havas Ph.D. ?	Potential adverse health effects from phones using Digital Enhanced Telecommunications [Request that first generation DECT phones be banned]]	19 June 2008	000121-00227
	REPLY Health Canada – Tony Clement		22 Oct 2008	00228
	RESPONSE: Health Canada		1 Nov 2008	00229-00235
	REPLY: Industry Canada: Tony Clement		15-12-2008	00236-00237
9	255 Individuals, Dennis and Sharon Noble, British Columbia	Health impact of electromagnetic radiation from telecommunication towers located in close proximity to residential areas	22 June 2008	00238-00269
	REPLY Industry Canada- Tony Clement		29-1-2008	00270-00283
	REPLY Health Canada – Leona Aglukkaq		5 Nov 2008	00284

	RESPONSE Health Canada		6 Nov 2008	00285-293
10	255 B – follow-up Dennis and Sharon Noble, British Columbia	Potential impact on human health of electromagnetic radiation emanating from telecommunication towers on Triangle Mountain, British Columbia (follow-up)	21 July 2008	00294
	Industry Canada – Tony Clement		29-1-2008	00300-00313
	Health Canada – Leona Aglukkaq		28 Nov 2008	314
	Health Canada		3 Dec 2008	315-320
11	260 Individual from Newfoundland	Electromagnetic sensitivity	Received 30 June 2008	00321
	Minister of Health -Tony Clement		29 Oct 2009	00327
	Health Canada RESPONSE:		11 Nov 2008	00328-00332
12	264 Individual had submitted a petition previously, Ontario	Environmental information in the “application for licence” to install a cellular tower in Simcoe, Ontario [Water Tower]	15Aug 2008	00333-00335
	Industry Canada – Tony Clement		29-1-2009	00334-00342
13	365 Individual, Ontario	Scientific evidence supporting the statements made in Health Canada’s Fact Sheet on Safety Code 6, which recommends limits for safe exposure to radio frequency electromagnetic radiation	25May2014	00406-00410
	REPLY: Minister of Health Rona Ambrose		15 Oct 2014	343
	RESPONSE: Health Canada	5 pages plus <i>Safety Code 6 Rationale (2013) # 00349-00394</i> with <i>Addendum to Rationale (2014) #00395-00405</i>	With letter of 15 October 2014	00344-00405
14	378 Individual, Norfolk County, Ontario	Safety Code 6 and protection from electromagnetic radiation generated by a cell tower antenna [Simcoe]	1 June 2015	00411
	Minister of Health Rona Ambrose		13 Oct 2015	412
	Health Canada RESPONSE:		With letter of 13 October 2014	413

15	398 Canadians for Safe Technology (C4ST)	Adequate warnings to Canadians about the effects of radiofrequency and microwave radiation from personal and household wireless devices [Submitted title: Failure of the Government of Canada to provide appropriate warnings so Canadians can take actions to protect themselves from excessive exposures to radiofrequency/microwave radiation from common personal and household wireless devices such as cell phones, baby monitors, cordless phones and Wi-Fi internet routers through normal, everyday use]	3 April 2017	00423-00427
	REPLY: Innovation Science and Economic Development (ISED)- Minister Navdeep Bains		28 July 2017	00419 -00422
	REPLY: Ginette Petitpas Taylor		16 Aug 2017	414
	RESPONSE: Health Canada		With letter 16 August 2017	00415-00418
16	398 B (Follow-up) Canadians for Safe Technology (C4ST)	Follow-up petition on adequate warnings to Canadians about the effects of radiofrequency and microwave radiation from personal and household wireless devices (follow-up)	3 April 2017	00429 (cover letter)
	REPLY: Minister of Health – Ginette Petitpas Taylor		12 April 2017	00431
	RESPONSE: Health Canada		With letter 12 April 2017	432-435
	Industry, Science and Economic Development (ISED) - Minister Navdeep Bains		10 April 2017	436-438
17	399 Individual- Frank Woodcock Simcoe, Ontario	Scientific weight of evidence for Safety Code 6, Health Canada’s radiofrequency exposure guidelines	7 April 2017	3 pages
	REPLY: Minister of Health-Jane Philpott		18 August 2017	1 page
	RESPONSE: HEALTH CANADA	The “discussion paper” titled Safety Code 6 (2015) deals only with excessive heating of tissue as being an “established” effect for radiofrequencies emitted by commonly used devices such as cell phones. Peripheral nerve stimulation is also an “established” effect for the very low	With letter of 18 August 2017	2 pages plus Safety Code 6 (2015) Rationale (See Addendum)

		radiofrequencies. No other effects such as DNA damage at low levels are incorporated into Safety Code 6 guidelines.		
18	402 Peel Parents for Safe Use of Technology in Schools, Ontario	Precautionary messaging and advisories in schools for safer use of wireless devices [Title as submitted: Need for Health Canada to provide appropriate precautionary messaging and advisories in schools for safer use of wireless devices such as cell phones and tablets, especially when connected through Wi-Fi, to protect children and others from radiofrequency/microwave radiation – above and below Safety Code 6 (2015) guidelines]	25 May 2017	8 pages
	REPLY: Minister of Health- Ginette Petitpas Taylor		11 October 2017	1 page
	RESPONSE: Health Canada		With letter of 11 October 2017	6 pages
	REPLY: Minister of Industry, Science and Economic Development (ISED), Navdeep Bains		11 October 2017	3 pages
19	403 Environmental Health Association of Manitoba	Exposure of vulnerable persons to microwave and radiofrequency radiation [Title as submitted: Scientific evidence for more substantial actions regarding the Parliamentary Standing Committee on Health (HESA) 2015 recommendations regarding children and pregnant women (vulnerable persons) exposed to wireless radiation in the microwave/radiofrequency range covered by Safety Code 6, from wireless devices such as baby monitors, tablets, cell phones, smart meters, Wi-Fi routers and 5G technology]	12 June 2017	15 pages
	REPLY: Minister of Health- Ginette Petitpas Taylor		20 Oct 2017	1 page
	Response: Health Canada		With letter of 20 October 2017	7 pages
20	406 Electromagnetic Pollution Illnesses Canada Foundation (EPIC)	Recognition, protection, and accessibility for persons who suffer health impairment related to contamination by electromagnetic pollution [Title as submitted: Recognition, protection, and accessibility for	16 June 2017	17 pages

		persons who suffer health impairment related to contamination by electromagnetic pollution in indoor and outdoor environments: Furthering Honourable Health Minister Philpott's topic "Greater Understanding and Management of Electromagnetic hypersensitivity (EHS)" in response to the Standing Committee on Health (HESA) report <i>Radiofrequency Electromagnetic Radiation and the Health of Canadians</i> (related to Safety Code 6 et al.)		
	REPLY: Minister of Health- Ginette Petitpas Taylor		25 October 2017	1 page
	RESPONSE: Health Canada- Minister Ginette Petitpas Taylor		With letter of 25 October 2017	8 pages
	REPLY: Minister of Science- Kristy Duncan		24 October 2017	2 pages
	Statistics Canada		No response ?	No response ?
21	407 Prevent Cancer Now	Scientific review processes to determine limits on exposure to radiofrequency radiation according to Safety Code 6 Title as submitted: <i>Regrading Scientific Review Processes to Determine Limits on Exposure to Radiofrequency Radiation according to Safety Code 6 – Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz (2015)</i>	21 June 2017	14 pages
	RESPONSE: Health Canada- Minister Ginette Petitpas Taylor		25 October 2017	00452 1 page
	RESPONSE: Health Canada		With letter of 25 October 2017	00453-00458 6 pages
	REPLY: JOINT LETTER – Minister of Industry, Science and Economic Development (ISED), Navdeep Bains and Minister of Science, Kristy Duncan		27 October 2017	00447-00451 5 pages
	REPLY: Minister of Environment and Climate Change - Catherine McKenna		3 August 2017	459 1 page
22	409 Individual,	Health Canada's Safety Code 6 threshold for excessive heating and	27 June 2017	11 pages

	Margaret Friesen, Manitoba	other adverse effects from radiofrequency and microwave wireless radiation on the human eye and on infants [Title as submitted: Health Canada's Safety Code 6 for Specific Absorption Rate (SAR) actual threshold of excessive heating and the adverse effects, for exposure of the eye, and of early human developmental stages e.g. newborn babies, to radiofrequency/wireless radiation e.g. from baby monitors, cell phones and 5 th Generation (5G) technologies]		
	REPLY: Health Canada- Minister Ginette Petitpas Taylor		25 October 2017	1 page
	RESPONSE: Health Canada		With letter of 25 October 2017	5 pages
	ADDENDUM:	<i>Safety Code 6 (2015) Rationale</i>	Made available to the public only after Safety Code 6 (2015) was published.	62 pages
		Health Canada's "discussion paper" titled <i>Safety Code 6 (2015)</i> deals only with excessive heating of tissue as being an "established" effect for radiofrequencies emitted by commonly used devices such as cell phones. Peripheral nerve stimulation is also an "established" effect for the very low radiofrequencies. No other effects such as DNA damage at low levels are incorporated into Safety Code 6 guidelines.		



RE-SUBMISSION

December 12, 2007

The Auditor General of Canada
Commissioner of the Environment and Sustainable Development
240 Sparks St.
Ottawa, On
K1A 0G6

Attn. Petitions

Dear Auditor General,

Please accept this letter as a petition under the Auditor General Act. I am submitting this petition because a cellular tower was installed in my backyard with no notification what so ever. I am concerned about this form of radiation and am suffering from symptoms specific to this form of emission and have been diagnosed as such.

I hold the Government of Canada, as the sole custodian and dispenser of licenses for this technology, responsible for the resolution of this issue.

The Facts:

1. In the early part of 2006 an antenna mysteriously appeared on the water tower on Union St. that is nestled in a quiet residential area in Simcoe, ON.
2. Rogers was the service provider and it appears that they secured a lease from the County of Norfolk.
3. Rogers, we are told, advised the County that providing public notice was not required.
4. The County, which did not have a cellular antenna siting policy, agreed and the cellular antenna were installed on the tower.
5. The County signed an 18 year lease with the first renewal date in March 2008.
6. On reviewing the documentation we have found the following:
 - The first preferred site on Virginia Av in Simcoe was turned down for the **same antenna** because public consultation was required.
 - This site got approval because of plain **omission, misinformation or in the worst case lying** on the attestation form by Rogers. *Lying is defined as conveying a false image or impression.*
 - Furthermore Industry Canada is grossly complacent because it allows cell companies to self attest and install antenna without any review of the attestation. Mr. Jack Holt from Industry Canada indicated in a meeting that I had with him that "these guys know what they are doing; they install thousands of these antenna." What does that imply? Who is in charge?

- In the attestation Rogers **attested** that a) there was **NO** building within **15 meters**. **Well there are 2 residences within 14 meters**. How does a professional engineer with all the technical tools at his disposal get it wrong?
- They also stated that the antenna was not significant. In fact the water tower had a 44 W FM antenna which was used by the OPP prior to 2006. Rogers added more than 3000 W of Radio Frequency and Microwave power to the water tower and then attested that the installation was **NOT SIGNIFICANT**.
- Industry Canada was asked in 2004/5, well before the installation in Simcoe, to define **SIGNIFICANT installations/modifications**. They did not and have yet to define significance. This has allowed Rogers and others to self "attest" and answer the significance question with a resounding **NO without any fear of sanctions**.
- What is the significance of answering **NO** to the questions in the attestation, notwithstanding the fact that they are not truthful? The answer is that it avoids a review by Environment Canada which could delay installations and could precipitate public consultation. This is something Rogers and others don't want and are soundly supported by Industry Canada. This support prompted me to ask Mr. Holt who Industry Canada represented: me a Canadian Citizen or Rogers.
- I pointed out to Industry Canada through Mr. Holt that the Client Procedure Circulars issued by Industry Canada include sanctions for answering improperly on the attestations. The fact is that Industry Canada does very little, if anything, to audit or review the process. By answering **NO** to all the attested questions, Environment Canada never gets to do its review.
- This insidious methodology allows for an antenna to get installed in neighbourhoods without consultation.

What should have happened:

1. Rogers should have filled out the attestation truthfully and answered **YES to the question on distance of 15 meters from a building**.
2. This would have allowed Industry Canada and Environment Canada to do their assessment before the antenna was installed notwithstanding the outcome. Note: As a Professional Engineer I am required to sign numerous attestations – passports, environmental certificates of approval, pre start health and safety reviews etc. Does the Government of Canada not require me to sign these attestations truthfully? Imagine if I took it upon myself to **LIE** on an attestation because I assumed that the outcome was not in my favour or inconsequential. **This is the situation we have here.**
3. The Industry Canada **FAQ** document, issued to the general public, clearly states that **all** interested parties have an opportunity to consult if one is aware of an antenna or tower that is being erected in a neighbourhood. Please reference the document that was in force in 2005 just before the erection of this tower. Industry Canada has indicated that they want to change this FAQ and the attestation. In other words "fit the evidence to the crime". This is what the FAQ states "*What should I do if I am concerned about a proposed tower in my community?* Industry

Canada recognizes that local community may have concerns aboutIf you have concerns about a proposed tower in your community you may wish to make your views known to your local municipal officials.....”

4. The residents in the neighbourhood of the Union Street tower in Simcoe should have had the opportunity, as stated in the FAQ, to a public consultation. We **DID NOT** get this opportunity.
5. Industry Canada was repeatedly asked, and this is well documented, at the National Tower Review Consultation well ahead of the Union Street tower installation in Simcoe, to define **SIGNIFICANT** installations and modifications. They did not and have yet to do so. They allow the cell companies to do so and then justify the installation after the fact with **NO** basis for a definition. In this situation the power was increased **10 fold** and was defined as **NOT SIGNIFICANT** by Rogers.
6. Industry Canada **DOES** have a dispute resolution mechanism **BEFORE** a tower goes up but **DOES NOT** have a dispute resolution mechanism after installation. Even Canada Post has one!!! Hence the only recourse is the Auditor General. Jack Holt from Industry Canada has pointed me in this direction.

What has happened since:

As a result of the “fight” from the residents around this tower in Simcoe, ON, Industry Canada has now revised its Client Procedure Circular, <http://www.ic.gc.ca/epic/site/smt-gst.nsf/en/sf08777e.html>, as of January 2008 stating:

- That new towers or upgrades will require consultation if installed in sensitive residential areas such as ours. The distance defined for consultation is 3 times the tower height which would have included my residence.
- That the Cell companies by default have to conduct consultation if the host County lacks a siting procedure.

My Petition:

1. Given the gross lack of public concern for due process including the host of issues surrounding the omission, misinformation or blatant lies in the attestation and Industry Canada’s “cover” for Rogers I am petitioning **Industry Canada** to reverse this situation in Simcoe and force Rogers to go through the process of public consultation if they still desire to use the water tower. **Attention Industry Canada**
2. Given my health issues and diagnosis I need to know why Health Canada, who is fully aware of this situation, chooses to ignore it. There is ample evidence that there are adverse health effects from being very near cell towers. This one in particular is **very, very low in height**, sits adjacent to **homes, an elementary school, a hospital and a nursing home. Where is the precautionary principle as espoused by Environment Canada under CEPA? Attention Health Canada**
3. Does the Government of Canada know about health studies that contradict Health Canada’s assertion that “no studies exist” on the biological effects of towers that are “buried” in neighbourhoods like ours. How does Health Canada explain the following studies:

- “Naila Study” in Germany, which is very closely scripted to the Simcoe Union Street Tower. In this study the newly developed cancer rate increased 4 fold, 10 years after the erection of a tower in Naila. The cancer rate outside the 400m radius remained unchanged.
 - A similar study in Israel?
 - The Santini et al study in France that describes significant and adverse illnesses within 300 m of a tower?
 - That RF radian illness is a recognized illness in Sweden?
 - That numerous countries have moratoriums on the installation of towers near residential areas, schools and hospitals?
 - That the last update to Health Canada information is 1999? Is it no wonder that they can say that they are “not aware”?
 - That TMOBILE buried a massive peer reviewed study done by ECOLOG an independent scientific institute? Is the AG aware that TMOBILE was the sponsor of the study?
 - That the cellular industry commissioned a study in China and then again buried it after the study determined DNA breaks? **Attention Health Canada**
4. Note: There is an opportunity for the relocation of this tower in the next 4 months. The first lease renewal comes up in March 2008. Another provider has offered to co-share a tower with Rogers. This option requires the Government to act immediately to facilitate this action. The County of Norfolk, who signed the lease, has stated publicly that they will terminate the lease if Rogers agrees. What does the **Industry Canada** intend to do to Facilitate this? **Attention Industry Canada**
5. What does Environment Canada intend to do faced with a tainted attestation form by Rogers? **Attention Environment Canada.**

Conclusion:

We in Simcoe did not get the opportunity to use the dispute resolution mechanism available prior to the installation. Had there been consultation or had the process been followed truthfully this situation would not have existed. On the contrary we have been told that we are hypochondriacs. Given the poor performance or lack of, by the Government through Industry Canada and Health Canada, and its complacency in the erection of this particular tower I am requesting that you the Auditor General conduct an inquiry into this matter and force the removal of this tower by March 2008. My health, the health of my family and neighbours is paramount.

Minister of the Environment



Ministre de l'Environnement

Ottawa, Canada K1A 0H3

MAR 27 2008

Dear

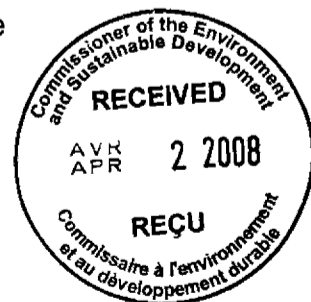
I am responding to your Environmental Petition No. 229, to the Commissioner of the Environment and Sustainable Development, regarding the effects on human health of radiation from cellular phone towers. Your petition was received in the Department on December 20, 2007.

Environment Canada has no regulations in place that cover the effects of electro magnetic field radiation on humans and their environment. This is a matter that falls under the responsibility of the provinces and territories. Therefore, it would be inappropriate for the Department to take any action in this regard.

Sincerely,

John Baird, P.C., M.P.

c.c.: The Honourable Jim Prentice, P.C., M.P.
The Honourable Tony Clement, P.C., M.P.
Mr. Ronald C. Thompson, Interim Commissioner of the
Environment and Sustainable Development



Canada

Minister of Health and the Minister
for the Federal Economic Development
Initiative for Northern Ontario



Ministre de la Santé et Ministre de
l'Initiative fédérale du développement
économique dans le Nord de l'Ontario

Ottawa, Canada K1A 0K9

15/4/08



Dear [Redacted]

This is in response to your environmental petition no. 229 of December 12, 2007, addressed to Mr. Ronald Thompson, the Interim Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised a number of health-related questions concerning a cell phone antenna installed on the water tower on Union Street in Simcoe, Ontario.

I am pleased to provide you with the enclosed Health Canada response to your petition. I understand that the Ministers of the Environment and of Industry will be responding separately to questions which come under the purview of their respective departments.

I appreciate your interest in this important matter, and I hope that you will find this information useful.

Yours sincerely,

Tony Clement

Enclosure

c.c. Mr. Ronald C. Thompson, Interim CESD
The Honourable John Baird, P.C., M.P., Minister of the Environment
The Honourable Jim Prentice, P.C., M.P., Minister of Industry

Canada

Health Canada Response to Environmental Petition no. 229
Cellular Antenna on Water Tower, Simcoe, ON.
Answers provided to Questions 2 and 3.

Q2. Given my health issues and diagnosis I need to know why Health Canada, who is fully aware of this situation, chooses to ignore it. There is ample evidence that there are adverse health effects from being very near cell towers. This one in particular is very, very low in height, sits adjacent to homes, an elementary school, a hospital and a nursing home. Where is the precautionary principle as espoused by Environment Canada under CEPA? Attention Health Canada

A2: For the past three decades, Health Canada (HC) scientific staff have continuously monitored the scientific evidence of the biological effects of radiofrequency (RF) electromagnetic fields, either as participants in standard-setting bodies and international scientific meetings, as academic or peer reviewers for publications, or as part of a continuous program of literature surveillance in support of HC's Safety Code 6. They are aware of some studies claiming that biological effects may occur at RF energy levels below the Safety Code 6 limits. However, it is important to point out that most of the biological effects at these low levels, reported over the past 30 years, are not scientifically well established or remain unproven. It is technically impossible to ever definitely "prove" that any activity, product or item is absolutely safe. You cannot prove the absence of anything, you can only demonstrate how diligently and thoroughly you have looked and make health risk decisions based on the current scientific evidence. With RF fields, the vast majority of the scientific literature does not suggest any adverse health impacts at human exposure levels below the limits outlined in Safety Code 6. There exists a wide range of variations in the quality of studies related to the investigation of the biological effects of RF fields. This area of research has been particularly subject to false-positive reports of adverse effects, owing to the complexity of conducting RF field bio-effects studies in the absence of appreciable heating. The majority of studies conducted prior to 1990 had little or no information related to dosimetry and did not adequately control for possible thermal effects. While research methodologies have generally improved in recent years, some research studies are still published where exposure conditions have not been thoroughly controlled.

When assessing the scientific literature related to the possible bio-effects of RF fields (or any other agent), it is important to use the weight of evidence approach to the evaluation of potential risks. This approach looks at all the scientific evidence as a whole, both the negative and positive results, whether they are related to heating of the tissue (thermal) or at exposure levels too low to cause significant tissue heating (non-thermal), and attempts to weigh them on the basis of quality of the study design and reporting. This is the same approach used by all other international, science-based risk assessment bodies such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP), the World Health Organization (WHO), and the Institute of Electrical and Electronics Engineers (IEEE). It is the policy of Health Canada to develop guidelines that have a sound, scientifically defensible basis.

In regards to the precautionary principle (PP), it is recommended by the WHO and others that precautionary approaches be implemented in a non-regulatory manner with cost-benefit considerations, and not by arbitrarily adjusting existing science-based limits. This approach to the PP is especially relevant to exposures originating from cellular telephone base stations where levels are typically measured to be thousands of times below current science-based exposure standards. Health Canada encourages dialogue between stakeholders in resolving disputes about tower siting.

Q3. Does the Government of Canada know about health studies that contradict Health Canada's assertion that "no studies exist" on the biological effects of towers that are "buried" in neighbourhoods like ours.

Q3: (This response should come from outside of Health Canada)

How does Health Canada explain the following studies:

Q3a) "Naila Study" in Germany, which is very closely scripted to the Simcoe Union Street Tower. In this study the newly developed cancer rate increased 4 fold, 10 years after the erection of a tower in Naila. The cancer rate outside the 400 m radius remained unchanged.

Q3b) A similar study in Israel?

Q3c) The Santini et al study in France that describes significant and adverse illnesses within 300 m of a tower?

A3a), b), c): The Naila and Wolf & Wolf (Israel) studies are epidemiological studies attempting to find an association between how close a person lives to a cellular base station and the incidence of cancer. Epidemiological studies cannot by themselves prove causality of an agent to a disease but can infer it if sufficiently strong associations are found. Neither of these two studies, no matter the diligence and sincerity of the authors, present strong associations despite the relatively high risk ratios quoted in the reports. They both suffer from a number of methodological shortcomings that are not obvious to the casual reader. For instance, in the Naila study there appears to be a discrepancy for the age of study subjects between exposed and control groups. Age is a well known risk factor for many cancers and should be matched as closely as possible. In the Wolf & Wolf study the extremely short time frame from exposure onset to cancer diagnosis (1-2 years) leads one to suspect the validity of the results. If one were to take these numbers at face value, the population of the exposed area would incur illnesses and possibly succumb within a decade.

The Santini study is an example of a questionnaire-type of study where participants are asked to subjectively rate health-related symptoms. This information is then collated to the distance of their residence to a cellular base station where this distance is used as an exposure index. This type of ecological study may be useful if causality has already been

established. Unfortunately, this type of study is difficult to conduct in a blinded fashion, meaning the study subjects would not be aware of the cell tower in their midst and would not be aware of the controversies surrounding the technology. This was not the case with the Santini study which subsequently cannot correlate the cause of the symptoms to exposure to RF energy (as opposed to some other hazardous agent).

Q3d): That RF radian illness is a recognized illness in Sweden?

A3d): There seems to be a popular misconception that the Government of Sweden recognises Electromagnetic Hypersensitivity Syndrome (EHS) as an illness attributable to RF exposure. That is not the case. While the Swedish Government recognises the non-specific symptoms of EHS, it does not recognise or acknowledge these symptoms as arising from exposure to RF fields.

Q3e): That numerous countries have moratoriums on the installation of towers near residential schools and hospitals?

A3e): Some municipalities in some countries have made suggestions not to install base stations near schools and residential areas or have suggested their own additional arbitrary limits for base stations. In those countries, adherence to nationally adopted exposure limits is mandatory, while other locally imposed recommendations are voluntary and not legally binding. The reasoning behind these more stringent recommendations is socio-political in nature and not solidly based on science. Safety Code 6 is a document based on concrete scientific evidence that encompasses all technologies operating at frequencies from 3 kHz to 300GHz. It is not specific to one particular technology or range of frequency.

Q3f): That the last update to Health Canada information is 1999? Is it no wonder that they can say that they are "not aware"?

A3f): Although Safety Code 6 last underwent a major revision in 1999, Health Canada scientists continuously monitor the worldwide peer-reviewed scientific research and to date, no new convincing scientific evidence has prompted an update of the code.

Since 1999, Health Canada's scientific staff have also carried out independent, internally funded studies of RF fields at a range of intensity levels (both many times greater and many times lower than those specified in Safety Code 6) to investigate the plausibility of some reported non-thermal RF field bio-effects. These studies found no evidence to support the claims of such non-thermal bio-effects. The results of these studies have been published in open, peer-reviewed literature and overwhelmingly support and validate the limits adopted in Safety Code 6. Also since 1999, several members of the RF expert panel of the Royal Society of Canada, originally engaged to review the then proposed revised Code, have undertaken two additional reviews, each time looking at the scientific literature published since their previous review period. In both cases, they concluded that there was no new information published that would cause them to change their original assessment of 1998 that the exposure limits set out in Safety Code 6 provide adequate protection for the Canadian public from adverse health effects.

Q3g): That TMOBILE buried a massive peer reviewed study done by ECOLOG an independent scientific institute? Is the AG aware that TMOBILE was the sponsor of the study?

A3g): This portion of the response will need to be addressed by the Auditor General. Health Canada scientists have read the press release in regards to the Ecolog Institute in Germany, however, the study paper has not been peer reviewed as suggested by the petitioner.

Q3h): That the cellular industry commissioned a study in China and then again buried it after the study determined DNA breaks? Attention Heath Canada.

A3h): To the best of our knowledge, the Chinese Study Paper has not been peer reviewed nor published, thus it is not in a position to be addressed at this time. Please keep in mind, however, that no single study or individual can directly impact the standards setting process. It is imperative that the findings of a research group be independently replicated by other organisations before they are taken as a definitive proof.

Minister of Industry



Ministre de l'Industrie

The Honourable L'honorable

Jim Prentice

Ottawa, Canada K1A 0H5

18 APR. 2008

Dear

I am writing to provide you with Industry Canada's response to your Environmental Petition No. 229, dated December 12, 2007, concerning the installation of a radiocommunication antenna system on the Union Street water tower in Simcoe, Ontario. Your petition was forwarded to me by the Commissioner of the Environment and Sustainable Development. I am pleased to respond to your specific questions, as numbered in your petition, that are within Industry Canada's area of responsibility.

Question 1: Given the gross lack of public concern for due process including the host of issues surrounding the omission, misinformation or blatant lies in the attestation and Industry Canada's "cover" for Rogers, I am petitioning Industry Canada to reverse this situation in Simcoe and force Rogers to go through the process of public consultation if they desire to use the water tower. Attention Industry Canada.

The *Preliminary Environmental Information, Municipal/Land-Use Consultation and Aeronautical Site Clearance Attestation* is an information gathering tool used by Industry Canada in its consideration of antenna installations. The questions listed on this form, as well as certain information provided on the licence application form, represent various information elements that assist Industry Canada officials to determine whether a proposal is excluded from environmental assessment under the *Exclusion List Regulations* of the *Canadian Environmental Assessment Act* (CEAA). My officials, independent of the information provided on the attestation, have assured me that the addition of the antennas to the Union Street water tower meets the criteria for exclusion from environmental assessment established under the *Exclusion List Regulations*. As such, it is considered to be a project likely to have insignificant environmental effects from the perspective of the CEAA.

Canada



...2

Industry Canada has procedures that require proponents of certain types of antenna structures to consult with the land-use authority, and to seek concurrence prior to erecting an antenna supporting structure. In this particular case, the antenna supporting structure, in the form of Norfolk County's water tower, was already in place. The County concurred with the proposal and subsequently entered into a lease agreement with Rogers Wireless for the use of the water tower as an antenna supporting structure. The addition of the Rogers Wireless antennas, in comparison with the overall size of the water tower and the existing antennas, was determined by Norfolk County, Rogers Wireless and Industry Canada to be an insignificant additional impact on the local surroundings. Rogers Wireless has fully complied with Industry Canada's antenna siting procedures.

Question 4: Note: There is an opportunity for the relocation of this tower in the next 4 months. The first lease renewal comes up in March 2008. Another provider has offered to co-share a tower with Rogers. This option requires the Government to act immediately to facilitate this action. The County of Norfolk, who signed the lease, has stated publicly that they will terminate the lease if Rogers agrees. What does the Industry Canada intend to do to facilitate this? Attention Industry Canada

It is the understanding of Industry Canada's local officials that Rogers Wireless and Norfolk County have entered into a multi-year lease agreement for the use of the Union Street water tower as an antenna supporting structure. Given that Rogers Wireless has complied with Industry Canada's requirements, it is Industry Canada's view that there would be no legal basis for the department to intervene in this matter and compel Rogers Wireless to relocate its antenna system.

Question 5: Please note that although you identified that this question should be directed to Environment Canada for response, my officials have confirmed with that Department that the matter falls under Industry Canada's area of responsibility. What does Environment Canada intend to do faced with a tainted attestation form by Rogers? Attention Environment Canada


Industry Canada is the federal authority responsible for approving antenna installations and is responsible under the CEAA to carry out environmental assessments on these types of installations where required. This particular attestation form was developed by Industry Canada to collect information in order to assist with the department's consideration of whether an installation will meet the criteria for exclusion established under the *Exclusion List Regulations*. My officials, independent of the information provided on the

...3

attestation, have assured me that the addition of the antennas to the Union Street water tower meets the criteria for exclusion from environmental assessment under the *Exclusion List Regulations*.

I appreciated this opportunity to respond to your petition, and trust this information is helpful.

Sincerely,

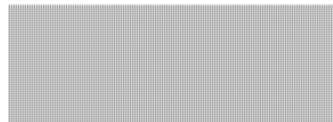
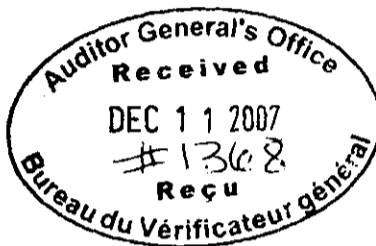
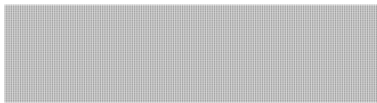
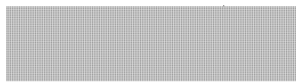
A handwritten signature in black ink, appearing to be 'Jim Prentice', with a long horizontal line extending to the right.

The Honourable Jim Prentice, P.C., Q.C., M.P.

c.c. Mr. Ron Thompson, FCA
Interim Commissioner of the Environment
and Sustainable Development



Action: K. Mark



November 28, 2007

Ms. Sheila Fraser,
The Auditor General of Canada,
Commissioner of the Environmental
and Sustainable Development,
240 Sparks Street,
Ottawa, Ontario. K1A 0G6

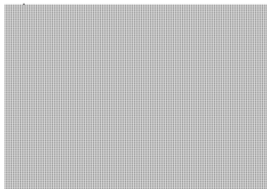
Attention : Petitions

Dear Auditor General :

I respectfully request your help and am attaching a petition under the Auditor General Act in resolving a health matter that has forced me, my wife and three children from our 137 year old family home. We have had to live away from our home for the past 21 months and have suffered severe physical, financial and emotional harm.

The Ministries of Health and Industry, responsible for our suffering, have made no attempts to resolve my health problem and I am calling on your Office for help.

Yours truly,



W

Background

Purchased our Family home from my Mother in November, 2004. House is of heritage vintage (1870) and has been in our family for over 20 years. I lived in the house for a couple of years when I first started out as an accountant (1987, 1988) and have never suffered any adverse health affects during the time we lived there, November, 2004 to February, 2006.

In December of 2005 Rogers Wireless completed the installation of cell phone transmitters along the perimeter of Norfolk County's Union Street water tower located a mere 11 meters from our property. This was done WITHOUT giving any public notification.

In February of 2006 I began suffering from electromagnetic hypersensitivity and by the third week of February, 2006 the pain was so intense I had to leave my home. The symptoms are not vague but very specific and include a tingling in the head between the temples (similar to the feeling one gets when your arm falls asleep) followed by a headache, which by the way I did not suffer from before this, and extreme fatigue where I just want to lay down and sleep. On extended exposure I have difficulty in formulating sentences, my short term memory is profoundly impacted and I get dizzy where I cannot navigate a straight line. My wife and I along with our three children, ages 16, 13 and 9 have lived in a two bedroom, one bath apartment ever since.

In February 2006 I contacted Norfolk County Public Works and Environmental Services Department regarding the cell phone transmitter installation and was told that the County entered into a long term lease agreement with Rogers Wireless (2023) that has no escape clauses and allows Rogers Wireless to install as much equipment as they deem necessary. I discussed the matter with the local Health Unit and was told that there were no communications with the Public Works Dept. prior to the execution of the lease.

I met with Rogers Wireless, Norfolk County Public Works and the Health Unit in March, 2006. I asked the individual responsible for the negotiation of the lease if he was aware that the County could have given Notification. His response was "no, he was not aware." In fact he believed that Notice should not have been given because it may negatively impact on his negotiations with Rogers Wireless. I further asked if he would purchase our home if Rogers Wireless refused to relocate to which he responded, "no, I would never locate near high power lines, transformers or cell phone antennas." I cannot understand that if he does not consider it safe why he would expect it to be safe for anyone else. Rogers Wireless response to our request was "no, we fall under Federal Guidelines, Safety Code 6."

Further research was conducted and we discovered that Health Canada's Safety Code 6 addresses only the thermal effects of these transmitters, the warming of human tissue over a 6 minute period. It does not consider the non-thermal biological effects that scientists are linking to long term exposure of this radiation and childhood leukemia and brain tumours. As mentioned earlier our property is only 11 meters from the structure housing these transmitters. Next to us is an elementary school where 420 children play directly in the shadow of this site and next to the school is a Nursing Home and 120 bed Hospital. Health Canada, in a letter dated March 2005, about the same time as this particular site was ready to be installed, acknowledges that there are studies making the link with this radiation and cancer but dismisses it by stating that there aren't enough studies and that they are not conclusive enough. I believe that in light of these suspicions the Precautionary Principle should be adopted and a moratorium placed on siting these installations in such sensitive areas until definitive proof is available. Why take the chance??

In June, 2006 I stood before Norfolk County Council along with 19 neighbours who were suffering from similar symptoms asking Norfolk County to relocate the cell phone transmitters. In an 8 to 1 vote the County agreed to begin negotiations with Rogers Wireless, based on health reasons, to relocate. The County also directed its Health Unit to investigate why 20 people were suffering. To date I have not been contacted by the Health Unit.

In August, 2006 I telephoned the County's negotiator requesting an update on how negotiations were progressing. I was told that most of the discussions were "off the record." I responded with "so I guess I'll have to put a For Sale sign on my lawn." His response was "no, it's not a matter of "if" the cell tower is going to move it's a matter of "when"." I then asked "are we talking years?" to which he responded, "no, it will not be years. It will take a while but it should be a matter of months."

In September, 2006 the Health Unit reported on their investigation. In its report to Council the Health Unit cites a study claiming there are no health concerns with this radiation. They did not inform Council that the study also recommends that the Precautionary Principle be adopted just in case they are incorrect. The Health Unit also refers to a Dr. Robert Bradley of Health Canada who was in attendance at our June, 2006 deputation. When asked if there were other sites in Canada with similar concerns he responded that there were other sites but concerns focussed on aesthetics and not health. The report finally attempts to tear the link between electromagnetic hypersensitivity and electromagnetic fields by quoting a Dr. John Moulder. It seems odd that the Health Unit, which claims to have no expertise in the area of electromagnetic radiation would be quoting an individual claiming to be an expert in the subject without examining his credentials, especially if they were *objectively* investigating the neighbourhood.. It so happens that Dr. Moulder, in the enclosed article from "Microwave News", is a consultant for the cell phone industry whose objectivity is suspect. I believe the Health Unit was in communication with Health Canada and was

told by Health Canada to report in the manner they did, without discussing matters with the patient (me) and in so doing Health Canada interfered with my ability to resolve my health problem Health Canada has gone out of its way to provide biased, misleading information to a municipality in order to quash any further investigation in an area that they don't want to see the light of day. I believe that Health Canada has played a continuous role in this process by assisting Norfolk County and its Health Unit with strategies...to belittle and undermine my health problem and my ability to cure it.

In October, 2006 Norfolk County decided not to pursue negotiations with Rogers Wireless. Rogers Wireless told the County they would relocate if the County paid for the move as set out in their lease agreement (copy enclosed). Rogers Wireless quoted a figure of anywhere between \$ 350,000 and \$ 1,000,000 to do so. Norfolk County did not take the time or effort to verify the relocation costs, they simply stopped the process in its tracks. There can be no other reason than MONEY to rationalize this decision.

In October, 2006 met with candidate for Mayor in November municipal elections. He agreed with us, supported us, even asked to assist in the preparation of subsequent deputations before Council.

In February, 2007 received a phone call from the Acting Medical Officer of Health. He stated that there is a problem with these installations and that I should resume efforts for relocation. This is the same Acting Medical Officer of Health who signed the report to Council (September, 2006). He could not discuss why he wanted me to pursue this matter further but he did tell me that he could not speak negatively against the subject and that communications from his Office were reviewed before being made public.

In April, 2007 provided Norfolk County Council with a letter signed by 11 Doctors advocating the Precautionary Principle. I assisted in the drafting of the letter at the request of the Acting Medical of Health. He reviewed it, agreed with it and asked other Doctors to sign it if they wished to. Rather than embrace this letter and act on its advise Council, instead, mocked the letter and said that the Doctors were coerced into signing it.

In April, 2007 made another deputation before the new County Council requesting the relocation of the site and was asked to provide Council with the information upon which we were basing our request. This was after we had arranged for an international expert to speak to Council the previous June.

In May, 2007 attended at the New Women's College/Sunnybrook Hospital and was diagnosed by Dr. Kerr as suffering from electromagnetic hypersensitivity.

In June, 2007 scheduled another deputation before Council and was not allowed to speak. We had provided Council with the information they had requested 5 days before the scheduled meeting and arranged for an international expert to speak directly on the subject and answer any questions. The Mayor, after a 14 minute assault of borderline slanderous and incorrect statements placed the information I had provided on his desk, declared it "old" information and would not allow anyone to speak on this 5 day old information. The Mayor changed the rules of presentation and when challenged on his new rules abruptly stopped the meeting and called the police. There were approximately 80 concerned residents in attendance ranging in age from 6 to 77. The number of affected residents in the immediate area of the cell phone transmitters is now up to 71. Included in our information were the results of a T-MOBILE study that was recently uncovered. In 2000 T-MOBILE retained ECOLOG, an independent laboratory to essentially peer-review all the peer-reviewed studies to date. T-MOBILE thought that this would finally put an end to the controversy. When the results were published and concluded that there is a direct link with cancer and cell phone radiation T-MOBILE buried the report and did not publish it. It was recently uncovered and is now creating a stir in the scientific community. Did Health Canada not want this to see the light of day as well?

In June, 2007 Norfolk County announces that Industry Canada would conduct a test of the site. We had advised the County that this would be meaningless since Industry Canada can only test for the thermal effects, the warming of tissue. We have never stated or expressed concern that we were being warmed by the radiation emitted from these transmitters. When Industry Canada arrived at our home my wife was in attendance and asked the chief technician "are you testing for the thermal and non-thermal effects at this site?" The response was "only the thermal effects, we cannot test for non-thermal in the field." My wife then said "then the testing being conducted is really a waste of time isn't it?" The response from the chief technician was "yes, and did you know that even when non-thermal radiation is tested in a laboratory environment the scientists do not know how to interpret the data."

Norfolk County, however, had an agenda. They would later receive the Industry Canada report stating that the radiation emitted from these transmitters is so low that it could not possibly harm anyone and close the file.

In July, 2007 the Mayor announced that Norfolk County has nothing to do with this matter, that it falls under the jurisdiction of the Federal Government and that copies of all records concerning the matter were to be transferred to the Honourable Diane Finley, PC.

In July, 2007 met with Dr. Kerr of the Environmental Sciences Clinic at the New Womens College/Sunnybrook Hospital for a follow up visit. My symptoms are getting worse. I could barely make the trip to downtown Toronto and my wife had to drive us home. Dr. Kerr advised that the continued exposure to this radiation could cause me to seizure. She further advised that there was nothing more she could do and that I should continue to minimize my exposure to this radiation. She said that I am affected in much the same manner as a peanut allergy where the slightest "dusting" could trigger a reaction.

In August, 2007 met with the Honourable Diane Finley after the Mayor transferred his responsibility to the Federal Government. Her Office communicated our concerns to both Health Canada and Industry Canada.

In September, 2007 I made another deputation before Council and arranged, yet again, for our international expert to speak on the subject. Before the meeting the Mayor placed several radio advertisements inviting those members of the public who disagreed with my position to come forward. No one came forward. Before the meeting the Mayor even went as far as scrambling the order of speakers we had registered. The date of the meeting was also scheduled at the same time as "Bingo Live" where the Cable network could not be present to televise our presentation to the community saying that the Bingo broadcast was much more important. Despite all of this we managed to make our presentation and had it taped by a student at a local high school tech class.

In September, 2007 met with the new Medical Officer of Health at the Health Unit. During our meeting he stated that there are no studies measuring the long term impact that this radiation has on children. He further confirmed that he understood that the installation is immediately adjacent to an elementary school. I asked him if he would provide a letter putting forward the Precautionary Principle to Council. He said he would.

In September, 2007 requested assistance from the Canadian Human Rights Commission on filing a complaint against Health Canada and Industry Canada. The Human Rights Commission posts on its website that anyone suffering from an environmental agent cannot be discriminated against because of their disability. That they have to be accommodated. Their response to my request was that the Human Rights Commission can only assist in an employer-employee matter and that my problem falls under the jurisdiction of the Province of Ontario. I had contacted Provincial bodies a long time ago, the Ministry of Health, the Ministry of Municipal Affairs, the Office of the Ombudsman...all directing me to the Federal bodies. Now I feel like collateral damage where I have had my health and my home taken from me and no one cares. I don't have the right as a Canadian citizen to enjoy my life in quiet enjoyment.

In October, 2007 Industry Canada presented its test results. Just as promised they reported low readings that couldn't possibly affect anyone. I asked Council to ask the Industry Canada representative the following :

If Industry Canada is so certain of the safety of this site ask them to put it in writing. Ask them for a letter, without disclaimer or condition, that there are no adverse non-thermal, biological health effects emanating from this site and that that will remain true for as long as it is in operation. Further, that the neighbourhood is as safe today as it was two years ago before this installation went up. Forgive the expression but you can't suck and blow at the same time and if a letter won't be or can't be provided then the answer is moot, move it.

Council did not ask for the letter.

In November, 2007 received a phone call from the same Industry Canada representative who presented the test results to Norfolk Council. He was acting on behalf of the Minister of Industry and was responding to my letter that was submitted to the Honourable Diane Finley. He was acting as a liaison where any information or requests would be directed to the Minister through him, his representative. My wife and I along with two concerned neighbours met with the representative and his associate. During the meeting the representative denied ever stating to Council that the installation was safe. He only reported on the test results. When challenged that Council had the distinct understanding that this installation was safe, based on his presentation, he responded that how they arrived at that conclusion was of their own doing. I am enclosing a copy of the newspaper article covering the matter that clearly states otherwise. During our meeting I asked the representative for the letter saying the installation was safe and he answered that I will never get such a letter from anyone. In our discussions we had provided the representative with two very legitimate resolutions, namely,

Rogers Wireless incorrectly completed an attestation form which forms part of the licensing process stating that 1) there are no buildings within 15 meters of the structure the transmitters are situated on (our garage is approximately 11 meters and our neighbours home is closer) and 2) that the addition of the equipment did not represent a significant modification to the existing site. Had Rogers Wireless correctly attested to these questions there may have been cause for an Environmental Assessment which, in its process, calls for Public Notification. We asked the representative to have the Industry Minister place Rogers Wireless license for the site in abeyance until the correct procedure is followed whereby Public Notification is given and the public is given its opportunity to speak to the matter. Then if Council, after hearing both sides of the matter, decides to not have the transmitters located here the license is revoked and a new site chosen.

The second resolution was to facilitate a meeting with Rogers Wireless and ourselves where we will negotiate with Rogers Wireless to relocate the installation. When asked what he thought of this suggestion he had no comment. It appeared obvious by his expression that he was just going to provide the Minister with our request without his support or endorsement.

We had also discussed the procedural changes adopted by Industry Canada effective the first of January, 2008 where notification has to be given for all transmitter sites regardless of whether or not the land use authority has a siting procedure. It appears to be an admission of guilt where Industry Canada is now putting into practise what we had been asking for all along, and yet we are still ignored.

On the same day of our meeting with the Industry Minister's representative I received a letter from the Chief of Staff of the Minister of Health stating that the Minister did not wish to speak to me.

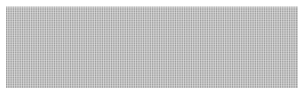
Now we have resigned ourselves to the fact that we will have to sell our home. Not only that but at a substantial loss, or at all.

I am not a scientist, I struggle replacing a light bulb, but I am a human being and a Canadian citizen. I suffer from a disability and have made every effort over the past 21 months now to get the cell phone transmitters perched, essentially, on top of my home relocated. No one is helping, further, I believe Health Canada has gone out of its way and interfered behind the scenes in an effort to make me go away. The physical, emotional and financial pain and suffering endured by my family has been unbearable. I place the blame for this squarely on the shoulders of Health Canada and Industry Canada for allowing it to happen and permitting it to continue. I am a Canadian citizen and as such have a right to quiet enjoyment of my own property. Health Canada and Industry Canada have the ability and power to effect the relocation but refuse to do so.

Petition

I am petitioning the Auditor General to act on my behalf with the Ministers of Health and Industry. Of Health Canada I want to know the following :

- what studies are you relying on that state that the electromagnetic radiation emitted from cell phone base stations is safe?
- what studies have you considered but rejected and why?
- have you participated in any way with Norfolk County and its Health Unit with the provision of advise and information that was biased, incomplete in factual accuracy, misleading, or subjective with the intention of discrediting my health claims.
- if you insist that this technology is safe please provide a letter, without disclaimer or condition, that there are no adverse non-thermal biological health effects emanating from this particular site and that that will hold true for as long as it is in operation. That the neighbourhood is as safe today as it was two years ago, before the installation went up. If not then are you prepared to :
 - 1) purchase my home;
 - 2) pay the difference between the appraised value and the final selling price in an arms length transaction;
 - 3) provide us with a living allowance until the house sells or you decide to purchase it;
 - 4) reimburse us for the costs of maintaining a home we could not live in for the past 21 months as well as the additional costs associated with having to relocate personal and business accommodation;
 - 5) compensate us for the physical and emotional pain and suffering you have caused to me, my wife and my three children.
- if I cannot be suffering from the radiation emanating from the cell phone installation investigate what is causing my illness. Arrange for neurological testing to determine the cause of my suffering. I have already undertaken extensive blood work on three occasions, ultrasound testing and CT scan and all have returned negative.
- why does the Minister not wish to meet with me?
- why is the Minister not placing a moratorium on siting these installations in sensitive areas, near schools, near residents, near hospitals...until there is definitive proof that this technology is safe?



Of Industry Canada I want to know the following :

- why was I not treated as other Canadian citizens and been notified that a cell phone base station was going to be installed right on top of me.
- why do all Canadian citizens, effective the first of January, 2008, have the right of notification and yet our plight is ignored even though it appears to be more than coincidental that these procedural changes are being implemented shortly after we shook some bushes.
- why is Industry Canada more concerned about the welfare of Industry than the welfare of residents. Why is there typically a strong community backlash expressed when prospective sites near sensitive areas are chosen and residents in the area are given public notification. If the technology is safe why do affected residents fight and have the site relocated?
- provide us with the same letter as requested of Health Canada. Put your money where your mouth is, if it's as safe as you espouse it to be then back your decision in writing. If you won't then I want answers to the same 5 financial requests made of Health Canada.

The time for discussion is over. We are sick and tired of the lies and we are not going to put up with it any longer. The Government of Canada, through its Ministries of Health and Industry, have caused me physical, emotional and financial harm. These same Ministries deny that a problem exists in the first place yet won't or can't back up their claims. I want resolution now, I have waited long enough. Failing that I will have little choice but to have my problems aired in a court of law where I trust many other Canadians can learn of the manner in which this entire process has taken.

Resolution

I believe there is an easy solution to this problem but it will take political will to do so and it revolves around the incorrect attestation form filed by Rogers Wireless.

There is a warning on the attestation form itself. It warns the provider that they, the provider, accepts any consequences arising from filing an incorrect attestation. The Industry Canada representative states that these oversights have never been acted on. Again, it boils down to the question of who regulates the Industry? If Industry Canada truly regulates the Industry and works for the citizens of Canada then it's time that these oversights that so heavily impacted on some citizens of Canada be dealt with.

I want Industry Canada to step up to the plate and do the following :

- 1) take back the license issued for that site based on Rogers Wireless filing inaccurate information in its attestation;
- 2) that the license will be held in abeyance until Rogers Wireless resubmits a corrected version of the attestation and that by holding the license in abeyance removes any form of liability to Norfolk County;
- 3) that after Rogers Wireless resubmits the corrected attestation, public notification be given to residents in the neighbourhood prior to a public meeting before Norfolk County Council;
- 4) that the neighbourhood have the opportunity to express their wishes in an open debate before Council;
- 5) that if Norfolk Council decides NOT to have the cell phone installation sited at this location that the license for this site be revoked and an agreement made that no other operator can place any equipment on the water tower structure;
- 6) that if Norfolk Council decides NOT to have the cell phone installation sited at this location that a group made up of residents, Industry and Government be involved in the relocation process.

Minister of Health and the Minister
for the Federal Economic Development
Initiative for Northern Ontario



Ministre de la Santé et Ministre de
l'Initiative fédérale du développement
économique dans le Nord de l'Ontario

Ottawa, Canada K1A 0K9

1574/08



Dear [Redacted]

This is in response to your environmental petition no. 230 of November 28, 2007, addressed to Mr. Ronald Thompson, the Interim Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised a number of health-related questions concerning a cell phone antenna installed on the water tower on Union Street in Simcoe, Ontario.

I am pleased to provide you with the enclosed Health Canada response to your petition. I understand that the Minister of Industry will be responding separately to questions which come under the purview of his department.

I appreciate your interest in this important matter, and I hope that you will find this information useful.

Yours sincerely,

Tony Clement

Enclosure

- c.c. Mr. Ronald C. Thompson, Interim CESD
- The Honourable Jim Prentice, P.C., M.P., Minister of Industry
- The Honourable John Baird, P.C., M.P., Minister of the Environment

Canada

Health Canada Response to Environmental Petition No. 230
Cellular Antenna on Water Tower, Simcoe, Ontario

Answers provided to Questions 1 through 7.

Q1. What studies are you relying on that state that the electromagnetic radiation emitted from cell phone base stations is safe?

A1. Health Canada relies on all credible scientific studies which are published in peer-reviewed scientific journals. It is important to point out that research into the safety of human exposure to radiofrequency (RF) fields has been ongoing for over 50 years and a large body of research exists upon which to base the health risk assessment of RF fields. A partial list of such studies is available on the WHO International EMF Research project website (<http://www.who.int/peh-emf/research/database/en/index.html>). When evaluating the potential health risk of RF fields, the source of the RF fields was not a consideration in Health Canada's safety guideline (Safety Code 6). This code was intended as a safety document and as such must be independent of the RF field source, so as to apply universally to all potential sources across the electromagnetic spectrum from 3 kHz to 300 GHz. From a health risk perspective, it is only the absorbed dose that matters not the source of the exposure. As for cellular phone base stations, survey data generated by Industry Canada and Health Canada scientists indicate that typical levels of RF fields emitted from them are thousands of times below the exposure limits specified in Safety Code 6. Based on the scientific studies to date, there is no substantiated evidence that there are adverse health effects resulting from exposure to RF fields at these levels.

Q2. What studies have you considered but rejected and why?

A2. All studies appearing in peer-reviewed scientific journals are considered. A weight-of-evidence approach is used when formulating the health risk assessment of RF fields. Certain studies with identifiable weaknesses (e.g. insufficient sample numbers, thermal confounding etc.) receive little weight, while properly conducted studies (e.g. complete dosimetry and environmental controls etc.) receive relatively more weight. In the end, the evidence of biological and/or health effects for a wide variety of biological endpoints are then considered when establishing the maximal allowable human exposure limits.

Q3. Have you participated in any way with Norfolk County and its Health Unit with the provision of advice and information that was biased, incomplete in factual accuracy, misleading, or subjective with the intent of discrediting my health claims?

A3. No.

Q4. If you insist that this technology is safe please provide a letter, without disclaimer or condition, that there are no adverse non-thermal biological health effects emanating from this particular site and that that will hold true for as long as it is in operation. That the neighbourhood is as safe today as it was two years ago, before the installation went up. If not, then are you prepared to:

- 1) purchase my home;
- 2) pay the difference between the appraised values and the final selling price in an arms length transaction;
- 3) provide us with a living allowance until the house sells or you decide to purchase it;
- 4) reimburse us for the costs of maintaining a home we could not live in for the past 21 months as well as the additional costs associated with having to relocate personal and business accommodation;
- 5) compensate us for the physical and emotional pain and suffering you have caused to me, my wife and my three children.

A4. Absolute safety from harm from any agent, whether it be chemical, biological or physical, can never be guaranteed by health agencies. The best that can be done is to demonstrate how thoroughly and for how long evidence for harm at environmentally relevant levels has been looked into. In the case of low-level RF fields, health effects research has been ongoing for over 50 years and there are thousands of published studies. In this instance, scientists have looked both long and hard and this adds to the hypothesis that there are no adverse effects below the safety limits recommended by science-based RF exposure standards, including Safety Code 6. As such, there is a great weight of evidence that RF field intensities below these limits are not harmful. Ensuring compliance with the limits in Safety Code 6 is a responsibility of Industry Canada and the cellular service provider.

Q5. If I cannot be suffering from the radiation emanating from the cell phone installation investigate what is causing my illness. Arrange for neurological testing to determine the cause of my suffering. I have already undertaken extensive blood work on three occasions, ultrasound testing and CT scan and all have returned negative.

A5. It is not the responsibility of Health Canada to provide medical diagnosis or advice to individuals. This lies within the responsibility of your provincial health care system.

Q6. Why does the Minister not wish to meet with me?

A6. Mr. Robert P Bradley, Director of the Consumer and Clinical Radiation Protection Bureau (CCRPB), was asked to review your previous correspondence as he and scientific staff deal with all matters relating to Safety Code 6. They are aware of the concerns raised by residents in Norfolk County and have corresponded with them for the past several months. It was for this reason that it was suggested Mr. Bradley attend a joint meeting with Industry Canada and yourself to discuss the tower siting issue.

Q7. Why is the Minister not placing a moratorium on siting these installations in sensitive areas, near schools, near residents, near hospitals...until there is definite proof that the technology is safe?

A7. As indicated previously, there is a long history of research into the potential health effects of exposure to RF fields. In 1979, Health Canada was among the first nations to limit human exposures to RF fields and our human exposure guidelines are still among the most stringent science-based human exposure limits in the world. No anticipated adverse health effects would be anticipated at any of the above locations, provided that the limits outlined in Safety Code 6 are respected. Having said that, we encourage owners/operators of RF transmission sites to use common sense and reduce exposure in such areas, where technically and economically feasible.

It must be pointed out that it is technically impossible to ever definitely "prove" that any activity, product or item is absolutely safe. You cannot prove the absence of anything, you can only demonstrate how diligently and thoroughly you have looked and make health risk decisions based on the current scientific evidence. With RF fields, the vast majority of the scientific literature does not suggest any adverse health impacts at human exposure levels below the limits outlined in Safety Code 6.

Minister of Industry



Ministre de l'Industrie

The Honourable L'honorable

Jim Prentice

Ottawa, Canada K1A 0H5

18 APR 2008

Dear I

I am writing in response to your Environmental Petition No. 230, dated November 28, 2007, concerning the installation of a radiocommunication antenna system on a water tower near your home. On December 21, 2007, your petition was forwarded by the Commissioner of the Environment and Sustainable Development to the ministers of Industry and Health. As Minister of Industry, I am pleased to provide responses to the petition questions that you directed to my department.

Question 1: Why was I not treated as other Canadian citizens and notified that a cell phone base station was going to be installed right on top of me?

Industry Canada recognizes the importance of considering the potential impact that antennas and their supporting structures may have on the local surroundings. It is for this reason that all antenna proponents must follow departmental procedures, which give consideration to the environment, health, and land-use consultation. These procedures require proponents of significant antenna supporting structures to consult with the local community. In this case, the proponent, Rogers Wireless, followed the then-applicable procedures outlined in the department's Client Procedure Circular CPC-2-0-03, Issue 3, entitled *Environmental Process, Radiofrequency Fields and Land-Use Consultation*. The antenna supporting structure selected by the proponent was Norfolk County's water tower, located in Simcoe, Ontario, which was an existing antenna site used by the County itself. The County concurred with the proposal and subsequently entered into a lease agreement with Rogers Wireless for the use of the water tower as an antenna-supporting structure. The addition of the Rogers Wireless antennas, in comparison with the overall size of the water tower and the existing antennas, was determined by Norfolk County, Rogers Wireless and Industry Canada to have minimal impact on the local surroundings and so

Canada



would not normally require consultation with the local community under Industry Canada's procedures. Rogers Wireless has fully complied with Industry Canada's antenna siting procedures.

Question 2: Why do all Canadian citizens, effective the first of January 2008, have the right of notification and yet our plight is ignored even though it appears to be more than coincidental that these procedural changes are being implemented shortly after we shook some bushes?

The revision of Industry Canada's Client Procedures Circular CPC-2-0-03, Issue 3, was announced in October 2002 when the Minister stated that the department would undertake an independent national review and consultation of its antenna tower policies. In March 2003, the department selected Professor David A. Townsend of the University of New Brunswick to lead the review. With the consideration of many of the recommendations of the National Antenna Tower Policy Review, Industry Canada's updated antenna siting procedures came into effect on January 1, 2008. The key elements of the updated CPC-2-0-03, Issue 4, involve:

- promoting the use of existing antenna supporting structures, including rooftops and water towers;
- contacting the land-use authority to determine local requirements and preferences;
- consulting with the public for non-excluded antenna proposals under the department's default process; and
- satisfying Industry Canada's general and technical requirements.

It is important to note that, under either Industry Canada's updated procedures or the version it replaced, public notification and consultation would not be a requirement for installations such as the one on the Union Street water tower in Simcoe, Ontario.

Question 3: Why is Industry Canada more concerned about the welfare of Industry than the welfare of residents? Why is there typically a strong community backlash expressed when prospective sites near sensitive areas are chosen and residents in the area are given public notification? If the technology is safe why do affected residents fight and have the site relocated?

Of the several thousand cellular and PCS installations in Canada, only a very small percentage have resulted in heightened local concern. Further, it would be quite rare that fields from a radio installation would ever approach Health Canada's Safety Code 6 limits, and Industry Canada's verification clearly demonstrates this.

A report by the Royal Society of Canada (RSC) on the potential health risk from radio frequency fields states that the exposure limits in Health Canada's Safety Code 6 are adequate based on current scientific evidence. Furthermore, the RSC states that there is no conclusive evidence that exposure to radio frequency fields, at the levels that respect the limits, leads to adverse health effects. This statement is also supported by recent epidemiological and laboratory studies. The report can be found on the RSC's website at www.rsc.ca. In addition, Health Canada and Industry Canada have jointly prepared a Frequently Asked Questions document, available at www.ic.gc/antenna, which relates to exposure limits and biological effects, among other issues.

However, while the department's mandate includes promoting the establishment, development and efficiency of communications systems, the antenna procedures are intended to ensure that the development of these systems is done in a manner that considers local issues.

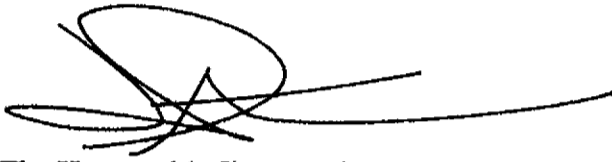
Question 4: Provide us with the same letter as requested of Health Canada. Put your money where your mouth is, if it's safe as you espouse it to be then back your decision in writing. If you won't then I want answers to the same 5 financial requests made of Health Canada.

Health Canada is the Canadian authority for establishing safety guidelines for human exposure to radio frequency fields and is responsible for its related Safety Code 6 publication entitled *Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz*. The responsibility for developing these safety guidelines rests with Health Canada. Industry Canada has adopted Safety Code 6 for the purpose of protecting the general public and requires all proponents of radio antenna installations to comply on an ongoing basis with Health Canada's Safety Code 6 guidelines. The guidelines for the protection of the general public are consistent with other international jurisdictions established by competent authorities and the World Health Organization.

I indicated to you in my letter of January 31, 2008, that Industry Canada's measurement survey, conducted on June 27, 2007, demonstrated that the received radio frequency field intensity on your property from the Rogers Wireless antennas are 178,600 to 222,410 times below Safety Code 6 levels.

I appreciate this opportunity to respond to your petition and trust this information is helpful.

Sincerely,

A handwritten signature in black ink, appearing to be 'Jim Prentice', with a long horizontal line extending to the right.

The Honourable Jim Prentice, P.C., Q.C., M.P.

c.c. Mr. Ronald C. Thompson, FCA
Commissioner of the Environment and Sustainable Development



[REDACTED]

June 27, 2008

Ms. Sheila Fraser,
The Auditor General of Canada,
Commissioner of the Environmental
and Sustainable Development,
240 Sparks Street,
Ottawa, Ontario. K1A 0G6

Attention : Petitions

Dear Auditor General :

Re: Supplemental to Petition 230

I respectfully request your help and am attaching a supplementary petition under the Auditor General Act in resolving a health matter that has forced me, my wife and three children from our 138 year old family home. We have had to live away from our home for the past 28 months and have suffered severe physical, financial and emotional harm.

The responses to my petition from the Ministries of Health and Industry were inadequate. Please forward these supplemental questions to the respective Ministries. I anxiously await their response.

Yours truly,

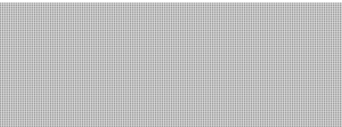
[REDACTED]

Petition

I am petitioning the Auditor General to act on my behalf with the Ministers of Health and Industry. The background of my personal situation is already on file in Petition 230. My family and I have been unable to live in our home since February 2006 because I began suffering from Electromagnetic Hypersensitivity due to the installation of a Rogers cell phone tower on the water tower directly behind home.

The following are questions that I would like Health Canada to answer:

1. What are the top 5 studies that Health Canada is relying on that state that the electromagnetic radiation emitted from cell phone base stations is safe? Please include in your response the name of the study, the names of the scientists, the dates of the studies, where the studies can be found and who funded the studies.
2. What are the 5 most important studies that Health Canada has considered but rejected and why were these studies rejected? Please include in your response the name of the study, the names of the scientists, the dates of the studies, where the studies can be found and who funded the studies.
3. Health Canada's response to question 2 of Petition 230 stated "weight of evidence approach is used when formulating the health risk assessment of RF fields." Of all the peer reviewed studies performed to date; please provide the number that were Industry funded, Government funded or independently funded.
4. Did Health Canada communicate in any way with the Norfolk County Health Unit regarding the installation of the Rogers Cell Phone Tower on the Union Street water tower? If so, please provide copies of all communications.
5. How many items of correspondence (letters, emails, telephone inquiries) has Health Canada received over the past ten years regarding cell phone towers? What was the nature of the concern (ie/health concerns) stated in the correspondence? Has the volume of inquiries received by Health Canada regarding cell phone towers increased over the past ten years? What response has Health Canada given to these concerns?



6. What is Health Canada doing to protect the health of Canadians regarding the electromagnetic radiation emitted from cell phone towers in light of Environment Canada's statement on the precautionary approach/principle?

Environment Canada states that the precautionary approach/principle "is a distinctive approach to managing threats of serious or irreversible harm where there is scientific uncertainty." Environment Canada further states that "the precautionary approach recognizes that the absence of full scientific certainty shall not be used as a reason to postpone decisions where there is a risk of serious or irreversible harm." (www.ec.gc.ca/econom/pamphlet_e.htm)

7. Studies/reports such as the Bioinitiative Report state the "the scientific evidence is substantial enough to warrant preventative action for RF". Given the scientific evidence and the definition of the precautionary principle as defined by the Government of Canada, why is Health Canada not adopting more stringent standards such as those in some European countries for RF exposure?

8. Health Canada stated in their response to Petition 230 that Canada's "human exposure guidelines are still among the most stringent science-based human exposure limits in the world." Please provide a list of all the countries that have cell phone technology, human exposure standards and indicate their exposure limits? Please rank them from strongest to weakest.

9. Why will Health Canada not meet with me to discuss my situation? They have held meetings with other Canadian citizens to discuss their concerns with this technology (ie/ the residents of Chelsea, Quebec). A letter was sent to Dr. Bradley from the Honourable Diane Finley dated April 25, 2008 requesting a meeting with Dr. Bradley and myself. To date, I have not heard from Dr. Bradley.

The following are questions that I would like Industry Canada to answer:

1. Why did Industry Canada ignore a false attestation signed by a Professional Engineer on behalf of Rogers stating that there were no buildings within 15 metres of the installations and that the installation did not represent a significant modification?

Please provide Industry Canada's definition of "significant modification".

[REDACTED]

If Industry Canada was aware of the false attestation, why did they not act on it? Further, now that they are aware of the false attestation, why are they not acting on it?

If Attestation Forms can be ignored, why does the Government of Canada have them? Why does the Government of Canada establish rules and then not act on them?

It is important to note that had Industry Canada acted on the false attestation form submitted by Rogers, and initiated the environmental assessment and given public notification; this installation would not have been sited on the water tower.

2. Was the Minister of Industry made aware of the meeting held between myself, my wife, area residents and Mr. Jack Holt in November of 2007 and what took place at that meeting?

Contrary to Norfolk Council and media interpretation, Mr. Jack Holt denied that he claimed the cell phone tower was safe during his report to Norfolk Council on the testing results. Further, we requested that Mr. Jack Holt act on the false attestation where the Rogers license would be put in abeyance, that the application be refiled correctly, that public notification be given and that an environmental assessment be conducted. His response was that would be a "career shortening move" for himself.

Mr. Jack Holt was to put forward a recommendation to the Minister of Industry on resolving the matter. Did the Minister of Industry receive the recommendation? If so, please provide a copy of the recommendation.

3. Industry Canada's Client Procedures Circular CPC-2-0-03 was significantly revised effective January 1, 2008 immediately following the cell dispute in Simcoe ON. Industry Canada's response to question 2 of Petition 230 indicated that the changes were a result of a review of the antenna siting policies. Please provide the timeline (what was done and when) from March 2003 when Professor David A. Townsend was retained to conduct a review of the antenna tower policies to January 1, 2008?

4. Why are water towers exempt from public consultation when cell phone antenna are installed on them? Why are these installation different from any other?

The Government of Canada, through its Ministries of Health and Industry, have caused me physical, emotional and financial harm. These same Ministries deny that a problem exists in the first place yet won't or can't back up their claims. I need a resolution now.

Minister of Health and the Minister
for the Federal Economic Development
Initiative for Northern Ontario



Ministre de la Santé et Ministre de
l'Initiative fédérale du développement
économique dans le Nord de l'Ontario

Ottawa, Canada K1A 0K9

OCT 29 2008

Dear [REDACTED]

This is in response to your environmental petition no. 230-B of June 27, 2008, addressed to Mr. Scott Vaughan, Commissioner of the Environment and Sustainable Development (CESD).

In your petition you raised concerns about the health effects of the electromagnetic radiation emitted from cellular phone towers.

I am pleased to provide you with the enclosed Health Canada response to your petition. I understand the Minister of Industry will be responding separately to the questions which come under the purview of his department.

I appreciate your interest in this important matter, and I hope that you will find this information useful.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Tony Clement', written over a white background.

Tony Clement

Enclosure

c.c. Mr. Scott Vaughan, CESD
The Honourable Jim Prentice, P.C., M.P.

Canada

FINAL

Date 2/10/08
Docket No. 08-011316-174

**Health Canada Response to
Environmental Petition No. 230-B filed by [REDACTED]
under Section 22 of the *Auditor General Act*
Received July 14, 2008**

Electromagnetic radiation (EMR) emitted from cellular phone towers

November 11, 2008

**Minister of Health and the Minister for the Federal Economic
Development Initiative for Northern Ontario**

1. *What are the top 5 studies that Health Canada is relying on that state that the electromagnetic radiation emitted from cell phone base stations is safe? Please include in your response the name of the study, the names of the scientists, the dates of the studies, where the studies can be found and who funded the studies.*
2. *What are the 5 most important studies that Health Canada has considered but rejected and why were these studies rejected? Please include in your response the name of the study, the names of the scientists, the dates of the studies, where the studies can be found and who funded the studies.*

Answer to Questions 1 & 2:

All credible peer-reviewed scientific studies are included in Health Canada's weight-of-evidence approach for risk assessment. Each study is evaluated individually for its scientific quality, the important factors being, proper scientific design and analysis. No single study or small subset of (five) studies provide the definitive evidence for the health risk assessment. Listing the five most important studies relied upon would inaccurately reflect the nature of how the risk assessment process is undertaken at Health Canada. No studies were rejected outright. As indicated in the response to Petition No. 230, certain studies with identifiable weaknesses (e.g. insufficient sample numbers, thermal confounding etc.) receive little weight, while properly conducted studies (e.g. complete dosimetry and environmental controls etc.) receive relatively more weight. Therefore, some studies carry less weight due to technical flaws – but they are not completely ignored.

3. *Health Canada's response to question 2 of Petition 230 stated "weight of evidence approach is used when formulating the health risk assessment of RF fields." Of all the peer reviewed studies performed to date; please provide the number that were industry funded, Government funded or independently funded.*

All credible peer-reviewed scientific literature is included in the weight-of-evidence approach for assessing the possible health risks of electromagnetic field (EMF). Thus, both adverse and no-effect studies are included as are those funded by industry or via other funding sources. The source of the research funding does not influence the evaluation process, only the quality and impact of the research outlined within the individual research papers are considered in the evaluation.

4. *Did Health Canada communicate in any way with the Norfolk County Health Unit regarding the installation of the Rogers Cell Phone Tower on the Union Street water tower? If so, please provide copies of all communications.*
5. *How many items of correspondence (letters, emails, telephone inquiries) has Health Canada received over the past ten years regarding cell phone towers? What was the nature of the concern (ie/health concerns) stated in the correspondence? Has the volume of inquiries received by Health Canada regarding cell phone towers increased over the past ten years? What response has Health Canada given to these concerns?*

Response to Questions 4 & 5:

The information requested by the Petitioner could possibly include personal information, confidential third party information, advice or recommendations to the Minister, or information subject to solicitor-client privilege, all of which are protected under the *Access to Information Act*. For this reason, Health Canada believes that it would be more appropriate for the Petitioner to submit these requests under the *Access to Information Act*, in order to ensure that the Act's exemptions are properly applied.

6. *What is Health Canada doing to protect the health of Canadians regarding the electromagnetic radiation emitted from cell phone towers in light of Environment Canada's statement on the precautionary approach/principle?*

*Environment Canada states that the precautionary approach/principle "is a distinctive approach to managing threats of serious or irreversible harm where there is scientific uncertainty." Environment Canada further states that "the precautionary approach recognizes that the absence of full scientific certainty shall not be used as a reason to postpone decisions where there is a risk of serious or irreversible harm."
(www.ec.gc.ca/econom/pamphlet_e.htm)*

Health Canada endorses the precautionary principle and its approach to decision making can be found at: <http://www.hc-sc.gc.ca/sr-sr/advice-avis/decision/index-eng.php>. Adverse health effects at radiofrequency (RF) exposure levels below the limits specified in Safety Code 6 are not anticipated.

7. *Studies/reports such as the Bioinitiative Report state the "the scientific evidence is substantial enough to warrant preventative action for RF". Given the scientific evidence and the definition of the precautionary principle as defined by the Government of Canada, why is Health Canada not adopting more stringent standards such as those in some European countries for RF exposure?*

The opinions expressed by the authors of the Bioinitiative report are not consistent with the conclusions drawn from the broader base of scientific literature reviewed by Health Canada or a large number of other national and international standards bodies (e.g. International Commission on Non-Ionizing Radiation Protection [ICNIRP], Institute of Electrical and Electronics Engineers [IEEE] C95.1). Health Canada's Safety Code 6 takes into account all possible biological and/or health effects of radiofrequency (RF) fields, including short-term heating effects, non-thermal effects and/or long-term effects. While some European municipalities have adopted more stringent limits, these recommendations are based upon socio-political considerations.

8. *Health Canada stated in their response to Petition 230 that Canada's "human exposure guidelines are still among the most stringent science-based human exposure limits in the world." Please provide a list of all the countries that have cell phone technology, human exposure standards and indicate their exposure limits? Please rank them from strongest to weakest.*

The basic restrictions outlined in Health Canada's Safety Code 6 guideline are similar to both the IEEE C95.1 and ICNIRP guidelines, which have been adopted by most western European nations and the U.S. Health Canada's Safety Code 6 is more restrictive in terms of compliance as it requires serious adverse reaction (SAR) evaluations to be conducted using an averaging volume of 1 g of tissue, whereas a 10 g volume is used for both IEEE C95.1 and ICNIRP guidelines. This means that possible small areas where hot-spots could occur are not missed using the Safety Code 6 approach during the dosimetric evaluation, as may be more likely to occur with the IEEE C95.1 and ICNIRP approach due to averaging of total energy over a larger tissue volume.

The information you request regarding national exposure guidelines is available on the World Health Organization (WHO) EMF project website:
<http://www.who.int/docstore/peh-emf/EMFStandards/who-0102/Worldmap5.htm>.

9. *Why will Health Canada not meet with me to discuss my situation? They have held meetings with other Canadian citizens to discuss their concerns with this technology (ie/ the residents of Chelsea, Quebec). A letter was sent to Dr. Bradley from the Honourable Diane Finley dated April 25, 2008 requesting a meeting with Dr. Bradley and myself. To date, I have not heard from Dr. Bradley.*

You have been contacted by Dr. Bradley but a date to discuss your concerns has not been finalized.

Minister of Industry



Ministre de l'Industrie

Ottawa, Canada K1A 0H5

15/12/08



Dear

I am writing to provide you with Industry Canada's response to your supplemental questions in Environmental Petition No. 230-B, dated June 27, 2008, concerning the installation of a radiocommunication antenna system on the Union Street water tower in Simcoe, Ontario. On July 14, 2008, this petition was forwarded by the Commissioner of the Environment and Sustainable Development to the Minister of Health and the Minister of Industry. I am pleased to respond to your questions that fall within Industry Canada's area of responsibility.

Question 1: Why did Industry Canada ignore a false attestation signed by a Professional Engineer on behalf of Rogers stating that there were no buildings within 15 metres of the installation and that the installation did not represent a significant modification?

The attestation to which you refer is the *Preliminary Environmental Information and Municipal/Land-Use Consultation Attestation*. Industry Canada officials use the information on both this attestation and the radio station licence application to determine whether a proposal is excluded from environmental assessment. I understand that your concern is that the attestation falsely indicated that there is no building within 15 metres of the installation. On review of all available information, including information gathered during a visit to the site, Industry Canada officials concluded that a building within 15 metres of the antenna system would not alter the conclusion that the installation is excluded from environmental assessment.

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Canada

Regarding the installation not being a significant modification, Industry Canada believes that the addition of the antenna system to the water tower is a negligible increase to the overall physical size of the water tower. As such, Industry Canada does not consider the installation to be a significant modification.

Please provide Industry Canada's definition of "significant modification."

Industry Canada has used the term "significant modification" and "significant antenna structure" in Client Procedures Circular (CPC)-2-0-03, Issue 3, June 1995, entitled *Environmental Process, Radiofrequency Fields and Land-Use Consultation*, and the attestation form previously mentioned, to describe installations that are deemed to have a consequential or highly visible impact on local surroundings.

As you are aware, in January 2008, Industry Canada issued CPC-2-0-03, Issue 4, June 2007, entitled *Radiocommunication and Broadcasting Antenna Systems*. Among other amendments, the newer version of the document has replaced the term "significant" by specifying, in Section 6, specific installations excluded from consultation. The exclusion list describes more clearly installations that are generally considered to not be significant. Of note, the installation on the Simcoe water tower meets the exclusion criteria.

If Industry Canada was aware of the false attestation, why did they not act on it? Further, now that they are aware of the false attestation, why are they not acting on it?

As indicated above, Industry Canada has conducted a site visit and reviewed the particulars of the *Preliminary Environmental Information and Municipal/Land-Use Consultation Attestation*, and has concluded that the installation did not require an environmental assessment or a consultation and no further action is required.

.../3

If attestation forms can be ignored why does the Government of Canada have them? Why does the Government of Canada establish rules and then not act on them?

Industry Canada has reviewed all information provided by the proponent and has considered all relevant information pertaining to the installation of this facility in accordance with the department's procedures.

Question 2: Was the Minister of Industry made aware of the meeting held between myself, my wife, area residents and Mr. Jack Holt in November of 2007 and what took place at the meeting?

On January 30, 2008, my predecessor, the Honourable Jim Prentice, responded to your letter of September 14, 2007, indicating that he was aware of a meeting conducted in your home with Industry Canada officials on November 13, 2007.

Mr. Jack Holt was to put forward a recommendation to the Minister of Industry on resolving the matter. Did the Minister of Industry receive the recommendation? If so, please provide a copy of the recommendation.

I have considered the information submitted by Rogers Wireless, the facts surrounding the installation of this facility, and the recommendations of my officials, all of which are reflected in my predecessor's letter of January 30, 2008. I conclude that Rogers Wireless has complied with all requirements for the establishment of an antenna system on the Union Street water tower.

Question 3: Industry Canada's Client Procedures Circular CPC-2-0-03 was significantly revised effective January 1, 2008, immediately following the cell dispute in Simcoe, ON. Industry Canada's response to question 2 of Petition 230 indicated that the changes were a result of a review of the antenna siting policies. Please provide the timeline (what was done and when) from March 2003 when Professor David A. Townsend was retained to conduct a review of the antenna tower policies to January 1, 2008.

.../4

The following is a chronological order of activities leading to the release of CPC-2-0-03, Issue 4:

- On March 28, 2003, the Minister of Industry announced the appointment of the National Antenna Tower Review Committee, chaired by Dr. David A. Townsend, Professor of Law at the University of New Brunswick;
- During the month of September 2003, Canadians were invited to submit comments to the National Antenna Tower Policy Review conducted by Professor Townsend;
- Based on these comments, Professor Townsend developed 34 recommendations to improve Industry Canada's antenna tower siting and approval processes which, along with the final report, were presented to Industry Canada in December 2004, and publicly released on February 18, 2005;
- After receiving the final report in December 2004, Industry Canada extensively reviewed the findings and recommendations, along with those from the Telecommunications Policy Review Panel (March 22, 2006) and, based on this evaluation, decided to consider additional stakeholder consultation;
- Additional consultation was undertaken with several national stakeholders, including the Canadian Environmental Assessment Agency, Transport Canada, NAV Canada, the Radio Advisory Board of Canada, the Federation of Canadian Municipalities, and the Canadian Wireless Telecommunications Association;
- After extensive consultation, Industry Canada implemented the necessary changes and, on June 22, 2007, announced the release of CPC-2-0-03, Issue 4, entitled *Radiocommunication and Broadcasting Antenna Systems*;

.../5

- Industry Canada allowed for a six-month transition period, during which Issue 3 remained in effect, allowing industry, government and the public time to become familiar with and adapt their internal processes to the new requirements;
- Between June 22, 2007, and January 1, 2008, Industry Canada representatives met with many stakeholders, including land-use authorities, organizations, associations and major licensees to introduce the new antenna siting procedures;
- On December 14, 2007, Industry Canada released its *Guide to Assist Land-use Authorities in Developing Antenna Siting Protocols*, Issue 1, intended to assist land-use authorities in ensuring effective local participation in decisions with respect to proposed antennas and their supporting structures within their communities; and
- On January 1, 2008, CPC-2-0-03, Issue 4, entitled *Radiocommunication and Broadcasting Antenna Systems*, came into effect. Details on the announcements and additional information can be found at:
<http://www.ic.gc.ca/epic/site/smt-gst.nsf/en/sf07012e.html>.

Question 4: Why are water towers exempt from Public consultation when cell phone antenna are installed on them?

Industry Canada promotes the use of existing antenna supporting infrastructure, such as water towers or buildings, that meet the exemption criteria outlined in CPC-2-0-03, Section 6. Industry Canada's requirements ensure that the concerns or suggestions of the local land-use authorities are considered in the establishment of new antenna infrastructure as part of the local community planning process. The addition of antennas on existing structures, such as the Simcoe water tower, result in low visual impact on the local surroundings given the comparatively small antenna added to the existing structure. As this type of installation results in minimal developmental impact compared with the

.../6

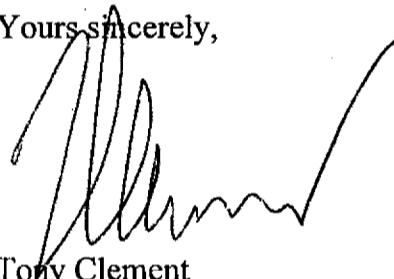
construction of a new antenna tower within the community, Industry Canada has provided an exemption from land-use authority and public consultation to encourage the placement of antennas on existing structures. It should be noted that such installations must still comply with all other general requirements set out in the CPC, such as radiofrequency exposure compliance and aeronautical safety.

Why are these installation different from any other?

As described above, the use of an existing structure can result in an installation with minimal local impact and is generally more acceptable compared with the construction of a new antenna tower within the community. For this reason, Industry Canada promotes the use of existing antenna supporting infrastructure, such as building rooftops, water towers and existing antenna towers, ahead of establishing new towers.

I appreciate this opportunity to respond to your petition, and trust that this information is of assistance.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Tony Clement', written over a horizontal line.

Tony Clement

c.c. **Mr. Scott Vaughan**
Commissioner of the Environment
and Sustainable Development

January 3, 2008

The Auditor General of Canada
Commissioner of the Environment and Sustainable Development
240 Sparks St.
Ottawa, ON
K1A 0G6



Attn. Petitions
Auditor General,

Please accept the following petition under the Auditor General Act.

My neighbours, my family and I live within 300 metres of the Union Street water tower supporting a cell tower. We have lived in the neighbourhood for many years prior to the surprise erection of this cell tower. We are concerned about the health effects of the microwave radiation emanating from this tower and have been unable to find any official, whether municipal, provincial or federal, who can guarantee our physical safety. Also within 300 metres of this cell tower are a school, a nursing home and a hospital.

I have sought help from the Minister of Health Canada, our local school board, the Haldimand/Norfolk health unit, my MPP, my MP, the Director of the Consumer and Clinical Radiation Protection Bureau of Canada and the Director of the Central and Western Ontario District of Industry Canada, with other bureaucrats in between. Throughout this process there has been no official willing to guarantee the safety of living within 300 metres of this cell tower.

I asked Malcolm S. Lock, Acting Medical Officer of Health, Haldimand-Norfolk Health Unit, "As medical officer of health I request your looking into medical complaints in my neighbourhood. His response, "The Health Unit has not been advised of any health issues within city limits. Everyone within the municipality is serviced by the municipal water supply with potable water therefore ground water contamination is not an issue for consumption. To my knowledge there has been no air quality issues reported. This leaves little within the jurisdictions of the Health Unit to investigate. I would remind you that air quality lies within the purview of the Ministry of Environment as does ground soil issues..."

Canadians are supposed to be protected from electromagnetic radiation (EMR) by Safety Code 6 (SC6), a guideline under the supervision of the Consumer and Clinical Radiation Protection Bureau of Canada (CCRPB) under the leadership of Dr. Robert P. Bradley. When I asked Mr. Bradley if health issues relating to the cell tower were Health Canada's (HC) purview, he replied, "...this is a public health issue that needs to be addressed locally."

1) Who is responsible for the health of individuals affected by proximity to a cell tower?

Mr. Bradley stated, "As indicated previously, this is a public health question that needs to be addressed locally. From your earlier correspondence I understand that you have raised this with the city. While they may not be able to attribute cause to any symptoms or illnesses reported by the residents, it seems to me reasonable that they can survey and validate the claims stated by the citizens. Analysis of the symptoms, pattern of illness etc. would add to the understanding of the situation."

2) Considering the health concerns of the community within the vicinity of the Simcoe cell tower, would HC provide continuous health monitoring of nearby citizens?

When asked if it is safe to live within 300 metres of a cell tower, Mr. Bradley replied, "In all risk assessment scenarios, one looks to establish levels that are hazardous or dangerous as these are relatively easily determined. One first chooses an adverse health outcome for which a known mechanism of interaction of the hazardous agent exists and then a determination of the level of exposure that will cause the outcome is made. The final step is to set exposure limits that will be protective against these particular adverse health outcomes. In subsequent monitoring and review of the emerging science around the hazard under consideration, one strives to confirm or modify as necessary these previously determined levels. This is, in simple terms, the approach taken in establishing the levels indicated in the current standard for exposure limits for wireless communication devices.

In the specific issue at hand, the exposure limits for radiation fields arising from wireless communication towers have been determined in the manner outlined above taking into consideration the collective body of peer-reviewed science. No adverse health outcomes that have an accepted causal relationship to exposure to the electric and magnetic fields produced by the towers have been identified for exposures at or below the limits set out in SC6."

3) I do not consider Mr. Bradley's response an adequate answer and would simplify the question by rephrasing, "Are the residents in the vicinity of the Union Street Cell Tower in Simcoe, Ontario as safe today as they were before the cell tower was enabled?"

According to the SC6 document posted on the government website, it has not been updated since 1999. Given the very recent explosion in popularity of cell phones, wireless internet, and other such devices, it is probably not an exaggeration to estimate that we are now being exposed to levels of electromagnetic radiation at levels thousands of times higher than we were in 1999.

4a) Why has SC6 not been updated since 1999? If it has not been updated, why not?

4b) If it has been updated does it include any of the above findings?

The particular cell tower in question is atop a water tower. I assume Mr. Bradley's scientists have taken water towers into account in SC6. This water tower is also a 3042 watt microwave cell tower. Water flows in and out of the water tower like a river. This river is encased in metal, almost an inside-out parabola. The water is flowing in this large metal case (refer to SC6 about large metal objects). The case is encircled with electricity going to the eight antennae. A microwave dish is attached to the tower. Microwaves constantly bombard the water tower. All this is in the middle of a residential community that includes a hospital, nursing home and elementary school.

5a) I ask Industry Canada (IC) and HC if such a tower is safe from a physics, electrical,...point of view?

5b) Would such a tower meet IEEE standards?

5c) Is it grounded properly?

5d) Who has verified the grounding?

5e) What part do metal objects play in the reflection of microwaves?

5f) Why does SC6 warn against large metal objects and then place a microwave on a large metal object?

5g) What is the appropriate SC6 signage for such a structure?

5h) Is this tower properly signed?

5i) What is the appropriate SC6 fencing for such a structure?

5j) Has such fencing been installed?

5k) What part does flowing water play in the reflection of microwaves?

Residents in Bayview, Long Island, NY, have gone to the Supreme Court over a cell tower located near a park and school. Four Bayville Primary School children have been diagnosed with leukemia or brain tumors; three of the children have since died. In addition, six teachers and several school aids have been diagnosed with serious cancer. Four of the adults have subsequently died.

Dr. Andrew Goldsworthy, Biological Sciences, writes, "Being exposed to chronic irradiation from a cell tower is not a good idea anyway, but to put the antennas on water towers is particularly bad because of the risk of electromagnetic contamination of the water. Treating water with weak pulsed electromagnetic radiation is the basis of many commercial "electronic water conditioners", which are now widely used to remove and prevent lime scale in plumbing.

But it also has biological effects. Brief exposure of the water to such fields (as when it flows through a conditioner) and supplying it to yeast, plants and farm animals can, stimulate their growth. However, when we tested exposures of more than about a minute (as it might be in a water storage tank with an antenna attached), we found that it inhibited the growth of yeast and was arguably harmful (See Goldsworthy et al. 1999 "Biological effects of physically conditioned water". Water Research 33 (7) 1618-1626).

The mechanism of the conditioning effect is controversial, but it appears to depend on the presence of colloidal impurities, and not all water supplies are equally affected. Its biological effect is probably because it removes structurally-important calcium ions from cell membranes in much the same way as it removes lime scale from plumbing. This would then make

them leak and affect metabolism in the same way as direct exposure to electromagnetic fields (See <http://tinyurl.com/28Lo82>).

In so much as water treated with pulsed electromagnetic radiation can have unusual and sometimes harmful biological effects, there should be a moratorium on placing cell phone antennas on water tanks until electromagnetically treated water has received full FDA approval."

6a) Is HC aware of Dr. Goldsworthy's work?

6b) Why is his work not included in SC6?

6c) Why does Industry Canada give preference to siting cell towers on water towers?

6d) What science does Industry Canada cite for such a preference?

The residents were never consulted on the siting of the cell tower and many have become ill, many seek medical attention and are on medications. Mr. Bradley's SC6 tells us the tower is safe. Our bodies tell us differently. Soon after the tower was erected, one family was forced from their home due to illness. Their home lies within the shadow of the tower. The husband has been diagnosed with electro-hypersensitivity (EHS) by a specialist. Mr. Bradley and his scientists will tell you that EHS sufferers have not been proven sensitive to low-level radiation.

Is it within the Canadian Government's ethical standards to erect such a controversial tower?

Whereas Safety Code 6 is 8 years old and in dire need of being updated, the Bioinitiative Report (2007) is a very recent document compiled by an international working group of scientists, researchers and public health policy professionals. The document presents serious scientific concerns about current limits that regulate exposure to EMFs from power lines, cell phones, and many other sources. The excerpt below gives an excellent overview of the current problem:

"You cannot see it, taste it or smell it, but it is one of the most pervasive environmental exposures in industrialized countries today. Electromagnetic radiation (EMR) or electromagnetic fields (EMFs) are the terms that broadly describe exposures created by the vast array of wired and wireless technologies that have altered the landscape of our lives in countless beneficial ways. However, these technologies were designed to maximize energy efficiency and convenience; not with biological effects on people in mind. Based on new studies, there is growing evidence among scientists and the public about possible health risks associated with these technologies.

Human beings are bioelectrical systems. Our hearts and brains are regulated by internal bioelectrical signals. Environmental exposures to artificial EMFs can interact with fundamental biological processes in the human body. In some cases, this can cause discomfort and disease. Since World War II, the background level of EMF from electrical sources has risen exponentially, most recently by the soaring popularity of wireless technologies such as cell phones (two billion and counting in 2006), cordless phones, WI-FI and WI-MAX networks. Several decades of international scientific research confirm that EMFs are biologically active in animals and in humans, which could have major public health consequences.

Today's public exposure limits for telecommunications are based on the presumption that heating of tissue (for RF) or induced electric currents in the body (for ELF) are the only concerns when living organisms are exposed to RF. These exposures can create tissue heating that is well known to be harmful in even very short-term doses. As such, thermal limits do serve a purpose. For example, for people whose occupations require them to work around radar facilities or RF heat-sealers, or for people who install and service wireless antenna tower, thermally-based limits are necessary to prevent damage from heating (or, in the case of power-frequency ELF from induced current flow in tissues).

In the past, scientists and engineers developed exposure standards for electromagnetic radiation based on what we now believe are faulty assumptions that the right way to measure how much non-ionizing energy humans can tolerate (how much exposure) without harm is to measure only the heating of tissue (RF) or induced currents in the body (ELF).

In the last few decades, it has been established beyond any reasonable doubt that bioeffects and some adverse health effects occur at far lower levels of RF and ELF exposure where no heating (or induced currents) occurs at all; some effects are shown to occur at several hundred thousand times below the existing public safety limits where heating is an impossibility." [1]

7a) Does the CCRPB agree with the above statements?

7b) What in particular causes the disagreement and how can the disagreement be proved 100%, with no doubts?

Speaking earlier this year in San Francisco, Dr. M Havas said,

"The Federal Communications Commission (FCC) (22) Guideline is similar to the international guideline ICNIRP guideline (15) and is based on **short-term thermal effects**. This guideline is based on the assumption that if microwave energy does not heat tissue it is not harmful. **This assumption is incorrect**. Adverse biological effects have been documented at levels below federal guidelines and there are no federal guidelines for **non-thermal effects**, nor are there guidelines for **long-term exposure**. The technological developments and uses of wireless devices are running well ahead of the policy decisions necessary to ensure their safety..."

According to Norbert Hankin, Chief EMF Scientist, U.S. Environmental Protection Agency:

"The U.S. Federal Communications Commission, (FCC's) exposure guidelines are considered protective of effects arising from a thermal mechanism but not from all possible mechanisms. Therefore, the generalization by many that the guidelines protect human beings from harm by any or all mechanisms is not justified." (<http://www.protectschools.org/epa%20letter.pdf>)

Organizations that set safety standards such as ANSI/IEEE or ICNIRP are quick to point out that "safe" radio frequency exposure rests on the fact that exposure is too weak to produce a rise in body temperature, or a "thermal" effect. Whether non-thermal effects occur is no longer the issue, the issue is at what level do these non-thermal effects occur and what are the safe levels of long-term exposure."[2]

8a) Does SC6 take into account non-thermal effects and long term exposure?

8b) What are the studies to back this claim?

Canada is subject to guidelines enforced by Industry Canada but generated by HC under the document SC6. There are only 3 sentences referencing biological effects in the whole document. It references biological effects thus: "Biological effects of RF fields at levels too low to produce significant heating have also been reviewed (3,6). These effects are not well established, nor are their implications for human health sufficiently well understood. Thus, they cannot provide a basis for making recommendation towards the restriction of human exposures to such low-intensity RF fields."

9) In a document as important to the safety of Canadians as SC6, why are there only 3 sentences referring to biological effects? How in the light of all the studies can it be said, "These effects are not well established, nor are their implications for human health sufficiently understood?"

Their references 3 and 6 are as follows:

3) World Health Organization. Environmental Health Criteria 137: Electromagnetic Fields (300 Hz - 300 GHz), 1993 (Available from: WHO, Geneva, or Canadian Public Health Association, Ottawa, Ontario)

6) M.H. Repacholi. Low-Level Exposure to Radiofrequency Fields: Health Effects and Research Needs. Bioelectromagnetics, Vol. 19, pp. 1-19, 1998.

10) With the biological effects of radiation so important, how can a document as important as SC6 have only two references to biological effects?

Note the first reference is dated 1993 and both involve Dr. Michael Repacholi. In the first study he was chairman of the study while at the Royal Adelaide Hospital, the second study while heading the Project into EMFs by the WHO. He was also emeritus chairman of ICNIRP, the body charged with setting "safe" International Exposure limits.

While leading the WHO EMF project Repacholi funneled industry donated money through the Royal Adelaide Hospital to the WHO. Seven years ago, Norm Sandler, a Motorola spokesman said, "This is the process for all supporters of the WHO program." At the time Motorola was sending \$50,000 each year and the Mobile Manufacturers Forum gave the project \$150,000 a year. (Microwave News)

A WHO Progress Report lists its funding as follows: Income: \$249,682 Governments, \$529,820 others, for a total USD of \$779,502. If the "Others" listed above were sourced from the Royal Adelaide Hospital (industry), then only less than 1/3 of the WHO EMF funding came from Governments around the world." (Microwave News)

Despite the UK Health Protection Agency's own advice that children under 16 should use mobile phones and other wireless equipment as little as possible because they are more prone to harm from them, Dr. Repacholi promoted wireless/microwave emitting devices to children at the Handheld Learning Conference, 10-12 October, 2007 in London, England.

11a) Mr. Repacholi was chairman of the Royal Adelaide Hospital studies, WHO studies, and chairman emeritus of ICNIRP. He has had great influence on world-wide standards for EMFs. Mr. Repacholi has ties to Industry. Did Mr. Repacholi at any time work for HC?

11b) What was his position?

11c) What influence did he have in the creation of SC6?

In a correspondence Mr. Bradley, director of the Consumer and Clinical Radiation Bureau of Canada (CCRPB), HC, wrote, "SC6 limits are based on both thermal and non-thermal effects. For frequencies from 3 kHz to 100 kHz, the biological endpoint on which the limits are based is nerve and muscle stimulation. Although these are acute effects, they are non-thermal in nature. At higher frequencies, non-thermal effects have not been convincingly demonstrated. Thus, they have not been accepted by either this Bureau or other international bodies such as ICNIRP and IEEE to be used as a basis for setting exposure limits. SC6 is protective of the identified non-thermal effect indicated above."

12a) Are there frequencies below 3kHz? What happens biologically at frequencies below 3 kHz?**12b) Exactly how is SC6 protective of non-thermal effects?**

He also says, "In addition, the biological tests that have been used in our examination of non-thermal effects are standard toxicological assays that are used throughout the scientific world for examining the effects of a multitude of environmental toxins. They are used primarily to detect damage to the genetic material in cells exposed to toxic agents. Before each test is applied, it is checked for sensitivity against agents such as a known dose of x-rays, which has a clearly defined and quantifiable effect on the genetic material in the cells. In this way, it is assured that the tests are able to detect any damage to the cells caused by electromagnetic radiation." And, "To date, experimental and epidemiological studies throughout the world have failed to provide clear support for a causal relationship between electromagnetic fields and complaints. The experimental studies strongly suggest that EHS symptoms are not related to actual exposures to electric or magnetic fields, and that electromagnetically hypersensitive individuals are no better than non-hypersensitive individuals in detecting the presence of EMF. EHS has no clear diagnostic criteria and there is no scientific basis to link electromagnetic hypersensitivity symptoms to EMF exposure.

At this time, neither HC nor the WHO recognize that symptoms attributed to EHS from low-level RF fields (as located around cell towers) are causally related to RF field exposure."

13a) I ask HC to name 3 such studies.**13b) What part did industry play in these studies?****13c) What was the background of the scientists running the study? Did any of them have a background in EHS?****13d) Did any of the scientists suffer and therefore understand EHS?****13e) Why would anyone with EHS put themselves through the pain of a study?****13f) Were EHS sufferers consulted on the design of the study?****13g) Most importantly, how many EHS dropped out of the study? How did these drop-outs influence the results of the study?**

In the report, "Electrohypersensitivity (EHS) in the Netherlands – A Questionnaire survey" by Hugo Schooneveld and Juliette Kuiper of the Dutch Electrohypersensitivity (EHS) Foundation, December 2007, they state "Some persons have become electrosensitive and respond to some specific EMFs in their environment and show some of the possible health effects induced by their personal stress system...One of the main problems is that many people with EHS symptoms have no idea which type of EMF –if any- is specifically annoying to him or her. This is caused by the length of time usually elapsing between EMF exposure and health effect: several hours is not unusual (Schooneveld and Arends-Zimmermann, 2006). One simply does not see the connection...The point never contemplated so far is that EHS is a problem of the individual, not of a group. We all tend to expect the classical picture of an illness: much like measles would make the skin of children appear reddish, and influenza would elevate body temperature, we expect a similar marker for EHS. An obvious marker apparently does not exist so far and we should perhaps stop looking for physically recognizable signs of EHS...There have been quite a few studies in which EMF sensitive and non-sensitive volunteers were exposed to high-frequency EMFs, signals mimicking those of GSM or UMTS transmitters. The question was whether EHS people could demonstrate –under controlled conditions- that they could 'feel' whether the transmitter was 'on' or 'off'...The outcome was mostly negative and authors like Rubin et al. (2006) and others conclude that there was no evidence for an EMF-feeling talent. The present data show that the situation is more complex: not all EHS people will react to high-frequency EMFs. In future experiments, more attention should be paid to the specific conditions under which EHS can be demonstrated by individual volunteers...Therefore, it seems essential that volunteers participating in such studies should

be selected with care and questioned in detail about their personal experiences. Exposure conditions should be adjusted to those individual preferences.”

14) Were the above characteristics of EHS sufferers taken into account in the EHS studies cited by Mr. Bradley?

As mentioned, soon after the tower was erected, one family was forced from their home within the shadow of the tower. The husband has been diagnosed with electro-hypersensitivity (EHS) by specialists. Mr. Bradley and his scientists will tell you that EHS sufferers have not been proven sensitive to low-level radiation. Mr. Bradley states that “At this time, neither HC nor the WHO recognize that symptoms attributed to EHS from low-level RF fields (as located around cell towers) are causally related to RF field exposure.”

15) When a family is forced from their home due to policies set forth by HC and implemented by IC, what government instituted recourse do they have to regain their family home?

In 1998, 1/3 of Canadian households owned a computer and today the figure is 70%. Canadian cell phone users have increased from 98,000 in 1987 to 18,000,000 to-day (Ottawa Citizen). In 1999, worldwide there were 86.1 million cell phones (World Almanac and book of facts 2001.571). 3 billion are in use today (Reuters). Although I have no statistics for Toronto, the city of San Francisco, with an area of only seven square miles, has over 2,500 licensed cell phone antennas positioned at 530 locations throughout the city. In practical terms, this city, like thousands of others, is being wave-nuked 24 hours day. (<http://www.globalresearch.ca/index.php?context=va&aid=7025>)

16a) How many towers were in Canada in Jan 2000? How many towers are in Canada today? How many towers are projected for Canada in 2010?

16b) How many people are subjected to cell tower radiation ½ hour a day; 8 hours a day and 24 hours a day?

Of the references used in Safety Code 6, 29 are from the 1990's, 14 from the 1980's and 6 pre 1980. There are no references beyond the year 2000 when Canada experienced an explosion of cell tower construction. Of the references in Magda Havas' paper, 17 are dated between 2000-2004, 20 in the 1990's and 3 are from between 1988-89.

17a) Why are there so few studies referenced in SC6?

17b) When is the next published update?

The following studies are not referenced in SC6.

1) Santini et al. (2002). A study of the health of people living in the vicinity of mobile phone base stations. *Pathologie Biologies*, 50, 369-373 Investigation on the health of people living near mobile telephone relay stations: Incidence according to distance and sex.

A survey study, using questionnaire was conducted in 530 people (270 men, 260 women) living or not in the vicinity of cellular phone base stations, on 18 Non Specific Health Symptoms. Comparisons of complaints frequencies (CHI-SQUARE test with Yates correction) in relation with distance from base station and sex, show significant ($p < 0.05$) increase as compared to people living > 300 m or not exposed to base station, till 300 m for tiredness, 200 m for headache, sleep disturbance, discomfort, etc. 100 m for irritability, depression, loss of memory, dizziness, libido decrease, etc. Women significantly more often than men ($p < 0.05$) complained of headache, nausea, loss of appetite, sleep disturbance, depression, discomfort and visual perturbations. This first study on symptoms experienced by people living in vicinity of base stations shows that, in view of radioprotection, minimal distance of people from cellular phone base stations should not be < 300 m.

2) Naila Study, Germany (November 2004) - [see <http://www.tetrawatch.net/papers/naila.pdf>], The influence of being physically near to a cell phone transmission mast on the incidences of cancer.

The result of the study shows that the proportion of newly developing cancer cases was significantly higher among those patients who had lived during the past ten years at a distance of up to 400 metres from the cellular transmitter site, which has been in operation since 1993, compared to those patients living further away, and that the patients fell ill on average 8 years earlier.

In the years 1999-2004, i.e. after five years' operation of the transmitting installation, the relative risk of getting cancer had trebled for the residents of the area in the proximity of the installation compared to the inhabitants of Naila outside the area.

3) Ecolog, 2000, T-Mobile\Ecolog Institute – Mobile Communications and health; review of current scientific research in view of precautionary health.

This review of over 220 peer-reviewed and published papers found strong indications for the cancer-initiating and cancer-promoting effects of high frequency electromagnetic fields used by mobile telephone technology. Experiments on cell cultures at power flux densities much lower than the guidelines, yielded strong indications for genotoxic effects of these fields, like single and double stranded DNA breaks and damage to chromosomes. The findings that high frequency

electromagnetic fields influence cell transformation, cell growth promotion and cell communication also point on a carcinogenic potential of the fields used for mobile telephony. The study also found teratogenic effects (birth deformities) and loss of fertility in animal studies. Moreover, disruptions of other cellular processes, like the synthesis of proteins and the control of cell functions by enzymes, have been demonstrated.

4) BioInitiative Report, Aug, 2007 – An international working group of scientists, researchers and public health policy professionals (The BioInitiative Working Group) released a report on electromagnetic fields (EMF) and health. They document serious scientific concerns about current limits regulating how much EMF is allowable from power lines, cell phones, and many other sources of EMF exposure in daily life. The report concludes the existing standards for public safety are inadequate to protect public health.

18) When will these studies be reflected in SC6?

According to Robert Bradley, "SC6 limits are based on both thermal and non-thermal effects. For frequencies from 3 kHz to 100 kHz, the biological endpoint on which the limits are based is nerve and muscle stimulation. Although these are acute effects, they are non-thermal in nature. At higher frequencies, non-thermal effects have not been convincingly demonstrated. Thus, they have not been accepted by either this Bureau or other international bodies such as ICNIRP and IEEE to be used as a basis for setting exposure limits. SC6 is protective of the identified non-thermal effect indicated above."

19) How does HC reconcile Mr. Bradley's words with the above studies?

Mr. Bradley makes the claim that studies are considered as long as they are "referenced in the context of peer-reviewed publications".

20a) Why are the studies listed in the above ignored?

20b) They are all valid studies, and they all show biological effects at levels many, many times below Safety Code 6. I would like an explanation as to why the studies listed above have not played a role in informing HC's policies?

Of the studies referenced in SC6, all before 2000, there are no acknowledgements of EHS symptoms relating to EMR. Regarding EHS, Dr. Havas writes,

"Symptoms of EHS include: cognitive dysfunction (memory, concentration, problem-solving); balance, dizziness & vertigo; facial flushing, skin rash; chest pressure, rapid heart rate; depression, anxiety, irritability, frustration, temper; fatigue, sleep disruptions; body aches, headaches; ringing in the ear (tinnitus) and are consistent with chronic fatigue and fibromyalgia.

'Electro hypersensitivity (EHS) is now recognized by the World Health Organization (WHO) and is defined as: ". . . a phenomenon where individuals experience adverse health effects while using or being in the vicinity of devices emanating electric, magnetic, or electromagnetic fields (EMFs). . . Whatever its cause, EHS is a real and sometimes a debilitating problem for the affected persons, while the level of EMF in their neighborhood is no greater than is encountered in normal living environments. Their exposures are generally several orders of magnitude under the limits in internationally accepted standards.'

EHS is classified as a disability in Sweden and health care facilities with low exposure to electromagnetic fields and radio frequency radiation are available for sensitive individuals. Approximately 2% (more probably 3%) of the population has severe symptoms of EHS. These people are unable to live in our modern society with its electrical and electronic appliances and with the increasing exposure to radio frequency radiation. Another 35% of the population has moderate symptoms represented by an impaired immune system and by chronic illness."

21) On what basis can SC6 ignore these facts?

Canada's population is 33,000,000. 2% is 660,000, 35% is 11,550,000. If we just consider the 2% who are highly sensitive, their illness will surely bring them to their physicians. Let's say they only visit their doctors once. That is 660,000 visits to the doctor. If the doctor prescribes medication, there will be a further 660,000 visits to renew whatever medication is prescribed. Multiply this by the length of time the patient is on medication and we are talking about a lot of medical visits at great cost to Canada.

22) What is the cost to the Canadian health care system of EHS? Why are there no statistics on the cost to the Canadian health care system of EHS?

I have neighbours within 300 metres of a cell tower who are not in the 2% of the highly sensitive and they visit their doctors concerning cognitive dysfunction (memory, concentration, problem-solving); balance, dizziness & vertigo; facial

flushing, skin rash; chest pressure, rapid heart rate; depression, anxiety, irritability, frustration, temper; fatigue, poor sleep; body aches, headaches; ringing in the ear (tinnitus) and are consistent with chronic fatigue and fibromyalgia.

23) Why are there no HC initiatives to recognize EHS? What is HC doing to inform the general public and physicians of EHS?

The Santini, Naila, Ecolog and BioInitiative studies are just the tip of a multitude of similar studies. The BioInitiative Report alone has over 600 pages and 1387 references covering multiple topics relating to electromagnetic radiation (EMR) or electromagnetic fields (EMF's).

24) I have talked to CCRPB's scientists and they pooh-poo these studies. They can cite opposing views, and yet by conceding the existence of opposing views, is it not logical to conclude that doubt exists in the science?

When it was pointed out that Palm Beach County, FL., Greece, New Zealand, and the state of California all prohibit cellular antennas near schools due to safety concerns, Mr. Bradley replied "Certain municipalities and states have chosen to implement more restrictive measures than current science-based exposure limits. These decisions are often based on **social policy considerations.**"

25) If the precautionary principle is referred to by Mr. Bradley as "social policy considerations" why are we not taking it into account in Canada as well?

It is because of this doubt I reference the precautionary principle.

The precautionary principle is a moral and political principle which states that if an action or policy might cause severe or irreversible harm to the public, in the absence of a scientific consensus that harm would not ensue, the burden of proof falls on those who would advocate taking the action. As taken from the Canadian government pamphlet on the precautionary principle - http://www.ec.gc.ca/econom/pamphlet_e.htm , "The precautionary approach recognizes that the absence of full scientific certainty shall not be used as a reason to postpone decisions where there is a risk of serious or irreversible harm. Even though scientific information may be inconclusive, decisions have to be made to meet society's expectations that risks be addressed and living standards maintained."

25) Was the precautionary principle used in the formulation of SC6?

The Vorsorgeprinzip, or "foresight" principle, only emerged as a specific policy tool during the German debates on the possible role of air pollution as a cause of "forest death" in the 1970-80s. However, John Graham, one of Bush's science policy advisors, and trenchant critic of the precautionary principle, has noted that:

"Precaution, whether or not described as a formal principle, has served mankind well in the past and the history of public health instructs us to keep the spirit of precaution alive and well". (Graham 2002).

Graham might have been thinking of the cholera episode of 1854 when precaution did indeed serve the people of London well. Dr. John Snow, a London physician, used the spirit of precaution to advise banning access to the polluted water of the Broad St. pump which he suspected was the cause of the cholera outbreak. He based his recommendation on the evidence he had been accumulating for some years including his study of S. London populations served by both piped and well water. Snow's views on cholera causation were not shared by The Royal College of Physicians who considered Snow's thesis and rejected it as 'untenable' as they and other "authorities" of the day believed that cholera was caused by airborne contamination. It took 30 years of further scientific inquiry. Such a long time lag between acknowledging compelling associations and understanding their mechanisms of action is a common feature of scientific inquiry, as the histories of TBT, PCBs, DES, the Great Lakes pollution, beef hormones and the other cases in the EEA report illustrate.

The Broad St. pump, TBT, DES, PCBs and Great Lakes Pollution examples described here also serve to illustrate the contingent nature of knowledge. Today's scientific certainties can be tomorrow's mistakes, and today's research can both reduce and increase scientific uncertainties, as the boundaries of the "known" and the unknown expand. Waiting for the results of more research before taking action to reduce threatening exposures may not only take decades but the new knowledge may identify previously unknown sources of both uncertainty and ignorance, as awareness of what we do not know expands, thereby supplying further reasons for inaction. "Paralysis by Analysis " can then follow. "The more we know, the more we realize what we don't know" is not an uncommon scientific experience. Socrates observed some time ago: "I am the wisest man alive, for I know one thing, and that is that I know nothing". (Plato's Apology 1.21).

Some measures that could help limit the consequences of ignorance and the impacts of surprises are:

- using intrinsic properties as generic predictors for unknown but possible impacts e.g. the persistence, bioaccumulation and spatial range potential of chemical substances. (Stroebe et al., 2004)

- reducing specific exposures to potentially harmful agents on the basis of credible 'early warnings' of *initial* harmful impacts, thus limiting the size of any other 'surprise' impacts from the same agent, such as the asbestos cancers that followed asbestosis; and the PCB neurotoxicological effects that followed its wildlife impacts.
- promoting a diversity of robust and adaptable technological and social options to meet needs, which limits technological 'monopolies' (such as those like asbestos, CFCs, PCBs etc.), and therefore reduces the scale of any 'surprise' from any one technological option.
- using more long-term research and monitoring of what appear to be "surprise sensitive sentinels", such as frogs and fetuses. [1]

27a) Does HC use intrinsic properties as generic predictors for unknown but possible impacts e.g. the persistence, bioaccumulation and spatial range potential of chemical substances when formulating SC6?

27b) Does HC reduce specific exposures to potentially harmful agents on the basis of credible 'early warnings' of initial harmful impacts, thus limiting the size of any other 'surprise' impacts from the same agent, such as the asbestos cancers that followed asbestosis; and the PCB neurotoxicological effects that followed its wildlife impacts when formulating SC6?

27c) Does HC promote a diversity of robust and adaptable technological and social options to meet needs, which limits technological 'monopolies' (such as those like asbestos, CFCs, PCBs etc.), and therefore reduces the scale of any 'surprise' from any one technological option when formulating SC6?

27d) Does HC use more long-term research and monitoring of what appear to be "surprise sensitive sentinels", such as frogs and fetuses when formulating SC6?

The distinction between *prevention* and *precaution* is also important. Preventing hazards from "known" risks is relatively easy and does not require precaution.

Banning smoking, or asbestos, today requires only acts of prevention to avoid the well-known risks. However, it would have needed precaution, (or foresight, based on a sufficiency of evidence), to have justified acts to avoid exposure to the then uncertain hazards of asbestos in the 1930s –50s, or of tobacco smoke in the 1960's). Such precautionary acts then, if implemented successfully, would have saved many more lives in Europe than today's bans on asbestos and smoking are doing. As Cogliano has recently pointed out, the difference between prevention and precaution can be further illustrated by showing that *prevention* is used to justify the restriction of exposure to an IARC Category 1 carcinogen whereas *precaution* is necessary to justify restricting exposure to a Category 2A or B carcinogen, where the evidence is less strong. [1]

28a) How is foresight used to formulate SC6?

28b) Does the existing strength of evidence justify precautionary actions now?

28c) Or will exposure reduction be delayed until the evidence is clear enough to justify the more belated and overall less protective prevention of "known" causes, so that EMF replicates the fate of asbestos, smoking and most of the other cases in the EEA report?

The key to understanding the added value of the PP requires a) acknowledging the distinction between prevention and precaution described above; b) an appreciation of the further distinctions between the primary, secondary and tertiary preventative *measures* that have long been adopted in public health, and the prior *justification* for any such measure, which the PP brings; and c) a recognition of the increased legitimacy and transparency that arises from the articulation and adoption of the PP in legal texts, international agreements and conventions, as opposed to being merely part of general practice.

More empirically, the evidence that many scientific disciplines, legal scholars (de Sadeleer, 2007), and international policymakers, have, since the 1970s, recognized the need for legitimizing the PP as a new policy tool that is better able to deal with systems complexities, ignorance and uncertainties, suggests that the PP brings added value to the protection of the environment and the public.

There is much discussion generated by the different meanings often attached to the common terms "prevention", "precaution", "risk", "uncertainty" and "ignorance".

There are some relatively rare but successful acts of "precautionary prevention" in the EEA report such as on cholera in 1854, on TBT in France in the 1980s, and on CFCs in the 1970s. Together with the many other examples of the failure to use the precautionary principle in the other case studies (EEA, 2001), these illustrate the wisdom of taking appropriate precautionary actions to avoid plausible and serious threats to health or environments, especially when the impacts are irreversible and likely to be much more costly to society than the precautionary measures. [1]

29) The failure to use the precautionary principle in the other case studies (EEA, 2001), these illustrate the wisdom of taking appropriate precautionary actions to avoid plausible and serious threats to health or environments, especially when the impacts are irreversible and likely to be much more costly to society than the precautionary measures. When it comes to EMR is there wisdom to change SC6 to reflect new information?

Some commentators have stressed the need for policymakers to take account of the foreseeable, or plausible, countervailing (secondary) costs of otherwise genuine precautionary attempts to protect the environment and health. This consideration of countervailing costs has long been recognized by the better policymakers, even if it is difficult in practice to anticipate and account for all consequences of actions. And of course there are the secondary benefits of precautionary actions as well, which tend to be less stressed, such as the benefit of reduced respiratory and cardiovascular disease from the reduced combustion of fossil fuels: a large and early secondary benefit of that climate change measure.

The outcomes of some controversial actions based on the PP, such as the EU ban on antibiotics as growth promoters, which is a Late Lessons case study, have since been scrutinized, and have been considered sound, or unsound, depending on the science used and its interpretation by different interests

Any policy effectiveness analysis of measures taken to deal with such multi-causal and long term hazards as antibiotics as growth promoters is fraught with methodological difficulties and is hampered by long latencies and complex biological systems: untangling the causal impact of one stressor amongst many inter-dependent ones is virtually impossible. The value of applying more probabilistic and value of information data to such conundrums is recognized by many risk managers. However, this cannot remove the need for scientific and political judgment about how to take appropriate and proportionate action in the face of irreducible uncertainties, ignorance and plausible hazards which could have serious, widespread and irreversible impacts and for which probabilities are not possible at the time when they are most needed. This is the current case with many EMF exposures. [1]

30a) Would the CCRPB scientists agree with this statement?

30b) If not, specifically why not?

30c) If yes, specifically what parts of the statement do they agree with?

30d) Does SC6 take into account the foreseeable, or plausible, countervailing (secondary) costs of otherwise genuine precautionary attempts to protect the environment and health?

The increasing awareness of complexity and uncertainty during the 1980/90's led to the German debates on the Vorsorgeprinzip shifting to the international level, initially in the field of conservation (World Charter for Nature UN 1982), but then particularly in marine pollution, where an overload of data accompanied an insufficiency of knowledge. (Marine Pollution Bulletin, 1997) This generated the need to act with precaution to reduce the large amounts of chemical pollution entering the North Sea.

Since then many international treaties have included the PP (including the often cited version from the Third North Sea Ministerial Conference, 1990) reference to the precautionary principle, or, as they refer to it in the USA, the precautionary approach.

The N. Sea declaration called for "action to avoid potentially damaging impacts of substances, even where there is no scientific evidence to prove a causal link between emissions and effects".

This definition has often, and sometimes mischievously, been used to deride the precautionary principle by claims that it appears to justify action even when there is "no scientific evidence" that associates exposures with effects. However, the N. Sea Conference definition clearly links the words "no scientific evidence" with the words "to prove a causal link". We have already seen with the Broad St. pump and TBT examples that there is a significant difference between evidence about an "association" and evidence that is robust enough to establish a "causal" link. (Hill, 1965). [1]

31a) Is there enough evidence to establish a causal link between EMR and cell damage?

31b) "Where there is uncertainty as to the existence or extent of risks to human health, the institutions may take protective measures without having to wait until the reality and seriousness of those risks become fully apparent" (Christoforou, 2002). Would the CCRPB agree with this statement? Would the CCRPB take this into account when formulating SC6?

31c) How are developing children taken into account in SC6?

31d) EHS is irreversible, is this irreversibility taken into account in SC6? If SC6 does not protect from citizens developing EHS, is HC legally liable? Would scientists who have suppressed this information be legally liable? Would they be fired?

31e) Is the goal of SC6 to protect public health, consumer safety and the safety of the environment? Is the consumer given a high, medium or low "balance of evidence or probability" when formulating SC6 guidelines?

Since the broad shoulders of the telecommunications industry are able to bear the costs of mistaken judgments rather better than the much narrower shoulders of the injured citizen, should the citizen be given broader leeway when determining safety standards such as SC6?

31f) Is it possible to use different levels of proof when formulating SC6?

31g) How robust, and over what periods of time, does the evidence on the absence of harm have to be before concluding that a restricted substance or activity is without significant risk?

31h) Why is the bias within SC6 towards avoiding “false positives”, thereby generating more “false negatives”, and the dominance within decision-making of short-term, specific, economic and political interests over the longer term, diffuse, and overall welfare interests of society?

31i) Are HC conducting any long term studies on EMR and young children? If not, why not?

Mr. Bradley, July 13, 2007 wrote. “To date, experimental and epidemiological studies throughout the world have failed to provide clear support for a causal relationship between electromagnetic fields and complaints.”

Bradford Hill established nine criteria for helping to move from association to causation in environmental health which have been, and still are, widely used in debates on issues such as EMF. Two of the apparently more robust of the “criteria” may not be so robust in the context of multi-causality, complexity and gene/host variability. For example, “**consistency**” of study findings is not always to be expected. As Prof. Needleman, who provided the first of what could be called the second generation of early warnings on lead in petrol in 1979 has observed: It follows that the *presence* of consistency of results between studies on the same hazard can provide robust evidence for a causal link, but the *absence* of such consistency may not provide very robust evidence for the absence of a real association. In other words, the “criterion” of consistency is asymmetrical, like most of the other Bradford Hill “criteria”. [1]

32a) Are every decision of HC based on causality?

32b) What determines how causality is used in HC’s decision making?

32c) Why are HC decisions on EMR pinned to causality when the absence of consistency may not provide very robust evidence for the absence of association?

Similarly, the criterion of “**temporality**”, which says that the putative cause X of harm Y must come before Y appears, is robust in a simple, uni-causal world. In a multi-causal, complex world of common biological end points that have several chains of causation this may not necessarily be so. For example, falling sperm counts can have multiple, co-causal factors, some of which may have been effective at increasing the incidence of the biological end point in question in advance of the stressors in focus, thereby confusing the analysis of temporality. The resulting overall sperm count trends could then be rising, falling or static, depending on the combined direction and strengths of the co-causal factors and the time lags of their impacts. It follows that say, chlorine chemicals, may or may not be co-causal factors in falling sperm counts: but the use of the “temporality” argument by the WHO, who observed that sperm counts began to fall before chlorine chemistry production took off, does not provide robust evidence that they are not causally involved. [1]

34a) If people living near cell towers are becoming ill, if HC cannot guarantee their health, if HC does not test for non thermal effects at cell tower sites, then how can they use causality as an excuse to do nothing?

34b) Does HC allow risk managers to provide risk assessors with guidance on the science policy to apply in their risk assessments of SC6?

34c) Does HC do risk analysis? Has a risk analysis been done on SC6? Is HC willing to wait 30-100 years to review the consequences of their actions regarding EMR?

34d) It appears it is the INFORMATION conveyed by electromagnetic radiation (rather than heat) that causes biological changes - some of these biological changes may lead to loss of wellbeing, disease and even death. Is this HC’s position? If not, why not?

34e) There may be no lower limit at which exposures do not affect us. Until we know if there is a lower limit below which bioeffects and adverse health impacts do not occur, is it unwise from a public health perspective to continue “business-as-usual” deploying new technologies that increase ELF and RF exposures, particularly involuntary exposures?

A WHO definition states that: “(A)nnoyance or discomforts caused by EMF exposure may not be pathological per se, but, if substantiated, can affect the physical and mental well-being of a person and the resultant effect may be considered as an adverse health effect. A health effect is thus defined as a biological effect that is detrimental to health or well-being. According to the WHO Constitution, health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.” www.who.int/peh-emf [1]

35) Mr. Bradley states that "At this time, neither HC nor the WHO recognize that symptoms attributed to EHS from low-level RF fields (as located around cell towers) are causally related to RF field exposure." When Mr. Bradley refers to WHO does he take the above into account?

Environmental Issue Report Number 29 from the World Health Organization (2002) cautions about the effects of radiofrequency radiation on children's health. As part of a publication on "Children's Health and Environment: A Review of Evidence" the World Health Organization (WHO) wrote:

"The possible adverse health effects in children associated with radiofrequency fields have not been fully investigated."

"Because there are suggestions that RF exposure may be more hazardous for the fetus and child due to their greater susceptibility, prudent avoidance is one approach to keeping children's exposure as low as possible."

"Further research is needed to clarify the potential risks of ELF-EMF and radiofrequency fields for children's health." [1]

36a) Does the HC support cell phone use by children and pregnant mothers?

36b) When findings prove EMR is a threat to the health of children will HC recommend age limits for cell phone use as there are age limits for smoking?

36c) Has childhood leukemia increased in Canada with increased use of cell phone technology?

36d) What specifically in SC6 protects children from cancer?

The Parliament of the United Kingdom commissioned a scientific study group to evaluate the evidence for RF health and public safety concerns. In May of 2000, the United Kingdom Independent Expert Group on Mobile Phones issued a report underscoring concern that standards are not protective of public health related to both mobile phone use and exposure to wireless communication antennas.

Conclusions and recommendations from the Stewart Report (for Sir William Stewart) indicated that the Group has some reservation about continued wireless technology expansion without more consideration of planning, zoning and potential public health concerns. Further, the Report acknowledges significant public concern over community siting of mobile phone and other communication antennas in residential areas and near schools and hospitals.

"Children may be more vulnerable because of their developing nervous system, the greater absorption of energy in the tissue of the head and a longer lifetime of exposure."

"The siting of base stations in residential areas can cause considerable concern and distress. These include schools, residential areas and hospitals."

"There may be indirect health risks from living near base stations with a need for mobile phone operators to consult the public when installing base stations."

"Monitoring should be especially strict near schools, and that emissions of greatest intensity should not fall within school grounds."

"The report recommends "a register of occupationally exposed workers be established and that cancer risks and mortality should be examined to determine whether there are any harmful effects." (IEGMP, 2000) [1]

37a) It may be noted that the Simcoe cell tower is located near a school, hospital and nursing home, let alone the dense residential area. There was no notification given of the erection of the cell tower. Why, with all the warnings about EMR, was there no consideration to resident consultation?

37b) Was this an isolated incident or was it general policy to allow cell towers near hospitals, nursing homes and schools?

37c) The policy of notifying residents begins in January 2008. Will special arrangements be made for schools, hospitals and nursing homes? If not, why not?

The evidence that power lines and other sources of ELF are consistently associated with higher rates of childhood leukemia has resulted in the International Agency for Cancer Research (an arm of the World Health Organization) to classify ELF as a Possible Human Carcinogen (in the Group 2B carcinogen list). Leukemia is the most common type of cancer in children. [1]

38a) Is there doubt that exposure to ELF causes childhood leukemia? Could HC explain?

38b) Is it true there is some evidence that other childhood cancers may be related to ELF exposure but not enough studies have been done?

38c) Children who have leukemia and are in recovery have poorer survival rates if their ELF exposure at home (or where they are recovering) is between 1mG and 2 mG in one /study; over 3 mG in another study. Is this something to be taken into account in SC6?

Factors that determine effects can depend on head shape and size, the location, size and shape of internal brain structures, thinness of the head and face, hydration of tissues, thickness of various tissues, dielectric constant of the tissues and so on. Age of the individual and state of health also appear to be important variables. Exposure conditions also greatly influence the outcome of studies, and can have opposite results depending on the conditions of exposure including frequency, waveform, orientation of exposure, duration of exposure, number of exposures, any pulse modulation of the signal, and when effects are measured (some responses to RF are delayed). There is large variability in the results of ELF and RF testing, which would be expected based on the large variability of factors that can influence test results. However, it is clearly demonstrated that under some conditions of exposure, the brain and nervous system functions of humans are altered. The consequence of long-term or prolonged exposures have not been thoroughly studied in either adults or in children. [1]

39) The consequence of prolonged exposures to children, whose nervous systems continue to develop until late adolescence, is unknown at this time. This could have serious implications to adult health and functioning in society if years of exposure of the young to both ELF and RF result in diminished capacity for thinking, judgment, memory, learning, and control over behavior. What child studies has HC (not others) initiated to investigate the effects of long-term or prolonged exposure?

The National Toxicology Program (NTP) is a part of the National Institute for Environmental Health Sciences, National Institutes for Health. Public and agency comment has been solicited on whether to add radiofrequency radiation to its list of substances to be tested by NTP as carcinogens. In February 2000 the FDA made a recommendation to the NPT urging that RF be tested for carcinogenicity (www.fda.gov.us). The recommendation is based in part on written testimony stating:

“Animal experiments are crucial because meaningful data will not be available from epidemiological studies for many years due to the long latency period between exposure to a carcinogen and the diagnosis of a tumor.”

“There is currently insufficient scientific basis for concluding either that wireless communication technologies are safe or that they pose a risk to millions of users.”

“FCC radiofrequency radiation guidelines are based on protection from acute injury from thermal effects of RF exposure and may not be protective against any non-thermal effects of chronic exposures.”

In March of 2003, the National Toxicology Program issued a Fact Sheet regarding its toxicology and carcinogenicity testing of radiofrequency/microwave radiation. These studies will evaluate radiofrequency radiation in the cellular frequencies.

“The existing exposure guidelines are based on protection from acute injury from thermal effects of RF exposure. Current data are insufficient to draw definitive conclusions concerning the adequacy of these guidelines to be protective against any non-thermal effects of chronic exposures.” [1]

40) The American National Institute for Environmental Health Sciences - National Toxicology Program is considering going away from the acute injury from thermals theory and the short term exposure concept. Is HC considering such a move?

An Assessment of Non-Lethal Weapons Science and Technology by the Naval Studies Board, Division of Engineering and Physical Sciences (National Academies Press (2002) has produced a report that confirms the existence of non-thermal bioeffects from information transmitted by radiofrequency radiation at low intensities that cannot act by tissue heating.

In this report, the section on Directed-Energy Non-Lethal Weapons it states that:

“The first radiofrequency non-lethal weapons, VMADS, is based on a biophysical susceptibility known empirically for decades. More in-depth health effects studies were launched only after the decision was made to develop that capability as a weapon. The heating action of RF signals is well understood and can be the basis for several additional directed-energy weapons. Leap-ahead non-lethal weapons technologies will probably be based on more subtle human/RF interactions in which the signal information within the RF exposure causes an effect other than simply heating: for example, stun, seizure, startle and decreased spontaneous activity. Recent developments in the technology are leading to ultrawideband, very high peak power and ultrashort signal capabilities, suggesting the phase space to be explored for subtle, yet potentially effective non-thermal biophysical susceptibilities is vast. Advances will require a dedicated effort to identify useful susceptibilities.”

This admission by the Naval Studies Board confirms several critical issues with respect to non-thermal or low-intensity RF exposures. First, it confirms the existence of bioeffects from non-thermal exposure levels of RF. Second, it identifies that some of these non-thermal effects can be weaponized with bioeffects that are incontrovertibly adverse to health (stun,

seizure, startle, decreased spontaneous activity). Third, it confirms that there has been knowledge for decades about the susceptibility of human beings to non-thermal levels of RF exposure. Fourth, it provides confirmation of the concept that radiofrequency interacts with humans based on the RF information content (signal information) rather than heating, so it can occur at subtle energy levels, not at high levels associated with tissue heating. Finally, the report indicates that a dedicated scientific research effort is needed to really understand and refine non-thermal RF as a weapon, but it is promising enough for continued federal funding. [1]

41) Is HC aware of the above information? If not, why not, considering the health implications for Canadians? If yes, why have they withheld it from Canadians by not factoring it in to SC6?

For brain tumors, people who have used a cell phone for 10 years or longer have a 20% increase in risk (when the cell phone is used on both sides of the head). For people who have used a cell phone for 10 years or longer predominantly on one side of the head, there is a 200% increased risk of a brain tumor. This information relies on the combined results of many brain tumor/cell phone studies taken together (a meta-analysis of studies). [1]

42a) People who have used a cell phone for ten years or more have higher rates of malignant brain tumor and acoustic neuromas. It is worse if the cell phone has been used primarily on one side of the head. Does the Canadian government take this information into account when issuing guidelines?

42b) The current standard for exposure to the emissions of cell phones and cordless phones is not safe considering studies reporting long-term brain tumor and acoustic neuroma risks. Is this the position of the Canadian government?

42c) In formulating SC6 Canadian government officials may have ignored relevant studies. In ignoring these studies are the Canadian government scientists negligent? Have they broken any oaths to uphold the safety of Canadians? What process is in place to address negligent Canadian government officials?

It can no longer be said that the current state of knowledge rules out or precludes risks to human health. The enormous societal costs and impacts on human suffering by not dealing proactively with this issue require substantive public health policy actions; and actions of governmental agencies charged with the protection of public health to act on the basis of the evidence at hand. [1]

43a) Why does HC ignore this current state of knowledge? Is it reasonable to conclude that HC would rather err on the side of Industry?

43b) Alzheimer's disease is a disease of the nervous system. There is strong evidence that long term exposure to ELF is a risk factor for Alzheimer's disease. Is this correct or does HC ignore this? Are the doctors, scientists, health care professionals, and beauraucrats all willing to let their fellow Canadians submit to such exposure?

Cancer risk is related to DNA damage, which alters the genetic blueprint for growth and development. If DNA is damaged (the genes are damaged) there is a risk that these damaged cells will not die. Instead they will continue to reproduce themselves with damaged DNA, and this is one necessary pre-condition for cancer. Reduced DNA repair may also be an important part of this story. When the rate of damage to DNA exceeds the rate at which DNA can be repaired, there is the possibility of retaining mutations and initiating cancer. [1]

44a) A person like myself who lives 90% of his time within 300 metres of a cell tower is bombarded by microwaves day after day after day. What are the effects of such close bombardment?

44b) Does the bombardment bounce off the skin? Does the bombardment pass through the body? On average how much of the bombardment penetrates the skin? To what depth? Does it dissipate? Does it just sit there? Does it interact with the body in any way? Does it affect cellular structure? Is the bombardment benign?

44c) If there is any penetration of the skin and if there is some doubt whether or not it might be harmful, should the precautionary principle be applied?

44d) For a person living 90% of their time within 300 metres of the Simcoe cell tower, how many units of radiation is the person bombarded with per day/per year/per lifetime?

In nearly every living organism, there is a special protection launched by cells when they are under attack from environmental toxins or adverse environmental conditions. This is called a stress response, and what are produced are stress proteins (also known as heat shock proteins).

Plants, animals and bacteria all produce stress proteins to survive environmental stressors like high temperatures, lack of oxygen, heavy metal poisoning, and oxidative stress (a cause of premature aging). We can now add ELF and RF exposures to this list of environmental stressors that cause a physiological stress response. [1]

45) Very low-level ELF and RF exposures can cause cells to produce stress proteins, meaning that the cell recognizes ELF and RF exposures as harmful. This is another important way in which scientists have

documented that ELF and RF exposures can be harmful, and it happens at levels far below the existing public safety standards. What studies does HC have to refute this statement?

The immune system is another defense we have against invading organisms (viruses, bacteria, and other foreign molecules). It protects us against illness, infectious diseases, and tumor cells.

There are many different kinds of immune cells; each type of cell has a particular purpose, and is launched to defend the body against different kinds of exposures that the body determines might be harmful. [1]

46) There is substantial evidence that ELF and RF can cause inflammatory reactions, allergy reactions and change normal immune function at levels allowed by current public safety standards. Oxidative stress through the action of free radical damage to DNA is a plausible biological mechanism for cancer and diseases that involve damage from ELF to the central nervous system. Is HC in agreement with this statement? If not, specifically why not?

Mr. Bradley wrote the following about SC6, "All aspects were reviewed, including possible effects related to cancer. It is important to note that this safety code, and all other codes and guidelines produced by this Bureau, rely on an understanding and assessment of the body of science, not selected studies that support a preconceived conclusion. This is the only approach that is justifiable and defensible in dealing with matters related to health and safety of the Canadian public." [1]

47) How can HC defend such a statement in light of the overwhelming contradictory evidence?

He also wrote, "In addition to these documents, HC staff participated in a specific review of the evidence for a link between EMR and cancer and this document contains more references: Moulder JE, Foster KR, Erdreich LS, McNamee JP. Mobile phones, mobile phone base stations and cancer: a review. *Int J Radiat Biol.* 2005 Mar;81(3):189-203) which is available at: <http://www.informaworld.com/smpp/content~content=a714033046~db=all~order=page>"

48a) I have read this paper. It was written before both the Wolf & Wolf (2004) study and before the Naila study. What is HC's response to this considering the Naila study is not referenced by HC?

48b) Are studies being selectively omitted from HC documents because they do not agree with the current administration's theories or objectives?

Many people are surprised to learn that certain kinds of EMFs treatments actually can heal.

These are medical treatments that use EMFs in specific ways to help in healing bone fractures, to heal wounds to the skin and underlying tissues, to reduce pain and swelling, and for other post surgical needs. Some forms of EMFs exposure are used to treat depression.

EMFs have been shown to be effective in treating conditions of disease at energy levels far below current public exposure standards. This leads to the obvious question. How can scientists dispute the harmful effects of EMF exposures while at the same time using forms of EMF treatment that are proven to heal the body? [1]

49a) Medical conditions are successfully treated using EMFs at levels below current public safety standards, proving another way that the body recognizes and responds to low-intensity EMF signals. Otherwise, these medical treatments could not work. The FDA has approved EMFs medical treatment devices, so is clearly aware of this paradox. Is HC aware of the paradox? Will HC resolve the paradox?

49b) No one would recommend that drugs used in medical treatments and prevention of disease be randomly given to the public, especially to children. Why then do random and involuntary exposures to EMFs occur all the time in daily life?

In July, 2007, The Alaska Supreme Court (Court) upheld the decision of the Alaska Workers' Compensation Board (Board) awarding an AT&T equipment installer 100% disability as a result of his workplace electromagnetic field exposure to radiofrequency (RF) radiation at levels slightly above the FCC RF safety limit. The award was based on the psychological and cognitive effects of RF radiation over-exposure. This decision is significant because the FCC RF limit is designed to keep people from being heated and ignores evidence of other adverse biological effects at much lower levels. The RF radiation exposure level in question was well below the FCC's recognized level of "thermal" harm. The FCC contends that there are no scientifically established harmful health effects below the thermal threshold. The Board decision agrees with the medical experts who found adverse health effects from this RF radiation exposure, which occurred above the FCC safety limit but below the thermal threshold. The complete text of Alaska Supreme Court OPINION No. 6139 - July 6, 2007 is found at: www.emrpolicy.org/litigation/case_law/index.htm.

50) When I contacted CCRPB on this ruling I was told the subject was overexposed to radiation. However, overexposure is not what the judge used to make his decision. I suggest CCRPB review the judgment more carefully.

According to the Canadian Human Rights Commission Policy on Environmental Sensitivities, "Individuals with environmental sensitivities experience a variety of adverse reactions to environmental agents at concentrations well below those that might affect the 'average person'". This medical condition is a disability and those living with environmental sensitivities are entitled to the protection of the *Canadian Human Rights Act*, which prohibits discrimination on the basis of disability. The Canadian Human Rights Commission will receive any inquiry and process any complaint from any person who believes that he or she has been discriminated against because of an environmental sensitivity. Like others with a disability, those with environmental sensitivities are required by law to be accommodated. EHS is considered a disability in Canada. The Canadian Human Rights Commission Policy on Environmental Sensitivities accommodates EHS.

51) HC maintains Canadians are protected by SC6 but it does not protect Canadians with EHS, therefore the Ministry of Health is in violation of the Canadian Human Rights Commission. Is this statement correct?

Recently Europe's top environmental watchdog, the European Environment Agency (EEA), has called for immediate action to reduce exposure to radiation from Wi-Fi, mobile phones and their masts. It suggests that delay could lead to a health crisis similar to those caused by asbestos, smoking and lead in petrol. The warning follows an international scientific review which concluded that safety limits set for the radiation are "thousands of times too lenient", and an official British report which concluded that it could not rule out the development of cancers from using mobile phones.

52) Is any such warning proposed by HC?

And the evidence keeps pouring in. In a lecture held on 1 October 2007 at the "Open University" in Gelsenkirchen, Germany, Prof. Franz Adlkofer presented his research results regarding the effect of UMTS radiation on human cells for the first time. There is no doubt – UMTS is ten times more damaging to genes than GSM radiation. He pointed out that the evidence of DNA strand breaks in conjunction with the formation of micronuclei does not allow any further doubting of the genotoxic effect of UMTS signals. This means that Prof Adlkofer demonstrated for UMTS what he had already demonstrated for GSM in the REFLEX project, which he headed: Mobile phone radiation damages the genetic material and raises the risk of cancer. The European Environment Agency, the highest scientific body within the EU, published a statement on 17 September 2007 in which it ranked the danger potential from mobile radiation and the policies supporting it in one line with Asbestos and PCBs.

And the evidence keeps pouring in. Washington, DC, November 16, 2007 – A groundbreaking scientific study published this week in the peer-reviewed "Australasian Journal of Clinical Environmental Medicine" warns that wireless communication technology may be responsible for accelerating the rise in autism among the world's children. (J.Aust.Coll.Nutr.& Env.Med, 2007; Vol.26, No.2 pages 3 – 7)

And the evidence keeps pouring in. Recently from the "Indian Express", November 26, 2007, "ICMR Study Confirms Health Risks From Mobile Phones". "Continuous use of cell phones can pose a serious threat to your reproductive health, says a study conducted by the Indian Council of Medical Research (ICMR). The Preliminary results of the study have indicated significant reduction of testicular size, weight and sperm count due to the Radio Frequency Radiation (RFR) emitted from cell phones.

53) What are HC's views on these three studies in light of the fact they cast doubt on the protection afforded Canadians by SC6?

The tobacco industry, 40 years ago, reacted to the historic Surgeon General's report linking cigarette smoking to cancer and other lung diseases by organizing a disinformation campaign. One of their memos, prepared in the 1960's, was recently uncovered during one of the lawsuits against the tobacco companies on behalf of millions of people who have been killed by their product. It is interesting to read it 40 years later in the context of the intransigence of HC: "Doubt is our product, since it is the best means of competing with the "body of fact" that exists in the mind of the general public. It is also the means of establishing controversy." Brown and Williamson Tobacco Company memo, 1960's.

53) Is HC stalling the reviewing of SC6 thereby allowing industry more time to build more towers?

Devra Lee Davis, Ph.D., MPH, is author of the *recently* released book "The Secret History of the War on Cancer. Dr. Davis is Visiting Professor at Carnegie Mellon University's Heinz School as well as Honorary Professor, London's School of Hygiene and Tropical Medicine, and an Expert Advisor to the World Health Organization. President Clinton appointed Dr. Davis to the Chemical Safety and Hazard Investigation Board, (1994-99), an independent executive branch agency that investigates, prevents, and mitigates chemical accidents.

As the former Senior Advisor to the Assistant Secretary for Health in the Department of Health and Human Services, she has counseled leading officials in the United States, United Nations, World Health Organization and World Bank. She was also a Distinguished Visiting Professor at The Yeshiva University and Stern College for 1996- 97 and Scholar in

Residence and Executive Director of the Board on Environmental Studies and Toxicology at the U.S. National Research Council, of the National Academy of Science, 1983-93.

Dr. Davis holds a B.S. in physiological psychology and a M.A. in sociology from the University of Pittsburgh. She completed a Ph.D. in science studies at the University of Chicago, as a Danforth Foundation Graduate Fellow and a M.P.H. in epidemiology at the Johns Hopkins University, as a Senior National Cancer Institute Post-Doctoral Fellow.

She has also authored more than 170 publications.

What Dr. Davis has to say about cancer and cell phones should be listened to although it is predictable HC will not listen.

"Cell phones transform and save lives... Then think of Ronald Regan and George Bush Sr.'s political adviser Lee Atwater, General Electric's Jack Welch, Dan Case, the high empowered brother or AOL founder Steve Case, Calgary business leader Clark H. Smith, writer Bebe Moore Campbell and other heavy users of the first generation of cell phones when they were first introduced. Each of these brain cancer cases spent hours with some of the early cell phones next to their skulls... The problems posed by cell phones in the real world are like huge simultaneous equations...

When it comes to sorting through the risks of cell phones, we have lately been assured that there are none based upon reports from what appear to be independent scientific reviewers. For example, researchers from the Danish Cancer Society reported in the *Journal of the National Cancer Institute* in 2006 that they found no evidence of risk in persons who had used cell phones. Headlines around the world boasted of this latest finding from an impeccable source published in a first tier scientific journal...

But let's look at what the researchers actually studied.

They reviewed health records through 2002 of about 421,000 people who had first signed up for private use of cell phones between 1982 and 1995. A "cell phone user" in the study was anyone who made a single phone call a week for six months during the period 1981 to 1995. The study kicked out anyone who was part of a business that used cell phones, including only those who had used a cell phone for personal purposes for eight years.

This research design raises a lot of questions. Why did they not look at business users – those with far more frequent use of cell phones? Why lump all users together, putting those who might have made a single phone call a week with those who used the phones more often?

Why stop collecting information on brain tumors in 2002 when we know that brain tumors often take decades to develop and be diagnosed?

When you are looking at a large population to find an effect, generally the more people you study, the better your chance of finding something. But if you merge a large number of people with very limited exposure together with a small number of people with very high exposure, you dilute the high-exposure group and so lower your chances of finding any effect at all. It would be better to compare the frequent users with non-users, omitting the limited users altogether. Lumping all these various users together is like looking all over a city for a stolen car when you know it's in a five-block radius. Perhaps you'll find what you're looking for, but the chances are greater that you won't... The Danish study was designed to look definitely thorough – 421,000 people! – but in fact it was biased against positive findings from the start. Given how broadly cell signals now penetrate coffee shops, airports, and some downtown areas of major cities, it is very difficult to find any truly unexposed groups against which to compare results. Because cell phone use has grown so fast and its technologies change every year, it is as if we are trying to study the car in which we are driving.

Another study that was published in 2000 found no increased risk in most types of brain cancer in cell phone users; but the average length of use among participants was less than three years. Still, the study found that those people who had used phones for even this short period of time had twice the risk of a very rare brain tumor – neuroepitheliomatous cancers, the kind that wraps itself around the nerve cells of the lining of the brain, right at the locus that cell signals can reach.

Of course, epidemiologic research is the research that works best when we have solid information on the nature of the use or exposure we are trying to understand. All of us have cell phone bills that provide detailed records of our use, and most of these can be accessed online. These were not used in the study, nor in any study of the industry to date. A gold mine of data lies untapped that could enable researchers to distinguish non-users from low frequency users from high frequency users, thereby increasing the validity and sensitivity of the studies.

Underlying this whole body of research is clear evidence that cell phone signals penetrate the brain. As the Danish researchers admitted in their own study, "During operation, the antenna of a cellular telephone emits radio frequency electromagnetic fields that can penetrate..."

The studies to date that have not found a general, clear and consistent risk from cell phones need to be understood as tentative. They have for the most part looked at older technologies over short periods of exposure. None is asking about the impact on of cell phones on the brains of children and teenagers – one of the fastest growing groups of users in the

world today. The governments of England, Israel and Sweden advise that those persons under eighteen should not use cell phones at all. American toddlers learn to play with toy versions of them.

What makes this especially troubling are the results from several other studies that have looked at more recent regular users. After a decade of heavy use, cell phone users have double the risk of brain cancer. The tumors tend to occur on the side of the head that the user favors.

Another, entirely different set of data on electromagnetic fields, exposures of which cell phone signals are but one type, come from looking at an illness even more extraordinarily rare than brain cancer – breast cancer in men. The total number of cases of male breast cancer in the United States today is thought to be less than 4,000 but some 1,400 new cases are reported each year, according to the American Cancer Society. Studies of men who work with electromagnetic fields in radio and television or in assembling cell towers have found that they have a much greater risk of breast cancer as well as cancer of the brain.

Men typically don't get breast cancer, and when they do, the disease is often much more difficult to treat... that for many professions involving work with electronics, men have between two and four times more breast cancer than those without such experiences...

Much of the research funding is provided by the telecommunications industry just as much of the research funding on more general electromagnetic field research was provided by the electric power industry. It may not surprise you to learn that the highly publicized Danish study that exonerated cell phones and the yet to be completed IARC study are directly funded by the industry."

54) Exactly how many more voices will it take to make Safety Code 6 more humane? This is not rhetorical.

John Updike wrote, "It is impossible for a man to understand something if his income depends on not understanding it." Public microwave exposure levels tolerated by Health/Industry Canada are a national health disaster. Yet, for pragmatic and lucrative reasons, federal exposure limits have been deliberately set so high that no matter how much additional wireless radiation is added to the national burden, it will always be "within standards". SC6 is outdated, lacking in modern EMR studies, does not adequately take into account low level radiation nor the long term effects of radiation exposure. SC6 fails to protect Canadians adequately by lacking a precautionary principal and in light of certain recent studies and court cases may even be considered lacking due diligence. SC6 discriminates against those with EHS, a recognized disability. SC6 does not protect Canadians' health and contributes to their ill health at significant cost to the health care system. On September 5, 2000 the court ruled that HC's civil servants and scientists are responsible to the Canadian people, and that politicians cannot shut them up when it suits them or their corporate friends.

55) Are whistleblowers like Dr. Chopra discouraged in the Consumer and Clinical Radiation Protection Bureau of Canada?

Again I would ask for a yes/no or percentage answer to the following question.

56) "Are the residents in the vicinity of the Union Street Water Tower Cell Tower in Simcoe, Ontario as safe today as they were before the cell tower was enabled?"

I submit the attached petition to have the responsible government agents answer for SC6's failings.

Sincerely,

[1] Bio Initiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF) 2007

[2] Analysis of Health and Environmental Effects of Proposed San Francisco Earthlink Wi-Fi Network, Magda Havis, B. Sc., Ph.D, Environmental & Resource Studies, Trent University.

[3] Microwave News, http://www.mastsanity.org/index.php?option=com_content&task=view&id=168&Itemid=1

Minister of Health and the Minister
for the Federal Economic Development
Initiative for Northern Ontario



Ministre de la Santé et Ministre de
l'Initiative fédérale du développement
économique dans le Nord de l'Ontario

Ottawa, Canada K1A 0K9

1415/08



Dear

This is in response to your environmental petition no. 235 of January 3, 2008, addressed to Mr. Ronald Thompson, the Interim Commissioner of the Environment and Sustainable Development (CESD).

In your petition you raised concerns about cellular telephone antennas and towers.

I am pleased to provide you with the enclosed Health Canada response to your petition. I understand that the Minister of Industry will be responding separately to the questions which come under the purview of his department.

I appreciate your interest in this important matter, and I hope that you will find this information useful.

Yours sincerely,

Tony Clement

Enclosure

c.c. Mr. Ronald C. Thompson, Interim CESD
The Honourable Jim Prentice, P.C., M.P.

Canada

HC Response to Environmental Petition no. 235
Cellular Antenna on Water Tower, Simcoe, Ontario.

Note: Italicized text is excerpted directly from Petition no. 235

Q1. Who is responsible for the health of individuals affected by proximity to a cell tower?

Q2. Considering the health concerns of the community with the vicinity of the Simcoe cell tower, would HC provide continuous health monitoring of nearby citizens?

A1,2. Individuals are primarily responsible for their own health in consultation with their family physician. If conditions arise that indicate a potential community health issue, then the local public health unit (PHU) should/would be called in by the physician. The PHU would proceed as it deems appropriate.

When asked if it is safe to live within 300 metres of a cell tower, Mr. Bradley replied, "In all risk assessment scenarios, one looks to establish levels that are hazardous or dangerous as these are relatively easily determined. One first chooses an adverse health outcome for which a known mechanism of interaction of the hazardous agent exists and then a determination of the level of exposure that will cause the outcome is made. The final step is to set exposure limits that will be protective against these particular adverse health outcomes. In subsequent monitoring and review of the emerging science around the hazard under consideration, one strives to confirm or modify as necessary these previously determined levels. This is, in simple terms, the approach taken in establishing the levels indicated in the current standard for exposure limits for wireless communication devices. In the specific issue at hand, the exposure limits for radiation fields arising from wireless communication towers have been determined in the manner outlined above taking into consideration the collective body of peer-reviewed science. No adverse health outcomes that have an accepted causal relationship to exposure to the electric and magnetic fields produced by the towers have been identified for exposures at or below the limits set out in SC6."

Q3. I do not consider Mr. Bradley's response an adequate answer and would simplify the question by rephrasing, "Are the residents in the vicinity of the Union Street Cell Tower in Simcoe, Ontario as safe today as they were before the cell tower was enabled?"

A3: Mr. Bradley's response reflects Health Canada's position that there is to date no convincing scientific evidence to support the occurrence of adverse health

health effects at levels below the exposure limits specified in Health Canada's Safety Code 6. This conclusion is based upon the bulk of scientific evidence from animal, in-vitro cellular and epidemiological studies that have been carried out worldwide, including at our laboratory. There is no convincing evidence of increased risk of disease from exposure to radiofrequency (RF) electromagnetic fields from cell towers.

According to the SC6 document posted on the government website, it has not been updated since 1999. Given the very recent explosion in popularity of cell phones, wireless internet, and other such devices, it is probably not an exaggeration to estimate that we are now being exposed to levels of electromagnetic radiation at levels thousands of times higher than we were in 1999.

Q4a: Why has SC6 not been updated since 1999? If it has not been updated, why not?

Q4b: If it has been updated does it include any of the above findings?

A4a&b: Although the current version of Safety Code 6 was published in 1999, Health Canada scientists have continued to carry out internally funded studies on RF fields and to review the scientific literature on an ongoing basis either as participants in standards setting bodies, as academic or as peer reviewers for publications. Based on information to date and the weight-of-evidence from this ongoing scientific review, the exposure limits specified in Safety Code 6 remain current and valid.

Q5a: I ask Industry Canada (IC) and HC if such a tower is safe from a physics, electrical,.. .point of view?

Q5b: Would such a tower meet IEEE standards?

Q5c: Is it grounded properly?

Q5d: Who has verified the grounding?

Q5e: What part do metal objects play in the reflection of microwaves?

Q5f: Why does SC6 warn against large metal objects and then place a microwave on a large metal object?

Q5g: What is the appropriate SC6 signage for such a structure?

Q5h: Is this tower properly signed?

Q5i: What is the appropriate SC6 fencing for such a structure?

Q5j: Has such fencing been installed?

Q5k: What part does flowing water play in the reflection of microwaves?

A 5a-k. These questions deal with the compliance of the installation with respect to Industry Canada's regulatory responsibility. Health Canada has no specific knowledge of this particular site and can not respond to these questions.

Residents in Bayview, Long Island, NY. have gone to the Supreme Court over a cell tower located near a park and school. Four Bayville Primary School children have been diagnosed with leukemia or brain tumors; three of the children have since died. In addition, six teachers and several school aids have been diagnosed with serious cancer. Four of the adults have subsequently died.

Dr. Andrew Goldsworthy, Biological Sciences, writes, "Being exposed to chronic irradiation from a cell tower is not a good idea anyway, but to put the antennas on water towers is particularly bad because of the risk of electromagnetic contamination of the water. Treating water with weak pulsed electromagnetic radiation is the basis of many commercial "electronic water conditioners," which are now widely used to remove and prevent lime scale in plumbing.

But it also has biological effects. Brief exposure of the water to such fields (as when it flows through a conditioner) and supplying it to yeast, plants and farm animals can, stimulate their growth. However, when we tested exposures of more than about a minute (as it might be in a water storage tank with an antenna attached), we found that it inhibited the growth of yeast and was arguably harmful (See Goldsworthy et al. 1999 "Biological effects of physically conditioned water". Water Research 33 (7) 1618-1626).

The mechanism of the conditioning effect is controversial, but it appears to depend on the presence of colloidal impurities, and not all water supplies are equally affected. Its biological effect is probably because it removes structurally-important calcium ions from cell membranes in much the same way as it removes lime scale from plumbing. This would then make them leak and affect metabolism in the same way as direct exposure to electromagnetic fields (See <http://tinyurl.com/28Lo82>).

In so much as water treated with pulsed electromagnetic radiation can have unusual and sometimes harmful biological effects, there should be a moratorium on placing cell phone antennas on water tanks until electromagnetically treated water has received full FDA approval,"

Q6a: Is HC aware of Dr. Goldsworthy's work?

Q6b. Why is his work not included in SC6?

A6a & b: Health Canada scientists are aware of Dr. Goldsworthy's work on electromagnetically treated water, where normal tap water is exposed to pulsed magnetic fields in the 1 – 100 kHz frequency range. HC considers all credible, peer-reviewed scientific studies and scientific evidence. A weight of evidence approach is employed to formulate Risk Management/Risk Assessment decisions.

Whereas Safety Code 6 is 8 years old and in dire need of being updated, the BioInitiative Report (2007) is a very recent document compiled by an international working group of scientists, researchers and public health policy professionals. The document presents serious scientific concerns about current limits that regulate exposure to EMFs from power lines, cell phones, and many other sources. The excerpt below gives an excellent overview of the current problem:

"You cannot see it, taste it or smell it, but it is one of the most pervasive environmental exposures in industrialized countries today. Electromagnetic radiation (EMR) or electromagnetic fields (EMFs) are the terms that broadly describe exposures created by the vast array of wired and wireless technologies that have altered the landscape of our lives in countless beneficial ways. However, these technologies were designed to maximize energy efficiency and convenience; not with biological effects on people in mind. Based on new studies, there is growing evidence among scientists and the public about possible health risks associated with these technologies.

Human beings are bioelectrical systems. Our hearts and brains are regulated by internal bioelectrical signals. Environmental exposures to artificial EMFs can interact with fundamental biological processes in the human body. In some cases, this can cause discomfort and disease. Since World War II, the background level of EMF from electrical sources has risen exponentially, most recently by the soaring popularity of wireless technologies such as cell phones (two billion and counting in 2006), cordless phones, WI-FI and WI-MAX networks. Several decades of international scientific research confirm that EMFs are biologically active in animals and in humans, which could have major public health consequences.

Today's public exposure limits for telecommunications are based on the presumption that heating of tissue (for RF) or induced electric currents in the body (for ELF) are the only concerns when living organisms are exposed to RF. These exposures can create tissue heating that is well known to be harmful in even very short-term doses. As such, thermal limits do serve a purpose. For example, for people whose occupations require them to work around radar facilities or RF heat-sealers, or for people who install and service wireless antenna tower, thermally-based limits are necessary to prevent damage from heating (or, in the case of power-frequency ELF from induced current flow in tissues).

In the past, scientists and engineers developed exposure standards for electromagnetic radiation based on what we now believe are faulty assumptions that the right way to measure how much non-ionizing energy humans can tolerate (how much exposure) without harm is to measure only the heating of tissue (RF) or induced currents in the body (ELF).

In the last few decades, it has been established beyond any reasonable doubt that bioeffects and some adverse health effects occur at far lower levels of RF and ELF exposure where no heating (or induced currents) occurs at all; some effects are shown to occur at several hundred thousand times below the existing public safety limits where heating is an impossibility." [1]

Q7a. Does the CCRPB agree with the above statements?

Q7b. What In particular causes the disagreement and how can the disagreement be proved 100%, with no doubts?

A7a&b: From the perspective of Health Canada scientists, the BioInitiative Report summarizes the majority of the evidence for non-thermal adverse health effects, but either briefly mentions or ignores the far greater number of scientific studies which do not support these hypotheses. This report is at odds with the evaluation of the scientific literature conducted by the Royal Society of Canada (www.rsc.ca), the International Commission on Non-Ionizing Radiation Protection (www.icnirp.org/pubEMF.htm) and the World Health Organization (www.who.int/mediacentre/factsheets/fs304/en/index.html). As such, the BioInitiative report represents a minority opinion among scientists in this subject area and health claims in this report should also be interpreted cautiously.

That there is disagreement among scientists studying the same phenomenon is not unusual. This is why in the context of standard setting, scientific consensus or the majority opinion is important, especially where the absence of any effect cannot be proven. In the case of adverse health effects at levels below the standards, the scales are tipping towards the absence of effects. One must consider that as scientific methods become more sophisticated, certain effects may be identified in the future. However, regulators must work with the information currently available.

Speaking earlier this year in San Francisco, Dr. M Havas said, "The Federal Communications Commission (FCC) (22) Guideline is similar to the international guideline ICNIRP guideline (15) and is based on short-term thermal effects. This guideline is based on the assumption that if microwave energy does not heat tissue it is not harmful. This assumption is incorrect. Adverse biological effects have

been documented at levels below federal guidelines and there ...are no federal guidelines for non-thermal effects, nor are there guidelines for long-term exposure. The technological developments and uses of wireless devices are running well ahead of the policy decisions necessary to ensure their safety..."

According to Norbert Hankin, Chief EMF Scientist, U.S. Environmental Protection Agency: "The U. S. Federal Communications Commission, (FCC's) exposure guidelines are considered protective of effects arising from a thermal mechanism but not from all possible mechanisms. Therefore, the generalization by many that the guidelines protect human beings from harm by any or all mechanisms is not justified." (<http://www.protectschools.org/epa%20letter.pdf>)

Organizations that set safety standards such as ANSI/IEEE or ICNIRP are quick to point out that "safe" radio frequency exposure rests on the fact that exposure is too weak to produce a rise in body temperature, or a "thermal" effect. Whether non-thermal effects occur is no longer the issue, the issue is at what level do these non-thermal effects occur and what are the safe levels of long-term exposure." [2]

Q8a. Does SC6 take into account non-thermal effects and long term exposure?

A8a: Yes, Safety Code 6 takes into account all possible biological and/or health effects of radiofrequency (RF) fields, including non-thermal effects and/or long term effects.

Q8b. What are the studies to back this claim?

A8b: Health effect studies on RF fields have been conducted for over 50 years. Over this time, a great deal of scientific information has been obtained regarding the health impacts of RF field exposures. There are literally thousands of research studies and many of them have evaluated long-term exposures in experimental animals, while others have investigated the possibility of possible non-thermal effects. There are too many studies to list here, but a searchable compendium of such studies is available at the WHO International EMF Project website (www.who.int/peh-emf/research/database/en/index.html). Other sources include reviews (see below for some examples). It is important to point out that all international science-based exposure standards are based on the same scientific literature.

Krewski D, Glickman BW, Habash RW, Habbick B, Lotz WG, Mandeville R, Prato FS, Salem T, Weaver DF. Recent advances in research on radiofrequency fields and health: 2001-2003. *J Toxicol Environ Health B Crit Rev.* 10:287-318 (2007).

Valberg PA, van Deventer TE, Repacholi MH. Workgroup report: base stations and wireless networks-radiofrequency (RF) exposures and health consequences. *Environ Health Perspect.* 115:416-424 (2007).

Moulder JE, Foster KR, Erdreich LS, McNamee JP. Mobile phones, mobile phone base stations and cancer: a review. *Int J Radiat Biol.* 81:189-203 (2005).

Vijayalaxmi, Obe G. Controversial cytogenetic observations in mammalian somatic cells exposed to radiofrequency radiation. *Radiat Res.* 162:481-496 (2004).

Ahlbom A, Green A, Kheifets L, Savitz D, Swerdlow A; ICNIRP (International Commission for Non-Ionizing Radiation Protection) Standing Committee on Epidemiology. Epidemiology of health effects of radiofrequency exposure. *Environ Health Perspect.* 112:1741-1754 (2004).

Canada is subject to guidelines enforced by Industry Canada but generated by HC under the document SC6. There are only 3 sentences referencing biological effects in the whole document. It references biological effects thus: "Biological effects of RF fields at levels too low to produce significant heating have also been reviewed (3,6). These effects are not well established, nor are their implications for human health sufficiently well understood. Thus, they cannot provide a basis for making recommendation towards the restriction of human exposures to such low-intensity RF fields."

Q9. In a document as important to the safety of Canadians as SC6, why are there only 3 sentences referring to biological effects? How in the light of all the studies can it be said, "These effects are not well established, nor are their implications for human health sufficiently understood?"

Their references 3 and 6 are as follows:

3) World Health Organization. Environmental Health Criteria 137: Electromagnetic Fields (300 Hz - 300 GHz), 1993 (Available from: WHO, Geneva, or Canadian Public Health Association, Ottawa, Ontario)

6) M.H. Repacholi. Low-Level Exposure to Radiofrequency Fields: Health Effects and Research Needs. Bioelectromagnetics, Vol. 19, pp. 1-19, 1998.

A9: Please see answer to Question 17a.

Q10. With the biological effects of radiation so important, how can a document as important as SC6 have only two references to biological effects?

A10: Please see answer to Question 17a.

Note the first reference is dated 1993 and both involve Dr. Michael Repacholi. In the first study he was chairman of the study while at the Royal Adelaide Hospital, the second study while heading the Project into EMFs by the WHO. He was also emeritus chairman of ICNIRP, the body charged with setting "safe" International Exposure limits.

While leading the WHO EMF project Repacholi funnelled industry donated money through the Royal Adelaide Hospital to the WHO. Seven years ago, Norm Sandler, a Motorola spokesman said, "This is the process for all supporters of the WHO program," At the time Motorola was sending \$50,000 each year and the Mobile Manufacturers Forum gave the project \$150,000 a year. (Microwave News)

A WHO Progress Report lists its funding as follows: Income: \$249,682 Governments, \$529,820 others, for a total USD of \$779,502. If the "Others" listed above were sourced from the Royal Adelaide Hospital (industry), then only less than 1/3 of the WHO EMF funding came from Governments around the world." (Microwave News)

Despite the UK Health Protection Agency's own advice that children under 16 should use mobile phones and other wireless equipment as little as possible because they are more prone to harm from them, Dr. Repacholi promoted wireless/microwave emitting devices to children at the Handheld Learning Conference, 10-12 October, 2007 in London, England.

Q11a) Mr. Repacholi was chairman of the Royal Adelaide Hospital studies, WHO studies, and chairman emeritus of ICNIRP. He has had great Influence on world-wide standards for EMFs. Mr. Repacholi has ties to Industry. Did Mr. Repacholi at any time work for HC?

Q11b) What was his position?

A11a&b: Dr. Repacholi joined the Department of National Health and Welfare (DNHW) on February 2, 1971 as a Technical Officer, X-Ray Safety in the Health Protection Branch (HPB). He became the Head, Lasers, Microwaves and Ultrasonics September 15, 1975, still in the HPB. He terminated his employment with DNHW on February 15, 1983.

Q11c. What influence did he have in the creation of SC6?

A11c: Dr. Repacholi was a co-author of the first version of Safety Code 6, which was published in 1979. However, he had no involvement in its subsequent updates.

In a correspondence Mr. Bradley, director of the Consumer and Clinical Radiation Bureau of Canada (CCRPB), HC, wrote, "SC6 limits are based on both thermal and non-thermal effects. For frequencies from 3 kHz to 100 kHz, the biological endpoint on which the limits are based is nerve and muscle stimulation. Although these are acute effects, they are non-thermal in nature. At higher frequencies, non-thermal effects have not been convincingly demonstrated. Thus, they have not been accepted by either this Bureau or other international bodies such as ICNIRP and IEEE to be used as a basis for setting exposure limits. SC6 is protective of the identified non-thermal effect indicated above."

Q12a. Are there frequencies below 3 kHz? What happens biologically at frequencies below 3 kHz?

A12a: The electromagnetic spectrum spans frequencies from the sub-hertz to the thousands of gigahertz (GHz). For frequencies commonly used by wireless technologies and lower, there is a continuum of interactions between matter and electromagnetic energy. Effects such as muscle and nerve stimulation which occur at 3-100 kilohertz (kHz) also occur at lower frequencies, albeit with higher field thresholds required for the occurrence of such effects.

Q12b. Exactly how is SC6 protective of non-thermal effects?

A12b: For frequencies from 3 kHz to 100 kHz, the biological endpoint on which the Safety Code 6 limits are based is nerve and muscle stimulation. Although these are acute effects, they are non-thermal in nature. At higher frequencies, non-thermal effects other than nerve and muscle stimulation have not been convincingly demonstrated. Thus, they have not been accepted by Health Canada or international bodies such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the Institute of Electrical and Electronics Engineers (IEEE) to be used as a basis for setting exposure limits. Safety Code 6 is protective of the identified non-thermal effect indicated above.

He also says, "In addition, the biological tests that have been used in our examination of non-thermal effects are standard toxicological assays that are used throughout the scientific world for examining the effects of a multitude of environmental toxins. They are used primarily to detect damage to the genetic material in cells exposed to toxic agents. Before each test is applied, it is checked for sensitivity against agents such as a known dose of x-rays, which has a clearly defined and quantifiable effect on the genetic material in the cells. In this way, it is assured that the tests are able to detect any damage to the cells caused by electromagnetic radiation," And, "To date, experimental and epidemiological studies throughout the world have failed to provide clear support for a causal

relationship between electromagnetic fields and complaints. The experimental studies strongly suggest that EHS symptoms are not related to actual exposures to electric or magnetic fields, and that electromagnetically hypersensitive individuals are no better than non-hypersensitive individuals in detecting the presence of EMF. EHS has no clear diagnostic criteria and there is no scientific basis to link electromagnetic hypersensitivity symptoms to EMF exposure.

At this time, neither HC nor the WHO recognize that symptoms attributed to EHS from low-level RF fields (as located around cell towers) are causally related to RF field exposure."

Q13a. I ask HC to name 3 such studies.

A13a: 1) Rubin GJ, Munshi JD, Wessely S. Electromagnetic Hypersensitivity: A systematic review of provocation studies. *Psychosomatic Medicine* 67:224-232 (2005).

2) Rubin GJ, Hahn G, Everitt BS, Cleare AJ, Wessely S. Are some people sensitive to mobile phone signals? Within participants double blind randomised provocation study. *BMJ* 332:886-891 (2006)

3) Rubin GJ, Cleare AJ, Wessely S. Psychological factors associated with self-reported sensitivity to mobile phones. *J Psychosom Res* 64:1-9 (2008)

4) Eltiti S, Wallace D, Ridgewell A, Zougkou K, Russo R, Sepulveda F, Mirshekar-Syahkal D, Rasor P, Deeble R, Fox E. Does short-term exposure to mobile phone base station signals increase symptoms in individuals who report sensitivity to electromagnetic fields? A double-blind randomized provocation study. *Environ Health Perspect*. 115:1603-1608 (2007).

Q13b. What part did industry play in these studies?

Q13c. What was the background of the scientists running the study? Did any of them have a background in EHS?

Q13d. Did any of the scientists suffer and therefore understand EHS?

Q13e. Why would anyone with EHS put themselves through the pain of a study?

Q13f. Were EHS sufferers consulted on the design of the study?

Q13g. Most importantly, how many EHS dropped out of the study? How did these drop-outs influence the results of the study?

A13 b-g: These questions refer to specific papers not authored by Health Canada scientists. As the questions do not deal with study results, it is neither appropriate

questions directly with the various authors indicated in the response to Question 13a.

In the report, "Electrohypersensitivity (EHS) in the Netherlands – A Questionnaire survey" by Hugo Schooneveld and Juliette Kuiper of the Dutch Electrohypersensitivity (EHS) Foundation, December 2007, they state "Some persons have become electrosensitive and respond to some specific EMFs in their environment and show some of the possible health effects induced by their personal stress system... One of the main problems is that many people with EHS symptoms have no idea which type of EMF -if any- is specifically annoying to him or her. This is caused by the length of time usually elapsing between EMF exposure and health effect: several hours is not unusual (Schooneveld and Arends-Zimmermann, 2006). One simply does not see the connection... The point never contemplated so far is that EHS is a problem of the individual, not of a group. We all tend to expect the classical picture of an illness: much like measles would make the skin of children appear reddish, and influenza would elevate body temperature, we expect a similar marker for EHS. An obvious marker apparently does not exist so far and we should perhaps stop looking for physically recognizable signs of EHS... There have been quite a few studies in which EMF sensitive and non-sensitive volunteers were exposed to high-frequency EMFs, signals mimicking those of GSM or UMTS transmitters. The question was whether EHS people could demonstrate -under controlled conditions- that they could 'feel' whether the transmitter was 'on' or 'off'... The outcome was mostly negative and authors like Rubin et al. (2006) and others conclude that there was no evidence for an EMF-feeling talent. The present data show that the situation is more complex: not all EHS people will react to high-frequency EMFs. In future experiments, more attention should be paid to the specific conditions under which EHS can be demonstrated by individual volunteers... Therefore, it seems essential that volunteers participating in such studies should be selected with care and questioned in detail about their personal experiences. Exposure conditions should be adjusted to those individual preferences."

Q14. Were the above characteristics of EHS sufferers taken into account in the EHS studies cited by Mr. Bradley?

A14: Mr. Bradley wasn't citing any specific study or studies, but rather the EHS literature in general. Health Canada cannot speak on behalf of the authors of the above quoted studies. For more information, you may wish to contact the authors directly.

Of the references used in Safety Code 6, 29 are from the 1990's, 14 from the 1980's and 6 pre 1980. There are no references beyond the year 2000 when Canada experienced an explosion of cell tower construction. Of the references in Magda Havas' paper, 17 are dated between 2000-2004, 20 in the 1990's and 3 are from between 1988-89.

Q17a. Why are there so few studies referenced in SC6?

A9,10&17a: Safety Code 6 was written as a technical guidance document which outlined maximal human exposure limits for RF fields and included information regarding how to evaluate the intensity of RF fields. This document was never intended as a scientific review of the current state of biological evidence of RF field bio-effects. As such, an extensive list of bio-effects literature was not deemed warranted in this document. However, HC scientists have written reviews on the current state of evidence for possible health effects from EMF (See below).

Moulder JE, Foster KR, Erdreich LS, McNamee JP. Mobile phones, mobile phone base stations and cancer: a review. *Int J Radiat Biol.* 81:189-203 (2005).

McNamee JP and Bellier PV. Cytogenetic and Carcinogenetic Effects of Exposure to Radiofrequency Radiation In: "Chromosomal alterations: Importance in Human Health". Vijayalaxmi and G. Obe (Editors), Springer-Verlag, Heidelberg, Germany (ISBN:9783540714132) (2007).

Based on Health Canada scientists' extensive review and ongoing surveillance of the health effects literature related to RF fields, it is still Health Canada's position that there is no credible evidence of adverse health effects below the limits outlined in Safety Code 6. While it can be acknowledged that there are some 'outlier' studies, when applying a weight-of-evidence approach there is an overwhelming lack of scientific evidence of adverse effects below the limits outlined in Safety Code 6.

Q17b. When is the next published update?

A17b: Health Canada maintains a number of Safety Codes that are reviewed and updated on an ongoing basis. CCRPB staff continuously monitor the health effects research literature pertinent to the Codes as well as performing in-house research in order to maintain the currency and validity of each code. If valid scientific evidence were to present itself indicating that the exposure limits in any one of the Safety Codes were in need of revision, steps would be taken to initiate a review.

The following studies are not referenced in SC6

1) Santini et al. (2002). *A study of the health of people living in the vicinity of mobile phone base stations. Pathologie Biologies, 50, 369-373 Investigation on the health of people living near mobile telephone relay stations: Incidence according to distance and sex.*

A survey study, using questionnaire was conducted in 530 people (270 men, 260 women) living or not in the vicinity of cellular phone base stations, on 18 Non Specific Health Symptoms. Comparisons of complaints frequencies (CHI-SQUARE test with Yates correction) in relation with distance from base station and sex, show significant ($p < 0.05$) increase as compared to people living > 300 m or not exposed to base station, till 300 m for tiredness, 200 m for headache, sleep disturbance, discomfort, etc. 100 m for irritability, depression, loss of memory, dizziness, libido decrease, etc. Women significantly more often than men ($p < 0.05$) complained of headache, nausea, loss of appetite, sleep disturbance, depression, discomfort and visual perturbations. This first study on symptoms experienced by people living in vicinity of base stations shows that, In view of radioprotection, minimal distance of people from cellular phone base stations should not be < 300 m.

2) Naila Study, Germany (November 2004) - [see <http://www.tetrawatch.net/papers/najla.pdf>], *The influence of being physically near to a cell phone transmission mast on the incidences of cancer. The result of the study shows that the proportion of newly developing cancer cases was significantly higher among those patients who had lived during the past ten years at a distance of up to 400 metres from the cellular transmitter site, which has been in operation since 1993, compared to those patients living further away, and that the patients fell ill on average 8 years earlier. In the years 1999-2004, i.e. after five years' operation of the transmitting installation, the relative risk of getting cancer had trebled for the residents of the area in the proximity of the installation compared to the inhabitants of Naila outside the area.*

3) Ecolog, 2000, T-Mobile\Ecolog Institute -*Mobile Communications and health; review of current scientific research in view of precautionary health. This review of over 220 peer-reviewed and published papers found strong indications for the cancer-initiating and cancer-promoting effects of high frequency electromagnetic fields used by mobile telephone technology. Experiments on cell cultures at power flux densities much lower than the guidelines, yielded strong indications for genotoxic effects of these fields, like single and double stranded DNA breaks and damage to chromosomes. The findings that high frequency electromagnetic fields influence cell transformation, cell growth promotion and cell communication also point on a carcinogenic potential of the fields used for mobile telephony. The study also found teratogenic effects (birth deformities) and loss of fertility in animal studies. Moreover,*

disruptions of other cellular processes, like the synthesis of proteins and the control of cell functions by enzymes, have been demonstrated.

4) BioInitiative Report, Aug, 2007 - An international working group of scientists, researchers and public health policy professionals (The BioInitiative Working Group) released a report on electromagnetic fields (EMF) and health. They document serious scientific concerns about current limits regulating how much EMF is allowable from power lines, cell phones, and many other sources of EMF exposure in daily life. The report concludes the existing standards for public safety are inadequate to protect public health.

Q18. When will these studies be reflected in SC6?

A18: The Santini and Naila studies as well as all of the studies reviewed in the BioInitiative and Ecolog reports have been reviewed by Health Canada scientific staff either as participants in standard-setting bodies and international scientific meetings, as academic or peer reviewers for publications or as part of a continuous program of literature surveillance in support of Safety Code 6. When it is determined that a revision of Safety Code 6 is required, these studies will form part of the weight-of-evidence evaluation of the current state of the science and appropriate revisions to the code will be made as deemed necessary.

According to Robert Bradley, "SC6 limits are based on non-thermal effects. For frequencies from 3 kHz to 100 kHz, the biological endpoint on which the limits are based is nerve and muscle stimulation. Although these are acute effects, they are non-thermal in nature. At higher frequencies, non-thermal effects have not been convincingly demonstrated. Thus, they have not been accepted by either this Bureau or other international bodies such as ICNIRP and IEEE to be used as a basis for setting exposure limits. SC6 is protective of the identified non-thermal effect indicated above."

Q19. How does HC reconcile Mr. Bradley's words with the above studies?

A19: A weight-of-evidence approach is employed when assessing the possible health risks of RF fields. This takes into account both the quantity of studies on a particular endpoint (whether adverse or no effect), but also the quality of those studies. Poorly conducted studies (e.g. incomplete dosimetry or inadequate control samples) receive relatively little weight while properly conducted studies (e.g. all controls included, appropriate statistics, complete dosimetry) will receive more weight. There are numerous concerns with the studies referenced above; therefore, these studies have little weight in the risk assessment process.

Mr. Bradley makes the claim that studies are considered as long as they are "referenced in the context of peer-reviewed publications.

Q20a. Why are the studies listed in the above ignored?

Q20b. They are all valid studies, and they all show biological effects at levels many, many times below Safety Code 6. I would like an explanation as to why the studies listed above have not played a role in informing HC's policies?

A20a, A20b: HC considers all credible, peer-reviewed scientific studies and scientific evidence. A weight-of-evidence approach is employed to formulate Risk Management/Risk Assessment decisions.

Of the studies referenced in SC6, all before 2000, there are no acknowledgements of EHS symptoms relating to EMR. Regarding EHS, Dr. Havas writes, "Symptoms of EHS include: cognitive dysfunction (memory, concentration, problem-solving); balance, dizziness & vertigo; facial flushing, skin rash; chest pressure, rapid heart rate; depression, anxiety, irritability, frustration, temper; fatigue, sleep disruptions; body aches, headaches; ringing in the ear (tinnitus) and are consistent with chronic fatigue and fibromyalgia. 'Electro hypersensitivity (EHS) is now recognized by the World Health Organization (WHO) and is defined as: "...a phenomenon where individuals experience adverse health effects while using or being in the vicinity of devices emanating electric, magnetic, or electromagnetic fields (EMFs). ..Whatever its cause, EHS is a real and sometimes a debilitating problem for the affected persons, while the level of EMF in their neighborhood is no greater than is encountered in normal living environments. Their exposures are generally several orders of magnitude under the limits in internationally accepted standards.'

EHS is classified as a disability in Sweden and health care facilities with low exposure to electromagnetic fields and radio frequency radiation are available for sensitive individuals. Approximately 2% (more probably 3%) of the population has severe symptoms of EHS. These people are unable to live in our modern society with its electrical and electronic appliances and with the increasing exposure to radio frequency radiation. Another 35% of the population has moderate symptoms represented by an impaired immune system and by chronic illness."

Q 21. On what basis can SC6 ignore these facts?

A21: Scientific investigations have been unable to consistently link the onset of the symptoms described above to exposure to EMFs. Provocation studies have failed to show that EHS sufferers are able to detect the presence of the exposure field any better than by pure chance. More telling is that intentional sham exposures have been shown to elicit similar symptoms in EHS sufferers. Additionally, clinical

reviews have suggested that the single most effective clinical treatment of EHS is Cognitive Behavioural Therapy.

Safety Code 6 is based on reviews of all relevant studies on a weight-of-evidence basis. As highlighted above, current scientific consensus is that EHS is not caused by exposure to low-level EMFs. There is no question that the symptoms experienced by EHS sufferers are real and in some cases debilitating. However, given the weight-of-evidence against causality of EHS to EMF exposure, it would be scientifically unjustifiable to adjust the exposure limits in Safety Code 6 based upon unsubstantiated claims of such a linkage.

Q22. What is the cost to the Canadian health care system of EHS? Why are there no statistics on the cost to the Canadian health care system of EHS?

A22: Health Canada's Consumer and Clinical Radiation Protection Bureau does not collect this information on electro-hypersensitivity (EHS), therefore it does not have any statistics on this topic.

I have neighbours within 300 metres of a cell tower who are not in the 2% of the highly sensitive and they visit their doctors concerning cognitive dysfunction (memory, concentration, problem-solving); balance, dizziness & vertigo; facial flushing, skin rash; chest pressure, rapid heart rate; depression, anxiety, irritability, frustration, temper; fatigue, poor sleep; body aches, headaches; ringing in the ear (tinnitus) and are consistent with chronic fatigue and fibromyalgia.

Q23. Why are there no HC initiatives to recognize EHS? What is HC doing to inform the general public and physicians of EHS?

A23: To date, numerous scientific studies have failed to demonstrate any association between claims of EHS and electromagnetic field (EMF) exposure. In provocation studies where subjects were intentionally exposed, the bulk of the individuals were unable to detect whether EMFs were present or not, or showed symptoms which did not correlate with their exposure condition.

A large number of studies in the field of exposure to EMFs have been conducted in recent years. A comprehensive review of EHS studies was recently published (Rubin et al. 2005) and is available on the World Health Organisation Website (WHO) website: www.who.int). According to this review, there is no convincing scientific evidence to suggest EHS symptoms can be triggered or made worse as a result of exposure to EMFs.

At the present time, there exist only a limited number of studies looking at treatments for EHS (since it is still an unsubstantiated condition). However, according to a recent systematic review of 9 clinical studies (Rubin et al., 2006), cognitive behavioural therapy treatments have had some success in alleviating concerns of patients towards exposure to low intensity EMFs. The current evidence indicates that other treatments for EHS such as shielding, supplementary oxidant therapy and acupuncture have yielded no significant success in treating EHS.

In view of the above information, it is the opinion of Health Canada that EHS is not caused by exposure to EMFs and, therefore, recognition of EHS along with its implied causality to EMFs runs counter to Health Canada's science-based approach for exposure limit setting. Nevertheless, Health Canada has informed the general public on EHS through a joint web publication with Industry Canada (<http://www.strategis.ic.gc.ca/epic/site/smt-gst.nsf/en/sf08792e.html>). This information is readily accessible to physicians.

Q24. I have talked to CCRPB's scientists and they pooh-pooh these studies. They can cite opposing views, and yet by conceding the existence of opposing views, is it not logical to conclude that doubt exists in the science?

A24: It is true that there are some 'outlier' reports and some scientists which express a 'minority' opinion with respect to the safety of low-level RF field exposures. However, it is important to point out that the vast majority of studies and scientists in this field do not consider low-level RF field exposures (e.g. levels below the limits outlined in Safety Code 6) to cause any adverse health effects. There are numerous scientific reviews on this issue by independent scientists and by government institutions around the world which share this scientific consensus (see below).

Krewski D, Glickman BW, Habash RW, Habbick B, Lotz WG, Mandeville R, Prato FS, Salem T, Weaver DF. Recent advances in research on radiofrequency fields and health: 2001-2003. *J Toxicol Environ Health B Crit Rev.* 10:287-318 (2007).

Valberg PA, van Deventer TE, Repacholi MH. Workgroup report: base stations and wireless networks-radiofrequency (RF) exposures and health consequences. *Environ Health Perspect.* 115:416-424 (2007).

Moulder JE, Foster KR, Erdreich LS, McNamee JP. Mobile phones, mobile phone base stations and cancer: a review. *Int J Radiat Biol.* 81:189-203 (2005).

Vijayalaxmi, Obe G. Controversial cytogenetic observations in mammalian somatic cells exposed to radiofrequency radiation. *Radiat Res.* 162:481-496 (2004).

Ahlbom A, Green A, Kheifets L, Savitz D, Swerdlow A; ICNIRP (International Commission for Non-Ionizing Radiation Protection) Standing Committee on Epidemiology. Epidemiology of health effects of radiofrequency exposure. *Environ Health Perspect.* 112:1741-1754 (2004).

WHO Fact Sheet on RF fields:

www.who.int/mediacentre/factsheets/fs304/en/index.html

WHO Fact Sheet on EHS:

www.who.int/mediacentre/factsheets/fs296/en/index.html

Royal Society of Canada:

www.rsc.ca//index.php?lang_id=1&page_id=120

It is because of this doubt I reference the precautionary principle.

The precautionary principle is a moral and political principle which states that if an action or policy might cause severe or irreversible harm to the public, in the absence of a scientific consensus that harm would not ensue, the burden of proof falls on those who would advocate taking the action. As taken from the Canadian government pamphlet on the precautionary principle -

http://www.ec.gc.ca/econom/pamphlet_e.htm, "The precautionary approach recognizes that the absence of full scientific certainty shall not be used as a reason to postpone decisions where there is a risk of serious or irreversible harm. Even though scientific information may be inconclusive, decisions have to be made to meet society's expectations that risks be addressed and living standards maintained;"

Q25 (duplicate number). Was the precautionary principle used in the formulation of SC6?

A25 (duplicate number): 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. As indicated previously, Safety Code 6 is based upon a review of all relevant scientific studies utilizing a weight-of-evidence basis.

The Vorsorgeprinzip, or "foresight principle, only emerged as a specific policy tool during the German debates on the possible role of air pollution as a cause of "forest death" in the 1970-80s. However, John Graham, one of Bush's science policy advisors, and trenchant critic of the precautionary principle, has noted that:

"Precaution, whether or not described as a formal principle, has served mankind well in the past and the history of public health instructs us to keep the spirit of precaution alive and Well" (Graham 2002).

Graham might have been thinking of the cholera episode of 1854 when precaution did indeed serve the people of London well. Dr. John Snow, a London physician, used the spirit of precaution to advise banning access to the polluted water of the Broad St. pump which he suspected was the cause of the cholera outbreak. He based his recommendation on the evidence he had been accumulating for some years including his study of S. London populations served by both piped and well water. Snow's views on cholera causation were not shared by The Royal College of Physicians who considered Snow's thesis and rejected it as 'untenable' as they and other "authorities" of the day believed that cholera was caused by airborne contamination. It took 30 years of further scientific inquiry. Such a long time lag between acknowledging compelling associations and understanding their mechanisms of action is a common feature of scientific inquiry, as the histories of TBT, PCBs, DES, the Great lakes pollution, beef hormones and the other cases in the EEA report illustrate.

The Broad St. pump, TBT, DES, PCBs and Great lakes Pollution examples described here also serve to illustrate the contingent nature of knowledge. Today's scientific certainties can be tomorrow's mistakes, and today's research can both reduce and increase scientific uncertainties, as the boundaries of the "known" and the unknown expand. Waiting for the results of more research before taking action to reduce threatening exposures may not only take decades but the new knowledge may identify previously unknown sources of both uncertainty and ignorance, as awareness of what we do not know expands, thereby supplying further reasons for inaction. "Paralysis by Analysis" can then follow. "The more we know, the more we realize what we don't know, is not an uncommon scientific experience. Socrates observed some time ago: "I am the wisest man alive, for I know one thing, and that is that I know nothing" (Plato's Apology 1.21).

Some measures that could help limit the consequences of ignorance and the impacts of surprises are:

using intrinsic properties as generic predictors for unknown but possible impacts e.g. the persistence, bioaccumulation and spatial range potential of chemical substances. (Stroebe et al., 2004)

Q27a) Does HC use intrinsic properties as generic predictors for unknown but possible impacts e.g. the persistence, bioaccumulation and spatial range potential of chemical substances when formulating SC6?

A27a: Safety Code 6 is based on reviews of all relevant EMF bio-effect studies utilizing a weight-of-evidence basis, and not using intrinsic properties as generic predictors for unknown but possible impacts.

Q27b. Does HC reduce specific exposures to potentially harmful agents on the basis of credible 'early warnings' of initial harmful impacts, thus limiting the size of any other 'surprise' impacts from the same agent, such as the asbestos cancers that followed asbestosis; and the PCB neurotoxicological effects that followed its wildlife impacts when formulating SC6?

A27b: This question is not relevant to the formulation of Safety Code 6, which is based on reviews of all relevant EMF bio-effect studies utilizing a weight-of-evidence basis.

Q27c. Does HC promote a diversity of robust and adaptable technological and social options to meet needs, which limits technological 'monopolies' (such as those like asbestos, CFCs, PCBs etc.), and therefore reduces the scale of any 'surprise' from anyone technological option when formulating SC6?

A27c: This question is not relevant to the formulation of Safety Code 6, which is based on reviews of all relevant EMF bio-effect studies utilizing a weight-of-evidence basis.

Q27d. Does HC use more long-term research and monitoring of what appear to be "surprise sensitive sentinels", such as frogs and fetuses when formulating SC6?

A27d: This question is not relevant to the formulation of Safety Code 6, which is based on reviews of all relevant EMF bio-effect research, either short-term or long-term, utilizing a weight-of-evidence basis.

The distinction between prevention and precaution is also important. Preventing hazards from "known" risks is relatively easy and does not require precaution.

Banning smoking, or asbestos, today requires only acts of prevention to avoid the well-known risks. However, it would have needed precaution, (or foresight, based on a sufficiency of evidence), to have justified acts to avoid exposure to the then

uncertain hazards of asbestos in the 1930s -50s, or of tobacco smoke in the 1960's). Such precautionary acts then, if implemented successfully, would have saved many more lives in Europe than today's bans on asbestos and smoking are doing. As Cogliano has recently pointed out, the difference between prevention and precaution can be further illustrated by showing that prevention is used to justify the restriction of exposure to an IARC Category 1 carcinogen whereas precaution is necessary to justify restricting exposure to a Category 2A or B carcinogen, where the evidence is less strong.[1]

Q28a. How is foresight used to formulate SC6?

A28a: Please see answer to Question 28c.

Q28b. Does the existing strength of evidence justify precautionary actions now?

A28b: Please see answer to Question 28c.

Q28c. Or will exposure reduction be delayed until the evidence is clear enough to justify the more belated and overall less protective prevention of "known" causes, so that EMF replicates the fate of asbestos, smoking and most of the other cases in the EEA report?

A28a-c: Given that health effects of EMFs have been studied for more than 50 years and most studies have reported no adverse health effects at exposure levels below international safety limits, any measures to reduce exposure should be voluntary and be on a low-cost or no-cost basis. Given the weight of evidence against low level effects, adjusting Safety Code 6 limits is not warranted.

The key to understanding the added value of the PP requires a) acknowledging the distinction between prevention and precaution described above; b) an appreciation of the further distinctions between the primary, secondary and tertiary preventative measures that have long been adopted in public health, and the prior justification for any such measure, which the PP brings; and c) a recognition of the increased legitimacy and transparency that arises from the articulation and adoption of the PP in legal texts, international agreements and conventions, as opposed to being merely part of general practice.

More empirically, the evidence that many scientific disciplines, legal scholars (de Sadeleer, 2007), and international policymakers, have, since the 1970s, recognized the need for legitimizing the PP as a new policy tool that is better able to deal with

systems complexities, ignorance and uncertainties, suggests that the PP brings added value to the protection of the environment and the public.

There is much discussion generated by the different meanings often attached to the common terms "prevention", "precaution", "risk", "uncertainty" and "ignorance". There are some relatively rare but successful acts of "precautionary prevention" in the EEA report such as on cholera in 1854, on TBT in France in the 1980s, and on CFCs in the 1970s. Together with the many other examples of the failure to use the precautionary principle in the other case studies (EEA, 2001), these illustrate the wisdom of taking appropriate precautionary actions to avoid plausible and serious threats to health or environments, especially when the impacts are irreversible and likely to be much more costly to society than the precautionary measures. [1]

Q29. The failure to use the precautionary principle in the other case studies (EEA, 2001), these illustrate the wisdom of taking appropriate precautionary actions to avoid plausible and serious threats to health or environments, especially when the impacts are irreversible and likely to be much more costly to society than the precautionary measures. When it comes to EMR Is there wisdom to change SC6 to reflect new information?

A29: Please see the answer to questions 28a-c.

The increasing awareness of complexity and uncertainty during the 1980/90's led to the German debates on the Vorsorgeprinzip shifting to the international level, initially in the field of conservation (World Charter for Nature UN 1982), but then particularly in marine pollution, where an overload of data accompanied an insufficiency of knowledge. (Marine Pollution Bulletin, 1997) This generated the need to act with precaution to reduce the large amounts of chemical pollution entering the North Sea.

Since then many international treaties have included the PP (including the often cited version from the Third North Sea Ministerial Conference, 1990) reference to the precautionary principle, or, as they refer to it in the USA, the precautionary approach.

The N. Sea declaration called for "action to avoid potentially damaging impacts of substances, even where there is no scientific evidence to prove a causal link between emissions and effects".

This definition has often, and sometimes mischievously, been used to deride the precautionary principle by claims that it appears to justify action even when there

is "no scientific evidence" that associates exposures with effects. However, the N. Sea Conference definition clearly links the words "no scientific evidence" with the words "to prove a causal link", We have already seen with the Broad St. pump and TBT examples that there is a significant difference between evidence about an "association" and evidence that is robust enough to establish a "causal" link. (Hill, 1965). [1]

Q30a. Would the CCRPB scientists agree with this statement?

Q30b. If not, specifically why not?

Q30c. If yes, specifically what parts of the statement do they agree with?

A 30 a-c. These questions seek the opinion of CCRPB scientists on policy development which is not an area that these scientists cover in their position.

Q30d. Does SC6 take into account the foreseeable, or plausible, countervailing (secondary) costs of otherwise genuine precautionary attempts to protect the environment and health?

A30d. Safety Code 6 (SC6) was written as a technical guidance document which outlined maximal human exposure limits for RF fields and included information regarding how to evaluate the intensity of RF fields. As such, it does not address costs to protect the environment and health. Cost decisions are the responsibility of the individual organizations applying the Code.

Q31a. Is there enough evidence to establish a causal link between EMR and cell damage?

A31a: There is no convincing evidence that RF fields cause cell damage, provided the exposures do not exceed the limits outlined in Safety Code 6.

Q31b. "Where there is uncertainty as to the existence or extent of risks to human health, the institutions may take protective measures without having to wait until the reality and seriousness of those risks become fully apparent" (Christoforou, 2002). Would the CCRPB agree with this statement? Would the CCRPB take this into account when formulating SC6?

A31b: Yes. Health Canada endorses the precautionary principle. However, precautionary measures related to RF fields from cellular base stations should be voluntary and based on low-cost/no-cost actions, since typical emissions are already thousands of times below the limits specified in Safety Code 6. The evidence of adverse health effects at RF exposure levels below these limits is virtually non-existent.

Q31c. How are developing children taken into account in SC6?

A31c: The exposure limits for the general public, as specified in Safety Code 6, were designed to take into account individuals of all ages of varying health status (which include susceptible groups or individuals such as children, pregnant women and the aged) who are unaware of potential risks.

Q31d. EHS is irreversible, is this irreversibility taken into account in SC6? If SC6 does not protect from citizens developing EHS, IS HC legally liable? Would scientists who have suppressed this information be legally liable? Would they be fired?

A31d: Whether EHS is irreversible or not, current scientific consensus is that it is not correlated with EMF exposure. There is no question that the symptoms experienced by EHS individuals are real and in some cases debilitating. However, the majority of studies indicate that EHS individuals cannot detect EMF exposure any more accurately than non-EHS individuals.

Q31e. Is the goal of SC6 to protect public health, consumer safety and the safety of the environment? Is the consumer given a high, medium or low "balance of evidence of probability" when formulating SC6 guidelines?

A31e: Safety Code 6 was originally intended as a safety guideline to protect human health in federally controlled workplaces. The limits outlined in Safety Code 6 have since been adopted by numerous federal and provincial governments in areas related to public health and labour. As such, the limits outlined in Safety Code 6 are being used to protect public health and consumer safety. Safety Code 6 does not relate to environmental protection. The safety of the Canadian public is always the most important consideration for all Health Canada guidelines and regulations.

Q31f. Is it possible to use different levels of proof when formulating SC6?

A31f. It is not clear what is meant by "different levels of proof". HC considers all credible, peer-reviewed scientific studies and scientific evidence. A weight of evidence approach is employed to formulate Risk Management/Risk Assessment decisions.

Q31g. How robust, and over what periods of time does the evidence on the absence of harm have to be before concluding that a restricted substance or activity is without significant risk?

A31g: It is impossible to prove the absence of risk/harm because one is restricted by what one currently knows. In the case of RF exposure, health effects research on RF fields has been ongoing for over 50 years and there are thousands of published studies. In this instance, scientists have looked both long and hard and this leads to their conclusion that there are no adverse effects below the safety limits recommended by science-based RF exposure standards, including Safety Code 6. As such, there is a great weight-of-evidence that RF field intensities below the exposure limits specified in Safety Code 6 are not harmful.

Q31h. Why is the bias within SC6 towards avoiding "false positives", thereby generating more "false negatives", and the dominance within decision-making of short-term, specific, economic and political interests over the longer term, diffuse, and overall welfare interests of society?

A31h: HC disagrees that there is a bias towards avoiding false-positives. In the risk assessment process, all data are treated equally and all peer-reviewed research studies are considered within a weight-of-evidence risk assessment approach. The health of Canadians is the only consideration for the design and implementation of Safety Code 6.

Q31i. Are HC conducting any long term studies on EMR and young children? If not. Why not?

A31i: Health Canada has no scientific reason to consider that radiofrequency (RF) electromagnetic radiation (EMR) causes adverse health effects to either adults or children, provided exposures are within the limits specified in Safety Code 6. Our conclusion is based upon the bulk of scientific evidence from animal, in-vitro and epidemiological studies that have been carried out worldwide, including at our laboratory.

Health Canada is not conducting any studies specifically with respect to young children and EMR. However, the ability of RF energy to cause DNA or chromosomal damage and affect gene expression in human-derived cell cultures has been assessed. A number of studies have been conducted at RF energy levels many times above and below the exposure limits specified in Safety Code 6. No effect from RF exposure was observed. The findings of HC studies have contributed to the assessment of health risks for both children and adults from RF exposure.

Research on possible health effects from exposure to weak RF fields, such as those from cellular base stations, is deemed to be of low priority by the World Health Organization, since studies of health risks (e.g. cancer risk) related to such

exposure are unlikely to be feasible and informative because of the difficulty of reconstructing adequately long-term historical exposures.

Mr. Bradley, July 13, 2007 wrote, "To date, experimental and epidemiological studies throughout the world have failed to provide clear support for a causal relationship between electromagnetic fields and complaints."

Bradford Hill established nine criteria for helping to move from association to causation in environmental health which have been, and still are, widely used in debates on issues such as EMF. Two of the apparently more robust of the "criteria" may not be so robust in the context of multi-causality, complexity and gene/host variability. For example, "consistency" of study findings is not always to be expected. As Prof. Needleman, who provided the first of what could be called the second generation of early warnings on lead in petrol in 1979 has observed: It follows that the presence of consistency of results between studies on the same hazard can provide robust evidence for a causal link, but the absence of such consistency may not provide very robust evidence for the absence of a real association. In other words, the "criterion" of consistency is asymmetrical, like most of the other Bradford Hill "criteria", [1]

Q32a: Are every decision of HC based on causality?

Q32b: What determines how causality is used in HC's decision making?

A 32 a-b. For Health Canada decisions on health and safety, the departmental standard used is the "Decision-Making Framework for Identifying, Assessing, and Managing Health Risks - August 1, 2000". Within the area of risk assessment, the topic of causality is included. The framework and guidance documents for this departmental standard are intended to provide a common, general basis for risk management decision-making throughout the Department. This document is found at: http://www.hc-sc.gc.ca/ahc-asc/pubs/hpfb-dgpsa/risk-risques_tc-tm_e.html

Q33c. Why are HC decisions on EMR pinned to causality when the absence of consistency may not provide very robust evidence for the absence of association?

A33c: Health Canada risk assessment decisions are based on a weight-of-evidence approach. Lack of evidence of causality, biological plausibility and reproducibility greatly weakens the support for the hypothesis of adverse health effects below the limits outlined in Safety Code 6. The existence of some studies with opposing results (when compared to the larger volume of studies which did not observe these effects) in itself does not constitute a situation where the weight-of-evidence can be considered controversial, contradictory or equivocal. There are always

contradictory results and/or opinions on virtually every test substance or activity. This is precisely the reason why a weight-of-evidence approach is employed.

Similarly, the criterion of "temporality", which says that the putative cause X of harm Y must come before Y appears, is robust in a simple, uni-causal world. In a multi-causal, complex world of common biological end points that have several chains of causation this may not necessarily be so. For example, falling sperm counts can have multiple, co-causal factors, some of which may have been effective at increasing the incidence of the biological end point in question in advance of the stressors in focus, thereby confusing the analysis of temporality. The resulting overall sperm count trends could then be rising, falling or static, depending on the combined direction and strengths of the co-causal factors and the time lags of their impacts. It follows that say, chlorine chemicals, may or may not be co-causal factors in falling sperm counts: but the use of the "temporality" argument by the WHO, who observed that sperm counts began to fall before chlorine chemistry production took off, does not provide robust evidence that they are not causally involved. [1]

Q34a. If people living near cell towers are becoming ill, if HC cannot guarantee their health, if HC does not test for non thermal effects at cell tower sites, then how can they use causality as an excuse to do nothing?

A34a: In the case of low-level RF fields (e.g. from cell towers), health effects research has been ongoing for over two decades and there are hundreds of published studies. In this instance, scientists have done extensive work and this adds to their conclusion that there are no adverse effects below the safety limits recommended by science-based RF exposure standards, including Safety Code 6.

Q34b. Does HC allow risk managers to provide risk assessors with guidance on the science policy to apply in their risk assessments of SC6?

A34b: Yes.

Q34c. Does HC do risk analysis? Has a risk analysis been done on SC6? Is HC willing to wait 30-100 years to view the consequences of their actions regarding EMR?

A34c: Health Canada uses a weight-of-evidence approach for risk analysis and this approach was applied with respect to the limits outlined in Safety Code 6. Since it is impossible to predict the future or rule out the possibility of a subtle unknown risk, regulators must make risk management decisions based upon historical knowledge. There is a large body of scientific evidence concerning the possible

health effects of RF fields, which encompasses thousands of studies conducted over the past 50 years. This constitutes a very significant knowledge base upon which to anchor the current health risk assessment of RF fields for application in Safety Code 6. If new, credible knowledge becomes available which suggests that exposures to RF fields at levels below the limits specified in Safety Code 6 are unsafe, then Safety Code 6 will be revised to reflect such new knowledge.

Q34d. It appears it is the INFORMATION conveyed by electromagnetic radiation (rather than heat) that causes biological changes -some of these biological changes may lead to loss of well-being, disease and even death. Is this HC's position? If not, why not?

A34d: If by the term "information" is intended to mean amplitude or pulse modulation of the radiofrequency (RF) carrier by a much lower frequency signal, then this statement is not supported by the bulk of the RF bioeffects literature.

Biological studies are generally carried out with either CW (continuous wave or no modulation) or pulsed RF waveforms (with pulse-like envelope) or both. While it is true that some of the studies utilizing pulsed RF waveforms have reported finding effects, so have some studies utilizing CW waveforms. In either case, these studies are in a minority of the considerable number of studies using pulsed RF or CW or both that found no effect. The hypothesis that it is the "information" in the radiation that causes the effect has not withstood the test of scientific rigour in terms of consistency and reproducibility.

An additional factor that makes such a hypothesis less relevant to exposures from cell towers is that cellular base station antennae emit signals from a large number of users simultaneously. Even if a single user's signal is pulse-like, the resulting envelope from the combined signals for all users is somewhat noise-like in that the envelope variations appear to have random amplitude characteristics. This can be observed in Figure 4 of the HC report "Report on: Measurement of Cellular Base-station Emissions Using a Newly Developed RF Field Mapping System" which can be viewed at:

http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/cell_base_stations/index_e.html

It would point to that fact that when considering signals from cellular base stations, the "information" is unintelligible (except to a cellular phone). It is similar to the example of the difficulty in trying to pick out a single person's voice in a large room filled with people where every-one is speaking simultaneously. The resulting cacophony is noise-like and unintelligible.

In summary, it is the opinion of Health Canada scientists that there is no credible scientific basis for the hypothesis that biological organisms react differently to a

specific modulation or signal envelopes, than to a noise or sinusoidal signal at the same frequency.

Q34e. There may be no lower limit at which exposures do not affect us. Until we know if there is a lower limit below which bioeffects and adverse health impacts do not occur, is it unwise from a public health perspective to continue "business-as-usual" deploying new technologies that increase ELF and RF exposures, particularly involuntary exposures?

A34e: The concept of a zero threshold or "no lower limit" may be applicable to ionizing forms of radiation, but is unlikely for non-ionizing radiation. All living systems generate biological and electrical noise (electrical noise is inherent to all matter that exists at a temperature above absolute zero). It is probable that at some level, the internally induced voltages and currents caused by RF exposure will be so far below the endogenous (biologically generated) noise that thermal or non-thermal effects are precluded. So far the science has not satisfactorily demonstrated a threshold for non-thermal effects below existing limits leaving only the well supported thresholds for thermal effects upon which are based most science-based standards.

Health effects studies on RF fields have been ongoing for over 50 years. To date, there is no convincing scientific evidence of adverse health effects from exposure to RF fields at levels below the limits outlined in Safety Code 6. If new, credible knowledge becomes available which suggests that exposures to RF fields below the limits in Safety Code 6 are unsafe, then Safety Code 6 will be revised to reflect such new knowledge.

A WHO definition states that: "(A)nnoyance or discomforts caused by EMF exposure may not be pathological per se, but, if substantiated, can affect the physical and mental well-being of a person and the resultant effect may be considered as an adverse health effect. A health effect is thus defined as a biological effect that is detrimental to health or well-being. According to the WHO Constitution, health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." www.who.int/peh-emf [1]

Q35. Mr. Bradley states that "At this time, neither HC nor the WHO recognize that symptoms attributed to EHS from low-level RF fields (as located around cell towers) are causally related to RF field exposure." When Mr. Bradley refers to WHO does he take the above into account?

A35: It is HC's understanding that the quoted statement was taken from the WHO document entitled "Framework for Developing Health-based EMF Standards"

(www.who.int/peh-emf/standards/framework/en). This Framework provides advice on how to develop science-based limits that will protect the health of the population from exposure to electromagnetic fields. The WHO statement above points out that the annoyances and discomforts are not based on actual exposure but rather by the perception of the person that the exposure will be harmful. This is what is meant by the phrase "*may not be pathological per se*".

Health Canada's guideline development procedures are in line with the guiding principles outlined in the WHO Framework. Also, Mr. Bradley's statement quoted above is consistent with the WHO's finding that "The majority of studies indicate that EHS individuals cannot detect EMF exposure any more accurately than non-EHS individuals. Well controlled and conducted double-blind studies have shown that symptoms were not correlated with EMF exposure."

(www.who.int/mediacentre/factsheets/fs296/en/index.html)

Environmental Issue Report Number 29 from the World Health Organization (2002) cautions about the effects of radiofrequency radiation on children's health. As part of a publication on .Children's Health and Environment: A Review of Evidence" the World Health Organization (WHO) wrote:

"The possible adverse health effects in children associated with radiofrequency fields have not been fully investigated."

"Because there are suggestions that RF exposure may be more hazardous for the fetus and child due to their greater susceptibility, prudent avoidance is one approach to keeping children's exposure as low as possible."

"Further research is needed to clarify the potential risks of ELF-EMF and radiofrequency fields for children's health. [1]"

Q36a. Does the HC support cell phone use by children and pregnant mothers?

A36a: There is no scientific evidence that children and pregnant women are more susceptible than other groups of the population to possible adverse health effects from RF field exposures. In regards to cell phone use by children, it is at the parents' discretion to determine if their children should limit their cell phone usage, use a hands-free kit, or restrict usage to an emergency-only basis.

Q36b. When findings prove EMR is a threat to health of children will HC recommend age limits for cell phone use as there are age limits for smoking?

A36b: There has been over 50 years of health effects research on RF field exposures, encompassing thousands of studies. If new, credible knowledge

becomes available which suggests that exposures to RF fields at levels below the limits given in Safety Code 6 are unsafe, then Safety Code 6 will be revised to reflect such new knowledge.

Q36c. Has childhood leukemia increased in Canada with increased use of cell phone technology?

A36c: No. The age-standardized incidence for leukemia for children and youth aged 0-19 years, published in the Canadian Cancer Statistics 2007 (available on the National Cancer Institute of Canada website www.ncic.cancer.ca), has remained relatively stable at 4-5 cases per 100,000 for the time period 1987-2005. This information can be viewed in Figure 12, page 69 of the report.

Q36d. What specifically in SC6 protects children from cancer?

A36d: Health Canada considers all peer-reviewed studies published in credible scientific journals. To date, there is no convincing scientific evidence to conclude that children are more susceptible to adverse health effects from RF fields than adults. As such, it is Health Canada's position that RF fields do not pose a human health risk, provided that the exposure limits in Safety Code 6 are respected. If new, credible knowledge becomes available which suggests that exposures to RF fields at levels below the limits given in Safety Code 6 are unsafe, then Safety Code 6 will be revised to reflect such new knowledge.

The evidence that power lines and other sources of ELF are consistently associated with higher rates of childhood leukemia has resulted in the International Agency for Cancer Research (an arm of the World Health Organization) to classify ELF as a Possible Human Carcinogen (in the Group 2B carcinogen list). Leukemia is the most common type of cancer in children. [1]

Q38a. Is there doubt that exposure to ELF causes childhood leukemia? Could HC explain?

A38a. HC fails to see the linkage of this question to the issue of the cellular antennas on the water tower in Simcoe, Ontario. That said, HC is aware of the issue of childhood leukemia and exposure from power line generated ELF. With respect to this question, there is still doubt regarding the causality of ELF EMFs in relation to childhood leukemia. The finding of weak associations between ELF EMFs and childhood leukemia are observed in some studies but not others. Furthermore, animal and laboratory studies have failed to find any biological mechanism by which these exposures may induce childhood leukemia, thus providing no evidence of biological plausibility. Finally, it must be pointed out that the observed association in some studies only occurs at the highest exposure

groups (>0.4 microtesla) where the number of actual cases is very low. As such, the statistical confidence in the possible association is very weak. Further research is required to delineate this issue.

Q38b. Is it true there is some evidence that other childhood cancers may be related to ELF exposure but not enough studies have been done?

A38b: HC fails to see the linkage of this question to the issue of the cellular antennas on the water tower in Simcoe, Ontario. That said, HC is aware of the issue of childhood leukemia and exposure from power line generated ELF. With respect to this question, while some studies have reported that various forms of adult and childhood cancers may be associated with ELF EMF exposure, other studies have shown contradictory results. More studies are required to fully delineate these possible associations and to refine the relative risks (if any).

Q38c. Children who have leukemia and are in recovery have poorer survival rates if their ELF exposure at home (or where they are recovering) is between 1mG and 2 mG in one/study; over 3 mG in another study. Is this something to be taken into account in SC6?

A38c: (CCRPB portion of answer) HC fails to see the linkage of this question to the issue of the cellular antennas on the water tower in Simcoe, Ontario. That said, HC is aware of the issue of childhood leukemia and exposure from power line generated ELF. The frequencies for ELF EMFs are in the range 0-300 Hz. Safety Code 6 does not set limits for fields below 3 kHz.

With respect to whether studies alluded to should be considered in the risk assessment of ELF EMFs, as stated previously all peer-reviewed scientific studies are taken into account in a weight-of-evidence risk assessment process.

Q39. The consequence of prolonged exposures to children, whose nervous systems continue to develop until late adolescence, is unknown at this time. This could have serious implications to adult health and functioning in society if years of exposure of the young to both ELF and RF result in diminished capacity for thinking, judgment, memory, learning, and control over behaviour. What child studies has HC (not others) initiated to investigate the effects of long-term or prolonged exposure?

A 39. Health Canada has not initiated studies involving children to investigate the effects of long-term or prolonged exposure.

The National Toxicology Program (NTP) is a part of the National Institute for

Environmental Health Sciences, National Institutes for Health. Public and agency comment has been solicited on whether to add radiofrequency radiation to its list of substances to be tested by NTP as carcinogens. In February 2000 the FDA made a recommendation to the NPT urging that RF be tested for carcinogenicity (www.fda.gov.us). The recommendation is based in part on written testimony stating:

"Animal experiments are crucial because meaningful data will not be available from epidemiological studies for many years due to the long latency period between exposure to a carcinogen and the diagnosis of a tumor.

"There is currently insufficient scientific basis for concluding either that wireless communication technologies are safe or that they pose a risk to millions of users."

"FCC radiofrequency radiation guidelines are based on protection from acute injury from thermal effects of RF exposure and may not be protective against any non-thermal effects of chronic exposures."

In March of 2003, the National Toxicology Program issued a Fact Sheet regarding its toxicology and carcinogenicity testing of radiofrequency/microwave radiation. These studies will evaluate radiofrequency radiation in the cellular frequencies.

"The existing exposure guidelines are based on protection from acute injury from thermal effects of RF exposure. Current data are insufficient to draw definitive conclusions concerning the adequacy of these guidelines to be protective against any non-thermal effects of chronic exposures." [1]

Q40. The American National Institute for Environmental Health Sciences - National Toxicology Program is considering going away from the acute, injury from thermals theory and the short term exposure concept. Is HC considering such a move?

A40: The National Toxicology Program (NTP) does not issue exposure guidelines nor regulate the wireless communications industry. It is a program set up to "Provide information about potentially toxic chemicals to health, regulatory, and research agencies, scientific and medical communities, and the public" amongst other objectives (NTP website: <http://ntp.niehs.nih.gov/ntpweb>). They are a sponsoring organization for independent research and assist independent research laboratories with funding for projects following a specific theme or line of investigation. In the case of EMF research, the line of investigation was defined by the statement quoted above "The existing exposure guidelines ... chronic exposures." In other words, the NTP was interested in funding projects looking at non-thermal effects only. Health Canada believes that this is not a denunciation of

existing guidelines but rather a statement that more research could be done in the area of non-thermal effects in order to lessen the uncertainty of their existence or non-existence. This is identical to the position taken by Health Canada which embarked on a series of internally-funded studies of non-thermal effects of RF exposure (specifically the work done on DNA strand breaks and genomics discussed elsewhere in this petition). The outcome of the Health Canada studies was concurrent with the bulk of other non-thermal effects studies in that no consistent evidence for non-thermal effects below international standards was demonstrated.

An Assessment of Non-Lethal Weapons Science and Technology by the Naval Studies Board, Division of Engineering and Physical Sciences (National Academies Press (2002) has produced a report that confirms the existence of non-thermal bioeffects from information transmitted by radiofrequency radiation at low intensities that cannot act by tissue heating.

In this report, the section on Directed-Energy Non-Lethal Weapons it states that:

"The first radiofrequency non-lethal weapons, VMADS, is based on a biophysical susceptibility known empirically for decades. More in-depth health effects studies were launched only after the decision was made to develop that capability as a weapon. The heating action of RF signals is well understood and can be the basis for several additional directed-energy weapons. Leap-ahead non-lethal weapons technologies will probably be based on more subtle human/RF interactions in which the signal information within the RF exposure causes an effect other than simply heating: for example, stun, seizure, startle and decreased spontaneous activity. Recent developments in the technology are leading to ultrawideband, very high peak power and ultrashort signal capabilities, suggesting the phase space to be explored for subtle, yet potentially effective non-thermal biophysical susceptibilities is vast. Advances will require a dedicated effort to identify useful susceptibilities."

This admission by the Naval Studies Board confirms several critical issues with respect to non-thermal or low-intensity RF exposures. First, it confirms the existence of bioeffects from non-thermal exposure levels of RF. Second, it identifies that some of these non-thermal effects can be weaponized with bioeffects that are incontrovertibly adverse to health (stun, seizure, startle, decreased spontaneous activity). Third, it confirms that there has been knowledge for decades about the susceptibility of human beings to non-thermal levels of RF exposure. Fourth, it provides confirmation of the concept that radiofrequency interacts with humans based on the RF information content (signal information) rather than heating, so it can occur at subtle energy levels, not at high levels

associated with tissue heating. Finally, the report indicates that a dedicated scientific research effort is needed to really understand and refine non-thermal RF as a weapon, but it is promising enough for continued federal funding. [1]

Q41. Is HC aware of the above information? If not, why not, considering the health implications for Canadians? If yes, why have they withheld it from Canadians by not factoring it in to SC6?

A41: Health Canada scientists are aware of the report cited above. However, it has not changed their conclusions concerning the evidence for non-thermal effects at intensities below the basic restrictions in most science-based exposure standards, including Safety Code 6. First of all, the report details progress made on millimetre-wave directed energy weapons whose mechanism of operation is entirely thermal. It goes on to speculate in the paragraph quoted above that other mechanisms might be exploited to achieve "stun, seizure, startle and decreased spontaneous activity" through choice of the optimal signal characteristics. These mechanisms are most likely in the realm of well understood interactions such as shock, nerve and muscle stimulation. The intrinsic doses required to bring about these effects are well known in terms of intensities and frequency characteristics and are below thresholds for tissue heating at lower frequencies (below 100 kHz). It is the delivery method which is the major unknown and the subject of the military's interest.

In our opinion, the conclusions in the last paragraph of the preamble above appear to be at odds with the content of the Naval Studies Board assessment. Firstly, that "it confirms the existence of bioeffects from non-thermal exposure levels of RF" is not supported since the mechanism of operation of the VMADS system is entirely thermal in nature. Secondly, that "it confirms that there has been knowledge for decades about the susceptibility of human beings to non-thermal levels of RF exposure" merely reiterates what scientists have been saying all along, that acute effects (nerve and muscle stimulation and even shock) exist at exposure intensities below thresholds for tissue heating at the lower frequencies. Finally, the authors' conclusion that it is the information content and not the intensity of RF that results in adverse effects, may arise due to a misunderstanding of acute effects on the nervous and skeleto-muscular system from lower frequency RF and ELF exposure at intensities above the basic restrictions.

In summary, the information presented in the Naval Studies Board Assessment does not contradict the scientific basis of Safety Code 6. It is a description of the application of high-intensity exposures, resulting in acute effects. The exposure limits specified in Safety Code 6 are designed to protect from such effects. It should be pointed out that Safety Code 6 does not apply to military applications where compliance would have detrimental effects on the Canadian Forces training

and operations. Also, it is highly unlikely that the Canadian public would be exposed to military training and operation environment.

Q42a. People who have used a cell phone for ten years or more have higher rates of malignant brain tumor and acoustic neuromas. It is worse if the cell phone has been used primarily on one side of the head. Does the Canadian government take this information into account when issuing guidelines?

A42a: Health Canada disagrees with the comments above, as stated. There are a couple of small (low case number) epidemiology studies reporting higher rates of brain tumours with long-term use and with laterality of where the phone was held. However, several much larger studies from the WHO INTERPHONE program have failed to replicate these findings. As indicated previously, all peer-reviewed scientific studies are considered in a weight-of-evidence risk assessment process for RF fields.

Q42b. The current standard for exposure to the emissions of cell phones and cordless phones is not safe considering studies reporting long-term brain tumor and acoustic neuroma risks. Is this the position of the Canadian government?

A42b: A number of studies have looked into whether RF fields, such as those from cell phones and cordless phones, can cause cancer initiation and promotion. While there are some reports on the association between RF exposure and cancer, the overwhelming majority of studies have found no evidence that RF fields damage DNA, and thus they are unlikely to be initiators or promoters of carcinogenesis. There is to date no convincing scientific evidence to support the contention of adverse health effects that are speculated to occur at levels below the exposure limits specified in Health Canada's Safety Code 6.

It can no longer be said that the current state of knowledge rules out or precludes risks to human health. The enormous societal costs and impacts on human suffering by not dealing proactively with this issue require substantive public health policy actions; and actions of governmental agencies charged with the protection of public health to act on the basis of the evidence at hand. [1]

Question 42c. In formulating SC 6 Canadian government officials may have ignored relevant studies. In ignoring these studies are the Canadian government scientists negligent? Have they broken any oaths to uphold the safety of Canadians? What process is in place to address negligent Canadian government officials?

A42c: Health Canada uses a weight-of-evidence approach for risk analysis and this approach was applied with respect to the limits outlined in Safety Code 6. This approach includes Health Canada giving due consideration to all relevant studies as well as weighing all scientific evidence according to its quality.

Q43a. Why does HC ignore this current state of knowledge? Is it reasonable to conclude that HC would rather err on the side of Industry?

A43a: HC considers all credible, peer-reviewed scientific studies and scientific evidence. A weight-of-evidence approach is employed to formulate Risk Management/Risk Assessment decisions. The mandate of Health Canada is to maintain and improve the health and well-being of Canadians.

Q43b. Alzheimer's disease is a disease of the nervous system. There is strong evidence that long term exposure to ELF is a risk factor for Alzheimer's disease. Is this correct or does HC ignore this? Are the doctors, scientists, health care professionals, and beauraucrats all willing to let their fellow Canadians submit to such exposure?

A43b: The issue of ELF EMFs is not relevant to the risk assessment process for RF fields, nor to the tower issue in Simcoe, Ontario.

Health Canada disagrees that there is strong evidence for a causal link between long-term ELF EMF exposure and the incidence of Alzheimer's disease. It is Health Canada's position that low-level RF fields and ELF EMFs (such as those experienced in daily life) do not have any adverse health effects, provided Canadian exposure limits are respected.

Cancer risk is related to DNA damage, which alters the genetic blueprint for growth and development. If DNA is damaged (the genes are damaged) there is a risk that these damaged cells will not die. Instead they will continue to reproduce themselves with damaged DNA, and this is one necessary pre-condition for cancer. Reduced DNA repair may also be an important part of this story. When the rate of damage to DNA exceeds the rate at which DNA can be repaired, there is the possibility of retaining mutations and initiating cancer. [1]

Q44a. A person like myself who lives 90% of his time within 300 metres of a cell tower is bombarded by microwaves day after day after day. What are the effects of such close bombardment?

Q44b. Does the bombardment bounce off the skin? Does the bombardment pass through the body? On average how much of the bombardment penetrates the skin? To what depth? Does it dissipate? Does it just sit there?

Does it interact with the body in any way? Does it affect cellular structure? Is the bombardment benign?

A44a&b: At a frequency of 1.9 GHz and depending on the type of tissue, approximately 55% to 60% of the incident power density is reflected from the surface of the body. Of the remaining energy that penetrates into the tissues, 90% is absorbed in the first 2.5 – 4 cm.

This approximate evaluation indicates that energy deposition at cellular frequencies is largely superficial and does not pass completely through the body. Once in the body, the energy that is deposited is dissipated as heat, predominantly through molecular interactions with polar molecules, principally water. Provided that exposures are below the limits outlined in Safety Code 6, the heat is easily accommodated by the body's thermoregulatory system. The scientific evidence that it affects cellular structure is overwhelmingly negative.

Q44c. If there is any penetration of the skin and if there is some doubt whether or not it might be harmful, should the precautionary principle be applied?

A44c: RF fields will penetrate into biological tissue to a depth that is dependent on the field strength, frequency and orientation of the incident RF field. However, there is no convincing scientific evidence that RF field exposures at levels below the limits outlined in Safety Code 6 cause any adverse health effects. Health Canada embraces the precautionary principle. However, it is Health Canada's opinion that precautionary measures related to minimizing RF exposures from cell towers should be voluntary (low-cost/no-cost) since typical exposures from such towers have been found to be thousands of times below the limits specified in Safety Code 6 and there is no convincing scientific evidence of harm from RF exposure at levels below these limits.

Q44d. For a person living 90% of their time within 300 metres of the Simcoe cell tower, how many units of radiation is the person bombarded with per day/per year/per lifetime?

A44d: For non-ionizing radiation at cellular telephone frequencies, the applicable units of radiation are the power density (or the amount of incident power per square centimetre or metre) and the Specific Absorption Rate (SAR) (or the amount of power absorbed in the tissues per gram or kilogram of tissue). Both represent rates of energy flow or deposition. Measures of radiation that are applicable on a per-day or per-year basis include the Specific Absorption (SA) (or the energy absorbed in the tissues in a given time span per gram or kilogram of

tissue) or the whole-body absorbed energy (energy absorbed in the whole body in a given time span).

Measurements of radiofrequency power density were conducted by Industry Canada (IC) at 5 outdoor locations in the vicinity of the Union St. water tower in Simcoe Ontario. Of the five locations, the worst case levels were approximately 5000 times lower than the general public limits specified in Safety Code 6. No information is available on power density measurements in your living spaces, however, the IC data can be used to estimate the amount of the energy absorbed by a person per day (and more likely an overestimate due to several conservative assumptions).

An approximate value for the absorbed power can be obtained by noting that the general public power density limit in Safety Code 6 is designed to induce a whole-body-averaged specific absorption rate (WBA-SAR) of no more than 0.08 watts per kilogram (W/kg). Thus, a power density exposure of 5000 times below Safety Code 6 limits would produce a worst case WBA-SAR of $0.08/5000=0.000016$ W/kg or 16 microwatts per kilogram (μ W/kg). This is a worst case estimate because this value would only result from a precisely determined set of exposure conditions which are not usually met in real life. The actual induced WBA-SAR will be somewhat less. (Safety Code 6 uses the worst case dosimetric conversions for any body size at all frequencies and under the severest geometric constraints of incident field polarization and body orientation).

Whole-body-averaged specific absorption rate can be thought of as the rate of total energy absorbed in the body by the incident field per unit of body weight. Thus, an 80 kg man would absorb 0.000016 (W/kg) \times 80 (kg) = 0.00128 watts, while being exposed to a field 5000 times below the Safety Code 6 limits. A watt is a measure of the rate of energy transfer or is equal to a joule of energy per second. To find out how much energy is absorbed by the same 80 kg man over time, the number of watts is multiplied by the time interval of interest. Since a day is equal to 86400 seconds (s), an 80 kg man would absorb 0.00128 (W) \times 86400 (s) = 111 joules per day while being exposed to a field 5000 times below the Safety Code 6 limits.

This number can be compared, for example, to the number of joules worth of energy that is contained in food. One calorie (nutritional) is equal to 4187 joules so that an 80 kg man exposed to a field 5000 times below Safety Code 6 would absorb $111/4187=0.027$ calories worth of energy in one day. This represents the amount of energy contained in less than one hundredth (0.01) of a gram of sugar or is less than 100 times smaller than the energy in a single potato chip.

The RF energy that is absorbed in the body does not accumulate over time. In comparison to the bodies own basal (resting) metabolic energy (about 8 million

joules per day for an 80 kg person), it is very small and is accommodated by the body's thermoregulatory system. In the case of low-level ionizing radiation, the thing that accumulates over exposure time is the chromosomal damage and not the absorbed energy, which is similarly insignificant compared to the metabolic energy. Since chromosomal damage* and other chronic health effects have not been consistently linked to EMF exposure at levels below standards, it follows that there should be no cumulative effects of living within 300 metres of a cell tower.

* To quote from the BioInitiative Report: "Other than the study by Phillips et al [1998], there is no indication that RFR at levels that one can experience in the vicinity of base stations and RF-transmission towers could cause DNA damage." (BioInitiative Report, section 7, pg 11).

In nearly every living organism, there is a special protection launched by cells when they are under attack from environmental toxins or adverse environmental conditions. This is called a stress response, and what are produced are stress proteins (also known as heat shock proteins).

Plants, animals and bacteria all produce stress proteins to survive environmental stressors like high temperatures, lack of oxygen, heavy metal poisoning, and oxidative stress (a cause of premature aging). We can now add ELF and RF exposures to this list of environmental stressors that cause a physiological stress response. [1]

Q45. Very low-level ELF and RF exposures can cause cells to produce stress proteins, meaning that the cell recognizes ELF and RF exposures as harmful. This is another important way in which scientists have documented that ELF and RF exposures can be harmful, and it happens at levels far below the existing public safety standards. What studies does HC have to refute this statement?

A45: Health Canada scientists have conducted numerous in-house studies over the past 4 years to investigate the ability of RF fields to elicit changes in stress proteins and gene expression in a variety of human-derived cell lines. No evidence of altered stress proteins or gene expression was observed in any of these studies (See below). In addition, a large number of other independent, international laboratories have also failed to replicate these findings.

Chauhan V, Mariampillai A, Kutzner BC, Wilkins RC, Ferrarotto C, Bellier PV, Marro L, Gajda GB, Lemay E, Thansandote A, McNamee JP. Evaluating the biological effects of intermittent 1.9 GHz pulse-modulated radiofrequency

fields in a series of human-derived cell lines. *Radiation Research* 167:87-93 (2006).

Qutob SS, Chauhan V, Bellier P, Yauk C, Douglas G, Williams A, Berndt L, Gajda G, Thansondote A and McNamee JP. Microarray gene expression profiling of a human glioblastoma cell line exposed *in vitro* to 1.9 GHz pulse modulated radiofrequency fields. *Radiation Research* 165:636-644 (2006).

Chauhan V, Mariampillai A, Bellier PV, Qutob SS, Gajda GB, Lemay E, Thansandote A and McNamee JP. Gene expression analysis of a human lymphoblastoma cell line exposed *in vitro* to an intermittent 1.9 GHz pulse-modulated radiofrequency field. *Radiation Research* 165:424-429 (2006).

Chauhan V, Qutob SS, Lui S, Mariampillai A, Bellier PV, Yauk CL, Douglas GR, Williams A, McNamee JP. Analysis of gene expression in two human-derived cell lines exposed *in vitro* to a 1.9 GHz pulse-modulated radiofrequency field. *Proteomics* 7:3896-3905 (2007).

The immune system is another defense we have against invading organisms (viruses, bacteria, and other foreign molecules). It protects us against illness, infectious diseases, and tumor cells.

There are many different kinds of immune cells; each type of cell has a particular purpose, and is launched to defend the body against different kinds of exposures that the body determines might be harmful. [1]

Q46. There is substantial evidence that ELF and RF can cause inflammatory reactions, allergy reactions and change normal immune function at levels allowed by current public safety standards. Oxidative stress through the action of free radical damage to DNA is a plausible biological mechanism for cancer and diseases that involve damage from ELF to the central nervous system. Is HC in agreement with this statement? If not, specifically why not?

A46: There are some reports (not substantial evidence) in the literature concerning these effects; however, many other laboratories have failed to replicate the findings. Health Canada scientists have conducted several of their own in-house research studies on DNA damage to the nervous system of rodents and have also failed to find any evidence of such effects (See below). The lack of independent reproducibility greatly weakens the biological plausibility of this hypothesis.

McNamee JP, Bellier PV, Chauhan V, Gajda GB, Lemay E, Thansandote A. Evaluating DNA damage in rodent brain after acute 60 Hz magnetic-field exposure. *Radiation Research* 164:791-797 (2005).

McLean JR, Thansandote A, McNamee JP, Tryphonas L, Lecuyer D, Gajda G. A 60 Hz magnetic field does not affect the incidence of squamous cell carcinomas in SENCAR mice. *Bioelectromagnetics* 24:75-81 (2003).

McNamee JP, Bellier PV, McLean JR, Marro L, Gajda GB, Thansandote A. DNA damage and apoptosis in the immature mouse cerebellum after acute exposure to a 1 mT, 60 Hz magnetic field. *Mutation Research* 513:121-133 (2002).

McLean JR, Thansandote A, Lecuyer D, Goddard M. The effect of 60-Hz magnetic fields on co-promotion of chemically induced skin tumours on SENCAR mice: a discussion of three studies. *Environ Health Perspect.* 105:94-96 (1997).

Mr. Bradley wrote the following about SC6, "All aspects were reviewed, including possible effects related to cancer. It is important to note that this safety code, and all other codes and guidelines produced by this Bureau, rely on an understanding and assessment of the body of science, not selected studies that support a preconceived conclusion. This is the only approach that is justifiable and defensible in dealing with matters related to health and safety of the Canadian public." [1]

Q47. How can HC defend such a statement in light of the overwhelming contradictory evidence?

A47: The reference to Mr. Bradley's statement is presumably from correspondence with him, and not as a reference to the BioInitiative Report. The quoted statement reflects the customary approach applied by Health Canada and other science-based standards setting bodies such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the Institute of Electrical and Electronics Engineers (IEEE). As previously stated, Health Canada considers all scientific studies whether they are related to thermal or non-thermal effects and short-term or long-term, and whether their outcomes are positive or negative. A weight-of-evidence approach is subsequently employed to formulate risk assessment decisions. The mandate of Health Canada is to maintain and improve the health and well-being of Canadians.

He also wrote, "In addition to these documents, HC staff participated in a specific review of the evidence for a link between EMR and cancer and this document contains more references: Moulder JE, Foster KR, Erdreich LS, McNamee JP. Mobile phones, mobile phone base stations and cancer: a review. *Int J Radiat Biol.* 2005 Mar; 81 (3):189-203) which is available at: <http://www.informaworld.com/smpp/content~content=a714033046~db=all~order=page> "

Q48a. I have read this paper. It was written before both the Wolf & Wolf (2004) study and before the Naila study. What is HC's response to this considering the Naila study is not referenced by HC?

A48a: HC considers all credible, peer-reviewed scientific studies and scientific evidence. A weight-of-evidence approach is employed to formulate Risk Management/Risk Assessment decisions.

Q48b. Are studies being selectively omitted from HC documents because they do not agree with the current administration's theories or objectives?

A48b: No. HC considers all credible, peer-reviewed scientific studies and scientific evidence. A weight of evidence approach is employed to formulate Risk Management/Risk Assessment decisions.

Many people are surprised to learn that certain kinds of EMFs treatments actually can heal. These are medical treatments that use EMFs in specific ways to help in healing bone fractures, to heal wounds to the skin and underlying tissues, to reduce pain and swelling, and for other post surgical needs. Some forms of EMFs exposure are used to treat depression. EMFs have been shown to be effective in treating conditions of disease at energy levels far below current public exposure standards. This leads to the obvious question. How can scientists dispute the harmful effects of EMF exposures while at the same time using forms of EMF treatment that are proven to heal the body? [1]

Q49a. Medical conditions are successfully treated using EMFs at levels below current public safety standards, proving another way that the body recognizes and responds to low-intensity EMF signals. Otherwise, these medical treatments could not work. The FDA has approved EMFs medical treatment devices, so is clearly aware of this paradox. Is HC aware of the paradox? Will HC resolve the paradox?

A49a: In the opinion of Health Canada scientists, there is no paradox. These therapies are conducted using waveforms and field strengths intended to induce

tissue electric field strengths and current densities greater than endogenous ones but, in most cases, below thresholds to cause muscle and nerve stimulation and most certainly below thresholds for tissue heating. In fact, the same healing modalities can be accomplished by other non-radiative means such as capacitively-coupled electrodes and implantable electrodes, neither of which rely upon externally-applied magnetic or electric fields. However, no matter the delivery method, the resulting tissue electric field strengths and current densities for these therapies are almost always greater than those which form the basic restrictions upon which most international exposure standards, including Safety Code 6, base their electric and magnetic field exposure limits.

As a specific example, the therapeutic use of Pulsed Electro Magnetic Fields (PEMFs) are conducted at intensities far below thresholds for tissue heating; however, they utilize relatively low frequencies (usually in the kilohertz range). At these frequencies, the threshold for tissue heating is quite high and exceeds the thresholds for muscle and nerve stimulation which form the underlying basis for most international exposure standards at these frequencies. As an example, one of the most prevalent PEMF therapeutic devices on the market (EBI Bone Healing System®, Biomet, Inc. Warsaw, Indiana) utilizes a pulsed 4 kilohertz (kHz) signal, pulsed at 15 pulses per second with an estimated peak magnetic flux density greater than 1 millitesla and an average flux density greater than 0.1 millitesla. By comparison, the maximum allowable general public magnetic flux density specified in Safety Code 6 at 4 kHz is 0.0028 millitesla.

Similarly, Transcranial Magnetic Stimulation (TMS) therapies produce sufficiently high induced tissue fields and currents that side effects such as transient scalp discomfort or pain are experienced in a small percentage of patients. These side effects are caused by unintentional muscle and nerve stimulation due to excessively intense induced fields and currents in the scalp and underlying musculature. At the frequencies in use by TMS, protection from muscle and nerve stimulation, form the basis for most international exposure standards, including Safety Code 6.

In summary, if the individual technologies are examined in terms of the electromagnetic dose delivered to the target tissues, some of these therapeutic uses of electromagnetic energy represent exposures well in excess of the code limits (where the frequencies correspond).

It should also be noted that therapeutic exposures exceeding Safety Code 6 limits are entirely consistent with the principles in the code, which states that “The exposure criteria in this Code are not intended to apply to deliberate exposure for treatment purposes of patients by, or under the direction of, practitioners in the healing arts.” [Safety Code 6, Preface, page 3].

Q49b. No one would recommend that drugs used in medical treatments and prevention of disease be randomly given to the public, especially to children. Why then do random and involuntary exposures to EMFs occur all the time in daily life?

A49b: The answer comes down to dosage. As mentioned in the answer to Question 49a, the dosages delivered to the target tissues by EMF therapy devices are usually higher than those employed as basic restrictions which form the basis for most international magnetic and electric field exposure standards. The random and involuntary exposures to EMFs experienced in daily life produce dosages below the basic restrictions and in the case of base stations, thousands of times below.

In July, 2007, The Alaska Supreme Court (Court) upheld the decision of the Alaska Workers' Compensation Board (Board) awarding an AT&T equipment installer 100% disability as a result of his workplace electromagnetic field exposure to radiofrequency (RF) radiation at levels slightly above the FCC RF safety limit. The award was based on the psychological and cognitive effects of RF radiation over-exposure. This decision is significant because the FCC RF limit is designed to keep people from being heated and ignores evidence of other adverse biological effects at much lower levels. The RF radiation exposure level in question was well below the FCC's recognized level of "thermal" harm. The FCC contends that there are no scientifically established harmful health effects below the thermal threshold. The Board decision agrees with the medical experts who found adverse health effects from this RF radiation exposure, which occurred above the FCC safety limit but below the thermal threshold. The complete text of Alaska Supreme Court OPINION No. 6139 -July 6, 2007 is found at: www.emrpolicy.org/litigation/case_law/index.htm.

Q50. When I contacted CCRPB on this ruling I was told the subject was overexposed to radiation. However, overexposure is not what the judge used to make his decision. I suggest CCRPB review the judgment more carefully.

A50: HC has reviewed the judgement made by the Alaska Supreme Court which affirmed the Alaska Workers' Compensation Board decision to award an AT&T equipment installer disability and medical benefits. This court case was applicable to an occupational exposure, and not to the exposure of the general public to RF fields.

According to the Canadian Human Rights Commission Policy on Environmental Sensitivities, "Individuals with environmental sensitivities experience a variety of

adverse reactions to environmental agents at concentrations well below those that might affect the 'average person'". This medical condition is a disability and those living with environmental sensitivities are entitled to the protection of the Canadian Human Rights Act, which prohibits discrimination on the basis of disability. The Canadian Human Rights Commission will receive any inquiry and process any complaint from any person who believes that he or she has been discriminated against because of an environmental sensitivity. Like others with a disability, those with environmental sensitivities are required by law to be accommodated. EHS is considered a disability in Canada. The Canadian Human Rights Commission Policy on Environmental Sensitivities accommodates EHS.

Q51. HC maintains Canadians are protected by SC6 but it does not protect Canadians with EHS, therefore the Ministry of Health is in violation of the Canadian Human Rights Commission. Is this statement correct?

A51: Health Canada disagrees with the contention that it is in violation of the Canadian Human Rights Commission. As previously stated, the mandate of Health Canada is to maintain and improve the health and well-being of all Canadians. The exposure limits for the Canadian public, as specified in Safety Code 6, were designed to take into account individuals of all ages of varying health status (which include susceptible groups or individuals such as children, pregnant women and the aged) who are unaware of potential risks. There is no question that the symptoms experienced by EHS individuals are real and in some cases debilitating. However, the majority of studies indicate that these individuals cannot detect EMF exposure any more accurately than non-EHS individuals. Since exposure to EMFs at levels below Safety Code 6 limits has overwhelmingly shown not to be a causal link to EHS conditions, it is fundamentally impossible for Safety Code 6 to protect Canadians who believe they are afflicted with EHS. As such, EHS cannot be taken into account in the development of science-based exposure guidelines such as Safety Code 6.

Recently Europe's top environmental watchdog, the European Environment Agency (EEA), has called for immediate action to reduce exposure to radiation from Wi-Fi, mobile phones and their masts. It suggests that delay could lead to a health crisis similar to those caused by asbestos, smoking and lead in petrol. The warning follows an International scientific review which concluded that safety limits set for the radiation are "thousands of times too lenient", and an official British report which concluded that it could not rule out the development of cancers from using mobile phones.

Q52. Is any such warning proposed by HC?

A52: In the opinion of Health Canada, there is no reason to issue a similar warning since exposures from these sources are below the exposure limits. The limits themselves are considered to be satisfactorily protective based on a weight-of-evidence approach to limit setting.

And the evidence keeps poring in. In a lecture held on 1 October 2007 at the "Open University in Gelsenkirchen, Germany, Prof. Franz Adlkofer presented his research results regarding the effect of UMTS radiation on human cells for the first time. There is no doubt -UMTS is ten times more damaging to genes than GSM radiation. He pointed out that the evidence of DNA strand breaks in conjunction with the formation of micronuclei does not allow any further doubting of the genotoxic effect of UMTS signals. This means that Prof Adlkofer demonstrated for UMTS what he had already demonstrated for GSM in the REFLEX project, which he headed: Mobile phone radiation damages the genetic material and raises the risk of cancer. The European Environment Agency, the highest scientific body within the EU, published a statement on 17 September 2007 in which it ranked the danger potential from mobile radiation and the policies supporting it in one line with Asbestos and PCBs.

And the evidence keeps poring in. Washington, DC, November 16, 2007 -A groundbreaking scientific study published this week in the peer-reviewed "Australasian Journal of Clinical Environmental Medicine" warns that wireless communication technology may be responsible for accelerating the rise in autism among the world's children. (J.AustColl.Nutr.& Env.Med, 2007; Vol.26, No.2 pages 3 -7)

And the evidence keeps pouring in. Recently from the "Indian Express", November 26, 2007, "ICMR Study Confirms Health Risks From Mobile Phones". -Continuous use of cell phones can pose a serious threat to your reproductive health, says a study conducted by the Indian Council of Medical Research (ICMR). The Preliminary results of the study have indicated significant reduction of testicular size, weight and sperm count due to the Radio Frequency Radiation (RFR) emitted from cell phones.

Q53. What are HC's views on these three studies in light of the fact they cast doubt on the protection afforded Canadians by SC6?

A53: Adlkofer/REFLEX - These are a series of in-vitro studies at exposure levels at or near international exposure limits. The results are not robust and are internally inconsistent as evidenced by the failure of some study participants to replicate outcomes reported by other study participants. In the REFLEX authors

own words, the project was designed for generating hypotheses as opposed to a definitive search for proof of causality.

Autism study in the Australasian Journal - This is a clinical study with no relevance to standard setting, no evidence for causality and a lack of experimental controls and exposure data. Authors admit the possibility of a placebo effect.

ICMR Study – Despite the press releases in the Indian press, the results have not been made available in the peer-reviewed open literature. Thus, Health Canada scientists are unable to comment on or appraise the significance of the data.

The tobacco industry, 40 years ago, reacted to the historic Surgeon General's report linking cigarette smoking to cancer and other lung diseases by organizing a disinformation campaign. One of their memos, prepared in the 1960's, was recently uncovered during one of the lawsuits against the tobacco companies on behalf of millions of people who have been killed by their product. It is interesting to read it 40 years later in the context of the intransigence of HC: "Doubt is our product, since it is the best means of competing with the "body of fact" that exists in the mind of the general public. It is also the means of establishing controversy." Brown and Williamson Tobacco Company memo, 1960's.

Q53. [Duplicate number] Is HC stalling the reviewing of SC6 thereby allowing Industry more time to build more towers?

A53: [Duplicate number] If new scientific information carrying sufficient weight were to arise that calls into question the validity of the current limits, a revision would be undertaken as soon as practicable.

Devra Lee Davis, Ph.D., MPH, is author of the recently released book "The Secret History of the War on Cancer. Dr. Davis is Visiting Professor at Carnegie Mellon University's Heinz School as well as Honorary Professor, London's School of Hygiene and Tropical Medicine, and an Expert Advisor to the World Health Organization. President Clinton appointed Dr. Davis to the Chemical Safety and Hazard Investigation Board, (1994-99), an independent executive branch agency that investigates, prevents, and mitigates chemical accidents.

As the former Senior Advisor to the Assistant Secretary for Health in the Department of Health and Human Services, she has counseled leading officials in the United States, United Nations, World Health Organization and World Bank. She was also a Distinguished Visiting Professor at The Yeshiva University and Stern College for 1996- 97 and Scholar in

Residence and Executive Director of the Board on Environmental Studies and Toxicology at the U.S. National Research Council, of the National Academy of Science, 1983-93.

Dr. Davis holds a B.S. in psychology and a M.A. in sociology from the University of Pittsburgh. She completed a Ph.D. In science studies at the University of Chicago, as a Danforth Foundation Graduate Fellow and a M.P.H. in epidemiology at the Johns Hopkins University, as a Senior National Cancer Institute Post-Doctoral Fellow.

She has also authored more than 170 publications.

What Dr. Davis has to say about cancer and cell phones should be listened to although it is predictable HC will not listen.

Cell phones transform and save lives... Then think of Ronald Regan and George Bush Sr.'s political adviser Lee Atwater, General Electric's Jack Welch, Dan Case, the high empowered brother or AOL founder Steve Case. Calgary business leader Clark H. Smith, writer Bebe Moore Campbell and other heavy users of the first generation of cell phones when they were first introduced. Each of these brain cancer cases spent hours with some of the early cell phones next to their skulls... The problems posed by cell phones in the real world are like huge simultaneous equations...

When it comes to sorting through the risks of cell phones, we have lately been assured that there are none based upon reports from what appear to be independent scientific reviewers. For example, researchers from the Danish Cancer Society reported in the Journal of the National Cancer Institute in 2006 that they found no evidence of risk in persons who had used cell phones. Headlines around the world boasted of this latest finding from an impeccable source published in a first tier scientific journal...

But let's look at what the researchers actually studied.

They reviewed health records through 2002 of about 421,000 people who had first signed up for private use of cell phones between 1982 and 1995. A "cell phone user" in the study was anyone who made a single phone call a week for six months during the period 1981 to 1995. The study kicked out anyone who was part of a business that used cell phones, including only those who had used a cell phone for personal purposes for eight years.

This research design raises a lot of questions. Why did they not look at business

users -those with far more frequent use of cell phones? Why lump all users together, putting those who might have made a single phone call a week with those who used the phones more often?

Why stop collecting information on brain tumours in 2002 when we know that brain tumours often take decades to develop and be diagnosed?

When you are looking at a large population to find an effect, generally the more people you study, the better your chance of finding something. But if you merge a large number of people with very limited exposure together with a small number of people with very high exposure, you dilute the high-exposure group and so lower your chances of finding any effect at all. It would be better to compare the frequent users with non-users, omitting the limited users altogether. Lumping all these various users together is like looking all over a city for a stolen car when you know it's in a five-block radius. Perhaps you'll find what you're looking for, but the chances are greater that you won't... The Danish study was designed to look definitely thorough -421,000 people! -but in fact it was biased against positive findings from the start. Given how broadly cell signals now penetrate coffee shops, airports, and some downtown areas of major cities, it is very difficult to find any truly unexposed groups against which to compare results. Because cell phone use has grown so fast and its technologies change every year, it is as if we are trying to study the car in which we are driving.

Another study that s well published in 2000 found no increased risk in most types of brain cancer in cell phone users; but the average length of use among participants was less than three years. Still, the study found that those people who had used phones for even this short period of time had twice the risk of a very rare brain tumor --neuroepitheliomatous cancers, the kind that wraps itself around the nerve cells of the lining of the brain, right at the locus that cell signals can reach.

Of course, epidemiologic research is the research that works best when we have solid information on the nature of the use or exposure we are trying to understand. All of us have cell phone bills that provide detailed records of our use, and most of these can be accessed online. These were not used in the study, nor in any study of the industry to date. A gold mine of data lies untapped that could enable researchers to distinguish non-users from low frequency users from high frequency users, thereby increasing the validity and sensitivity of the studies.

Underlying this whole body of research is dear evidence that cell phone signals penetrate the brain. As the Danish researchers admitted in their own study, "During operation, the antenna of a cellular telephone emits radio frequency electromagnetic fields that can penetrate...

The studies to date that have not found a general, clear and consistent risk from cell phones need to be understood as tentative. They have for the most part looked at older technologies over short periods of exposure. None is asking about the impact on of cell phones on the brains of children and teenagers -one of the fastest growing groups of users in the world today. The governments of England, Israel and Sweden advise that those persons under eighteen should not use cell phones at all. American toddlers learn to play with toy versions of them.

What makes this especially troubling are the results from several other studies that have looked at more recent regular users. After a decade of heavy use, cell phone users have double the risk of brain cancer. The tumours tend to occur on the side of the head that the user favors.

Another, entirely different set of data on electromagnetic fields, exposures of which cell phone signals are but one type, come from looking at an illness even more extraordinarily rare than brain cancer -breast cancer in men. The total number of cases of male breast cancer in the United States today is thought to be less than 4,000 but some 1,400 new cases are reported each year, according to the American Cancer Society. Studies of men who work with electromagnetic fields in radio and television or in assembling cell towers have found that they have a much greater risk of breast cancer as well as cancer of the brain.

Men typically don't get breast cancer, and when they do, the disease is often much more difficult to treat... that for many professions involving work with electronics, men have between two and four times more breast cancer than those without such experiences...

Much of the research funding is provided by the telecommunications industry just as much of the research funding on more general electromagnetic field research was provided by the electric power industry. It may not surprise you to learn that the highly publicized Danish study that exonerated cell phones and the yet to be completed IARC study are directly funded by the industry."

Q54. Exactly how many more voices will it take to make Safety Code 6 more humane? This is not rhetorical.

A54: Safety Code 6 is a scientifically-based guideline document, which was reviewed by committees of scientists and health protection professionals with long-standing experience in the area of exposure assessment, radiofrequency dosimetry and radiofrequency bio-effects research. The recommendations in the code represent a consensus view of the state of knowledge concerning exposure to radiofrequency fields and their effects on humans. At the request of Health

Canada, the Royal Society of Canada (RSC) convened an expert panel on radiofrequency fields to conduct an independent assessment of the adequacy of Safety Code 6 for protection the public from RF field exposures. The conclusion of the RSC report was that the exposure limits set out in Safety Code 6 were an adequate reflection of the published science and provided the necessary protection of the general public from adverse health effects.

John Updike wrote, "It is impossible for a man to understand something if his income depends on not understanding it," Public microwave exposure levels tolerated by Health/Industry Canada are a national health disaster. Yet, for pragmatic and lucrative reasons, federal exposure limits have been deliberately set so high that no matter how much additional wireless radiation is added to the national burden, it will always be "within standards". SC6 is outdated, lacking in modern EMR studies, does not adequately take into account low level radiation nor the long term effects of radiation exposure. SC6 fails to protect Canadians adequately by lacking a precautionary principal and in light of certain recent studies and court cases may even be considered lacking due diligence. SC6 discriminates against those with EHS, a recognized disability. SC6 does not protect Canadians' health and contributes to their ill health at significant cost to the health care system. On September 5, 2000 the court ruled that HC's civil servants and scientists are responsible to the Canadian people, and that politicians cannot shut them up when it suits them or their corporate friends.

Q 55. Are whistleblowers like Dr. Chopra discouraged in the Consumer and Clinical Radiation Protection Bureau of Canada?

A55: Health Canada staff are committed to protecting the health and well-being of all Canadians. One of the cornerstones of the scientific method is a continuous process of review, criticism and reappraisal of the body of scientific knowledge. Health Canada staff actively prescribe to and participate in this process.

Again I would ask for a yes/no or percentage answer to the following question.

Q56. "Are the residents in the vicinity of the Union Street Water Tower Cell Tower in Simcoe, Ontario as safe today as they were before the cell tower was enabled?"

A56: Any confident scientist would estimate it in percentages as approximately 99.99%. This reflects the fact that there is always some level of uncertainty in science. There is to date no convincing scientific evidence to support the occurrence of adverse health effects at levels below the exposure limits specified

in Health Canada's Safety Code 6. This conclusion is based upon the bulk of scientific evidence from animal, *in-vitro* cellular and epidemiological studies that have been carried out worldwide, including at our laboratory. There is no convincing evidence of increased risk of disease from exposure to radiofrequency (RF) electromagnetic fields from cell towers.

Minister of Industry



Ministre de l'Industrie

The Honourable L'honorable

Jim Prentice

Ottawa, Canada K1A 0H5

14 MAY 2008



Dear :

I am writing in response to Environmental Petition No. 235, dated January 3, 2008, regarding the installation of a radiocommunication antenna system on the Union Street water tower in Simcoe, Ontario. On January 17, 2008, the petition was forwarded by the Commissioner of the Environment and Sustainable Development, to the Ministers of Health and Industry. I am pleased to respond to your questions that are within Industry Canada's area of responsibility.

5a. I ask Industry Canada (IC) and HC if such a tower is safe from a physics, electrical, ... point of view?

Health Canada has established safety guidelines for exposure to radio frequency fields in its Safety Code 6 publication entitled *Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz*. While the responsibility for developing Safety Code 6 rests with Health Canada, Industry Canada has adopted this guideline for the purpose of protecting the general public. Current biomedical studies in Canada and other countries indicate that there is no scientific or medical evidence that a person will experience adverse health effects from exposure to radio frequency fields provided that the installation complies with Safety Code 6. Industry Canada requires all radiocommunication installations to comply with Safety Code 6 on an ongoing basis to ensure that the general public is protected.

Industry Canada's field measurement survey, conducted on June 27, 2007, demonstrated that the received radio frequency field intensity levels in the area surrounding the Rogers Wireless Inc. antennas located on the Union Street water tower comply with the radio frequency general public exposure requirements by a significant margin.

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Canada

Specifically, the received radio frequency field intensity at neighbouring properties from the Rogers antennas are 178,600 to 222,410 times below Safety Code 6 general public exposure levels. Information concerning safe exposure levels can be found in Health Canada's Safety Code 6 guidelines.

5b. Would such a tower meet IEEE standards?

Industry Canada does not require radio communication towers to meet standards put in place by the Institute of Electrical and Electronics Engineers (IEEE). IEEE standards are voluntary standards used in industry. Questions with respect to these standards may be directed to either the IEEE or Rogers.

Within Ontario, the cellular/PCS industry employs engineers licensed by Professional Engineers Ontario, under the provincial *Professional Engineers Act*, to design and supervise the construction of their wireless network, which ensures that antenna installations are consistent with acceptable engineering practice and standards.

5c. Is it grounded properly?

5d. Who has verified the grounding?

To protect communication equipment, radio antenna systems, including towers, are installed with the appropriate mechanical interfaces and are grounded in order to safely dissipate lightning strikes and static electricity. It is in Rogers' best interest to properly ground its antenna system; to do otherwise would put the antenna and associated radio apparatus at risk for destruction by lightning strikes.

5e. What part do metal objects play in the reflection of microwaves?

Metal objects, depending on their size in comparison to the incident wavelength of the transmitted radio signal, have the ability to reflect radio waves in all radio frequency bands, including microwave frequency bands.

5f. Why does SC6 warn against large metal objects and then place a microwave on a large metal object?

Health Canada's Safety Code 6, section 3.2, paragraph (d) states that "metallic objects that are not necessary shall not be present near any radiating RF device, as they may cause high intensity fields in some locations." However, in this case, it is not a consideration given that the antennas are all directional and focus the radio frequency energy away from the metal water tower.

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The reason for using the Union Street water tower, which is a large metallic object by design, is that it provides ample structural integrity for the antennas while not hindering their performance.

- 5g. What is the appropriate SC6 signage for such a structure?**
- 5h. Is this tower properly signed?**

Section 7.2 of Safety Code 6 deals with area demarcation and it states that a warning sign shall be placed at the entrance of any zone within which a survey has shown that the radio frequency levels exceed those specified for general public exposure. Safety Code 6 is only exceeded within a few metres directly in front of the antennas, which are located on the water tank itself and where the general public would not normally have access. Accordingly, Industry Canada does not require the installation of a warning sign because the grounds surrounding the Union Street water tower, where the general public might have access, are not exposed to levels exceeding the general public exposure limits set out in Safety Code 6.

- 5i. What is the appropriate SC6 fencing for such a structure?**
- 5j. Has such fencing been installed?**

Safety Code 6 indicates that where access is possible, warning signs shall be posted at entrances to any locations containing radio frequency devices capable of producing, under normal working conditions, levels that exceed those specified for the protection of the general public. By extension, fences may be installed in lieu of warning signs to prevent access to areas that exceed Safety Code 6 general public exposure levels. In the case of the Union Street water tower, Norfolk County has chosen to install a security fence to prevent public access to guard against vandalism, climbing and hazards associated with height.

- 5k. What part does flowing water play in the reflection of microwaves?**

The water that is contained within the metallic envelope of the water tower tank has no reflective effect on the radio signals emitted from the directional antennas attached to the outside of the water tower.

- 6c. Why does Industry Canada give preference to siting cell towers on water towers?**

Canadians are increasingly expressing concern about the installation of new, purpose-built antenna towers due to issues that include the impact of towers on

their property values, the environment, and “right to enjoy” considerations. Sharing sites is a method of alleviating these concerns, thereby meeting the real technical requirements without the need to install new towers. Industry Canada promotes the sharing of existing antenna supporting infrastructure, such as building rooftops, water towers and existing antenna towers, for the use by those proposing to build a new antenna supporting structure. The use of an existing structure can result in an installation with minimal local impact and is generally more acceptable compared to the construction of a new antenna tower within the community.

6d. What science does Industry Canada cite for such preference? Is it within the Canadian Government’s ethical standards to erect such a controversial tower?

The reports of the Telecommunications Policy Review Panel and the national Antenna Tower Policy Review, both of which were independent public consultation reviews, indicate that there are compelling social and economic reasons to mandate antenna tower and site sharing. These reasons include dealing with antenna tower proliferation and local concerns, as well as how these facilities can be used as barriers to market entry and competition. In order to minimize the impact on local surroundings, local communities generally prefer the use of existing infrastructure over the construction of new towers or other purpose-built antenna supporting structures. Industry Canada believes that water towers, such as the one located on Union Street in Simcoe, Ontario, are generally good locations for the siting of radio antennas.

15. When a family is forced from their home due to policies set forth by HC and implemented by IC, what government instituted recourse do they have to regain their family home?

Industry Canada requires all proponents of radio antenna installations to comply with Health Canada’s Safety Code 6 guidelines on an ongoing basis. These guidelines for the protection of the general public are consistent with those of other international jurisdictions established by competent authorities and the World Health Organization.

Industry Canada’s measurements at various locations around the Union Street water tower verified that the radio frequency field levels from the Rogers antenna system are thousands of times below Health Canada’s Safety Code 6 exposure limits. Given that the installation complies with Safety Code 6 and that Rogers Wireless has satisfied all other departmental licensing requirements, Industry Canada will not impede the installation of this radiocommunication installation.

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16a. How many towers were there in Canada in Jan 2000? How many towers are there in Canada today? How many towers are projected for Canada in 2010?

Radiocommunication, including broadcasting, is used daily by Canadians and is necessary to support many essential services, such as police, fire, ambulance, national security and air navigation, and is used by private businesses, provincial and federal governments, as well as commercial systems such as PCS and cellular services. Thousands of radiocommunication sites currently exist throughout Canada and all require antennas, which are often supported by towers or other tall structures, in order to function effectively.

Cellular service in Canada, for example, has grown substantially since its introduction in 1985, when less than 100 sites across Canada were placed into service. Due to demand by Canadians, by 1998, PCS and cellular services had grown to approximately 5,300 sites in service. Currently, an estimated 10,500 sites are installed across Canada. Between 1998 and 2008, the average growth rate was about 500 sites per year. By extrapolating and assuming this growth rate remains unchanged, by 2010, there will be approximately 11,500 cellular and PCS sites in Canada.

16b. How many people are subjected to cell tower radiation ½ hour a day; 8 hours a day and 24 hours a day?

Based on current departmental estimates, 98 percent of Canada's population receive PCS and cellular service. Statistics Canada's 2006 Census indicated that Canada's population was approximately 31.6 million people. Given that PCS and cellular systems are typically designed to provide service 24-7, this would indicate that approximately 31 million Canadians are exposed to PCS and cellular emissions daily.

37a. It may be noted that the Simcoe cell tower is located near a school, hospital and nursing home, let alone the dense residential area. There was no notification given of the erection of the cell tower. Why, with all the warnings about EMR, was there no consideration to resident consultation?

Industry Canada recognizes the importance of considering the potential impact that antennas and their supporting structures may have on the local surroundings. It is for this reason that all antenna proponents must follow departmental procedures, which give consideration to the environment, health and land use

consultation. In this case, the proponent, Rogers Wireless, followed the procedures applicable at the time, namely Industry Canada's Client Procedure Circular (CPC) 2-0-03, Issue 3, *Environmental Process, Radiofrequency Fields and Land-Use Consultation*. The antenna supporting structure selected by Rogers Wireless was Norfolk County's water tower located on Union Street in Simcoe, Ontario. The County concurred with the proposal and subsequently entered into a lease agreement with Rogers Wireless for the use of the water tower as an antenna supporting structure.

The addition of the antennas, in comparison with the overall size of the water tower and the existing antennas, was determined by Norfolk County, Rogers Wireless and Industry Canada to have minimal impact on the local surroundings and that public consultation would not be a requirement for the installation. It is important to note that on January 1, 2008, Industry Canada updated CPC-2-0-03, Issue 3, to Issue 4 entitled *Radiocommunication and Broadcasting Antenna Systems*. Under this update, public notification and consultation is not required for installations such as the one on the Union Street water tower in Simcoe, as they generally have minimal impact on local surroundings.

- 37b. Was this an isolated incident or was it general policy to allow cell towers near hospitals, nursing homes and schools?**
- 37c. The policy of notifying residents begins in January 2008. Will special arrangements be made for schools, hospitals and nursing homes? If not, why not?**

Industry Canada requires all proponents of radio antenna installations to comply with Health Canada's Safety Code 6 guidelines on an ongoing basis. These guidelines are for the protection of the general public, including pregnant women, the aged, children, the chronically ill and disabled, as well as certain members of the general public who may be more susceptible than others, including their protection while in schools, hospitals and nursing homes.

Safety Code 6 exposure limits are consistent with those of other international jurisdictions established by competent authorities and the World Health Organization.

As of January 1, 2008, under CPC-2-0-03, Issue 4, proponents of certain types of antenna installations must undertake public notification and address relevant concerns, either by following the local land use authority's requirements or Industry Canada's default process, as is required and appropriate. Provided that

Safety Code 6 is respected, there is no established scientific basis supporting the need for specific notification to schools, hospitals and nursing homes.

I appreciate this opportunity to respond to your petition and trust this information is helpful.

Sincerely,

A handwritten signature in black ink, appearing to be 'Jim Prentice', with a long horizontal line extending to the right.

The Honourable Jim Prentice, P.C., Q.C., M.P.

c.c. Mr. Ronald C. Thompson, FCA
Interim Commissioner of the Environment
and Sustainable Development

June 20, 2008

The Auditor General of Canada
Commissioner of the Environment and Sustainable Development
240 Sparks St.
Ottawa, ON
K1A 0G6



Attn. Petitions
Auditor General,

Please accept the following petition under the Auditor General Act.

On Tuesday, May 20, 2008, I received a late response to my petition no. 235 from the Honourable Tony Clement, present Minister of Health for Canada. His answers to my questions only lead to further questions. My previous petition comprised of 56 (with some duplicate numbers) questions. This petition comprises of 25 questions.

Prologue to Question 1)

Mr. Clement, as this question progresses I think you will share with me the concern that there are those in your Ministry that would misrepresent you. I'm speaking of whoever penned your response to my petition.

It is understood that you supervised the writing of your response but were not the sole author. I assume members of the Consumer and Clinical Radiation Protection Bureau of Canada (CCRPB) such as Dr. J. P. McNamee, Dr. Robert P. Bradley, Dr. G. B. Gajda and Dr. A Thansandote had a hand in your response. It is a shame the true authors of the report remain anonymous and therefore cannot be held accountable.

The main thrust of your responses were "bulk of studies" or "majority of studies" or the 27 times you used "weight-of-evidence". These responses are typified by your answer to my question 19.

'Response: A weight-of-evidence approach is employed when assessing the possible health risks of RF fields. This takes into account both the quantity of studies on a particular endpoint (whether adverse or no effect), but also the quality of those studies. Poorly conducted studies (e.g. Incomplete dosimetry or inadequate control samples) receive relatively little weight while properly conducted studies (e.g. all controls included, appropriate statistics, complete dosimetry) will receive more weight. There are numerous concerns with the studies reference above; therefore, these studies have little weight in the risk assessment process.

This statement does not add up. The scales being used to weigh the evidence are not true measure as you will agree after reading the following article.

<http://www.microwavenews.com/docs/mwn.7-06.RR.pdf>

Microwave News Vol. XXVI No. 4, July 2006.

"Radiation Research" and The Cult of Negative Results

"Radiation Research" is a scientific journal whose primary focus is on ionizing radiation, with only a minority of papers devoted to the nonionizing side of the electromagnetic spectrum. Its June issue,

however, features five papers, all of which claim to show that EMFs of one type or another have no biological effects. To account for this departure from the norm, Sara Rockwell, the editor-in chief, Bruce Kimler, an associate editor, and John Moulder, a senior editor, have offered an apology, under the title, “Publishing Negative Results.” (In this context, “negative results” refers to studies that show no effects.) The editors want you to believe that they are offering this bumper crop of negative papers as a public service. They are on a mission, they say, to allay “widespread concern” over power lines and cell phones by giving a voice to those who, despite great effort, could not substantiate previously reported findings of “deleterious health effects.”

The editorial tacitly concedes that *Radiation Research* only rarely publishes papers showing any type of EMF effects by failing to cite a single example from its own pages. At the same time, it fails to mention that other journals, for instance *Mutation Research* and *Bioelectromagnetics*, have had no trouble finding high-quality papers with “positive” results—that is, those that do show biological effects. Many of the negative EMF studies that have been published in *Radiation Research* were paid for by industry and the U.S. Air Force, both of which seek to control EMF research (often by stopping it) and to show that microwaves are essentially harmless except at high exposure levels.

Promoting no-effect studies has long been part of their strategy to keep a lid on the microwave-health controversy. Wireless companies like Motorola have fostered the spurious view that negative studies cancel out positive ones. Their strategy is this: First, seed the journals with no-effect papers that run counter to previously published work which does show biological changes. Then argue: “If we couldn’t replicate the effect, it cannot be real.” The assumption here is that industry science is superior to everyone else’s. They make no effort to resolve inconsistent results.

Another important fact goes undisclosed in the editorial. One of its authors, John Moulder, a professor at the Medical College of Wisconsin in Milwaukee, has a lucrative consulting practice on EMFs and health. Over the years, Moulder has earned hundreds of thousands of dollars disputing the existence of adverse EMF health effects, even those accepted by most other members of the EMF community. To explore the potential biases at work, *Microwave News* investigated a subset of health studies published in peer-reviewed scientific journals. We selected papers on microwave-induced genotoxicity; that is, microwave effects on DNA, the genetic blueprint inside every living cell. With the generous help of Henry Lai of the University of Washington, Seattle, we identified 85 radiofrequency (RF) /microwave-genotox papers published since 1990. Of these, 43 found some type of biological effect and 42 did not. (You can download a complete list of references and abstracts from our Web site.)

Lai is an interested party to this controversy. Together with N.P. Singh, Lai made RF/microwave genotoxicity a major concern when, in the mid-1990’s, they were the first to report that microwaves could lead to DNA single- and double-strand breaks. As you can see in Table 1, Lai is the lead author of four of the 43 “effect” or positive studies.

Genotox Studies on RF/Microwave Radiation (Table 1)

Effect: Aitken (05); Baohong (05); Balode (96); Belyaev (05, 06); Busljeta (04); d’Ambrosio (02); Diem (05); Fucic (92); Gadhia (03); Gandhi (05a, 05b); Garaj-Vrhovac (90, 91, 92, 99); Haider (94); Lai (95, 96, 97a, 97b, 05); Maes (93, 96, 97); Markova (05); Mashevich (03); Narasimhan (91); Paulraj (06); Phillips (98); Sarimov (04); Sarkar (94); Semin (95); Sykes (01); Tice (02); Trosic (01, 02, 04, 06); (DY)Zhang (06); (MB)Zhang (02); Zotti-Martelli (00, 05).

No Effect: Antonopoulos (97); Bisht (02); Chang (05); Ciaravino (91); Garson (91); Gorlitz (05); Gos (00); Hook (04); Kerbacher (90); Komatsubara (05); Koyama (04); Lagroye (04a, 04b); Li (01); Maes (95, 00, 01, 06); Malyapa (97a, 97b, 98); McNamee (02a, 02b, 03); Meltz (90); Ono (04); Roti Roti (01); Sakuma (06); Scarfi (06); Stronati (06); Takahaski (02); Verschaeve (06); Vijayalaxmi (97a, 97b*, 99, 00, 01a, 01b, 01c, 03); Zeni (03, 05).

Source: Adapted from Henry Lai

There is just about an even split between effect and no effect papers. But look what happens when we superimpose the funding source for each study (where available):

Those sponsored by industry are in red and those sponsored by the U.S. Air Force are in purple in Table 2. (Papers with no declared funding source are in green.) A clear—and disconcerting—pattern emerges: 32 of the 35 studies that were paid for by the mobile phone industry and the U.S. Air Force show no effect. They make up more than 75% of all the negative studies. You don't need to be a statistician to infer that money, more often than not, secures the desired scientific result.

Genotox Studies on RF/Microwave Radiation (Table 2)

Papers with Industry and U.S. Air Force Funding

Effect: Aitken (05); Baohong (05); Balode (96); Belyaev (05, 06); Busljeta (04); d'Ambrosio (02); Diem (05); Fucic (92); Gadhia (03); Gandhi (05a, 05b); Garaj-Vrhovac (90, 91, 92, 99); Haider (94); Lai (95, 96, 97a, 97b, 05); Maes (93, 96, 97); Markova (05); Mashevich (03); Narasimhan (91); Paulraj (06); Phillips (98); Sarimov (04); Sarkar (94); Semin (95); Sykes (01); Tice (02); Trosic (01, 02, 04, 06); (DY)Zhang (06); (MB)Zhang (02); Zotti-Martelli (00, 05).

No Effect: Antonopoulos (97); Bisht (02); Chang (05); Ciaravino (91); Garson (91)*; Gorlitz (05); Gos (00); Hook (04); Kerbacher (90); Komatsubara (05); Koyama (04); Lagroye (04a, 04b); Li (01); Maes (95, 00, 01, 06); Malyapa (97a, 97b, 98); McNamee (02a, 02b, 03); Meltz (90); Ono (04); Roti Roti (01); Sakuma (06); Scarfi (06); Stronati (06); Takahaski (02); Verschaeve (06); Vijayalaxmi (97a, 97b, 99, 00, 01a*, 01b*, 01c*, 03*); Zeni (03, 05).

Source: Adapted from Henry Lai

Wireless Industry Funding (*partial). **USAF Funding (*partial).** **No Funding Source Specified.**

One of the three industry studies that did find an effect nearly failed to make it into print. It was carried out by Jerry Phillips under a Motorola contract. Motorola opposed Phillips' decision to write up his positive findings and, according to Phillips, the company tried to stop him. Phillips resisted and succeeded, but it was the last piece of original EMF research he ever completed. A similar loss of balance occurs when you look at only the papers published in *Radiation Research*. These are colored orange in Table 3.

Genotox Studies on RF/Microwave Radiation (Table 3)

Papers Published in *Radiation Research*

Effect: Aitken (05); Baohong (05); Balode (96); Belyaev (05, 06); Busljeta (04); d'Ambrosio (02); Diem (05); Fucic (92); Gadhia (03); Gandhi (05a, 05b); Garaj-Vrhovac (90, 91, 92, 99); Haider (94); Lai (95, 96, 97a, 97b, 05); Maes (93, 96, 97); Markova (05); Mashevich (03); Narasimhan (91); Paulraj (06); Phillips (98); Sarimov (04); Sarkar (94); Semin (95); Sykes (01); Tice (02); Trosic (01, 02, 04, 06); (DY)Zhang (06); (MB)Zhang (02); Zotti-Martelli (00, 05).

No Effect: Antonopoulos (97); Bisht (02); Chang (05); Ciaravino (91); Garson (91); Gorlitz (05); Gos (00); Hook (04); Kerbacher (90); Komatsubara (05); Koyama (04); Lagroye (04a, 04b); Li (01); Maes (95, 00, 01, 06); Malyapa (97a, 97b, 98); McNamee (02a, 02b, 03); Meltz (90); Ono (04); Roti Roti (01); Sakuma (06); Scarfi (06); Stronati (06); Takahaski (02); Verschaeve (06); Vijayalaxmi (97a, 97b, 99, 00, 01a, 01b, 01c, 03); Zeni (03, 05).

Source: Adapted from Henry Lai

Published in *Radiation Research*.

Over the last 16 years, only one positive paper on microwave genotoxicity has appeared in *Radiation Research*. During the same time, the journal has published 21 negative genotox papers. (Australia's Pam Sykes, the lead author of the lone positive paper, was denied money for a follow-up and soon moved on to other research areas.)

When Tables 2 and 3 are combined, you can see that 80% of the negative papers (17 out of 21) published in *Radiation Research* were paid for by either industry or the U.S. Air Force. These are in red in Table 4.

Genotox Studies on RF/Microwave Radiation (Table 4)

***Radiation Research* Papers Sponsored by Industry and/or USAF**

Effect: Aitken (05); Baohong (05); Balode (96); Belyaev (05, 06); Busljeta (04); d'Ambrosio (02); Diem (05); Fucic (92); Gadhia (03); Gandhi (05a, 05b); Garaj-Vrhovac (90, 91, 92, 99); Haider (94); Lai (95, 96, 97a, 97b, 05); Maes (93, 96, 97); Markova (05); Mashevich (03); Narasimhan (91); Paulraj (06); Phillips (98); Sarimov (04); Sarkar (94); Semin (95); Sykes (01); Tice (02); Trosic (01, 02, 04, 06); (DY)Zhang (06); (MB)Zhang (02); Zotti-Martelli (00, 05).

No Effect: Antonopoulos (97); Bisht (02); Chang (05); Ciaravino (91); Garson (91); Gorlitz (05); Gos (00); Hook (04); Kerbacher (90); Komatsubara (05); Koyama (04); Lagroye (04a, 04b); Li (01); Maes (95, 00, 01, 06); Malyapa (97a, 97b, 98); McNamee (02a, 02b, 03); Meltz (90); Ono (04); Roti Roti (01); Sakuma (06); Scarfi (06); Stronati (06); Takahaski (02); Verschaeve (06); Vijayalaxmi (97a, 97b, 99, 00, 01a, 01b, 01c, 03); Zeni (03, 05).

Source: Adapted from Henry Lai

And of these 17, most are associated with a single lab: Joe Roti Roti's at Washington University in St. Louis. Roti Roti's principal funding source is Motorola. The 10 Roti Roti–Motorola papers on RF/microwave genotoxicity are in pink in Table 5.

Genotox Studies on RF/Microwave Radiation (Table 5)

Roti Roti–Motorola Papers in *Radiation Research*

Effect: Aitken (05); Baohong (05); Balode (96); Belyaev (05, 06); Busljeta (04); d'Ambrosio (02); Diem (05); Fucic (92); Gadhia (03); Gandhi (05a, 05b); Garaj-Vrhovac (90, 91, 92, 99); Haider (94); Lai (95, 96, 97a, 97b, 05); Maes (93, 96, 97); Markova (05); Mashevich (03); Narasimhan (91); Paulraj (06); Phillips (98); Sarimov (04); Sarkar (94); Semin (95); Sykes (01); Tice (02); Trosic (01, 02, 04, 06); (DY)Zhang (06); (MB)Zhang (02); Zotti-Martelli (00, 05).

No Effect: Antonopoulos (97); Bisht (02); Chang (05); Ciaravino (91); Garson (91); Gorlitz (05); Gos (00); Hook (04); Kerbacher (90); Komatsubara (05); Koyama (04); Lagroye (04a, 04b); Li (01); Maes (95, 00, 01, 06); Malyapa (97a, 97b, 98); McNamee (02a, 02b, 03); Meltz (90); Ono (04); Roti Roti (01); Sakuma (06); Scarfi (06); Stronati (06); Takahaski (02); Verschaeve (06); Vijayalaxmi (97a, 97b, 99, 00, 01a, 01b, 01c, 03); Zeni (03, 05).

Source: Adapted from Henry Lai

□ **Published in *Radiation Research* from Roti Roti's group at Washington University and supported fully or partially by Motorola.**

In addition, many other Roti Roti papers on other types of microwave effects, also paid for by Motorola, have been published in *Radiation Research*. With respect to microwave radiation, it almost appears as if *Radiation Research* is a house organ of the Motorola Corporation.

Peer Review: Who Picks the Peers?

Is it possible that all these imbalances can be explained by the fact that only sloppy studies show positive effects and that the superior peer review process at *Radiation Research* weeds out the chaff leaving only the well-controlled and well-executed negative studies fit for publication? The three editors suggest that this is so: "Negative studies are held to considerably higher standards than positive studies," they write. To refute this line of argument one needs only to look at the now-infamous "dead-mice-walking" study by Tim Kuchel and Tammy Utteridge published in *Radiation Research* in 2002. That paper appears to have been rushed into print in order to nullify an earlier study, which found that microwaves could promote cancer in mice. (Motorola supplied the exposure equipment for the new experiment.) As we commented when Kuchel's paper first appeared, it signaled a "massive failure of

peer review” (see *MWN*, S/O02). There were many errors in the paper, but the most obvious and egregious one allowed two figures to appear on the same page in open contradiction to each other. Mice that were shown to have died in one figure were still being counted, picked up, and weighed in the other. Even Q. Balzano, a former senior Motorola executive, told us at the time that, “The paper is chock-full of contradictions.” Whatever its shortcomings, the Kuchel-Utteridge study continues to be touted by Motorola and Moulder as a key indicator that wireless radiation is harmless. Peer review is only as good as the reviewers. A flawed paper can be published, if the supervising editor selects sympathetic reviewers who will be likely to overlook them. This is what appears to have been going on at *Radiation Research*.

John Moulder: Industry Consultant

We suspect that much of *Radiation Research*'s bias against EMF effects can be attributed to John Moulder, who came on as an editor in 1991 and was promoted to senior editor in 2000. For this whole time—during which the microwave-genotox controversy became more and more contentious—Moulder has been a consultant to the power, electronics and communications industries, as well as for anyone, it seems, who disputes the existence of EMF-induced adverse health effects. For years he posted his skeptical views on the health impacts of cell phones, base stations and power lines on his Web site, and these serve as lures for potential like-minded clients.

Last year, for example, Moulder testified against the family of Richard Beissinger, a professor at the Illinois Institute of Technology (IIT) in Chicago who died of a brain tumor in 2003. His widow and five children were seeking worker's compensation for what they believed was an EMF induced cancer.

Beissinger taught and worked in rooms near electrical transformers. His magnetic field exposures are uncertain, but very high, ranging from 10mG to 820 mG, and at times probably more than 1G.

At a hearing held in 2005, Moulder stated under oath that, in his opinion, “power-frequency magnetic fields do not cause any kind of brain cancer *under any exposure, intensity and duration*” [our emphasis].

Moulder was no doubt aware that the California EMF program had previously concluded that magnetic fields are a likely cause of adult brain cancer. And that many years earlier, a team coordinated by the Electric Power Research Institute (EPRI) had reported that, taken together, epidemiological studies of workers exposed to magnetic fields pointed to a statistically significant elevated risk of brain cancer.

While electric utility industry operatives may have conceded that there may well be a link between long-term exposure to magnetic fields and brain cancer, that did not deter Moulder. He made \$10,000–\$12,000 trying to deprive the Beissinger family of a small pension. On May 23, at about the same time that the “negative effects” editorial appeared in *Radiation Research*, an arbitrator rejected Moulder's argument and ruled in favor of Beissinger's family. The decision is under appeal.

In the course of his testimony, Moulder acknowledged that he had earned approximately \$300,000 in litigation related fees, on power-frequency EMFs. This probably represents a fraction of Moulder's earnings, since litigation services represents only one part of his consulting practice.

For instance, in 2001 Moulder testified at a hearing on behalf of the Minnesota Power Co. and Wisconsin Public Service Corp., which had applied to build a new transmission line. In that testimony, Moulder revealed that he would be paid about \$35,000 for this case alone. Nor is Moulder's consulting limited to power-frequency EMFs. In 1999, he prepared a report for the U.K. Federation of Electronic Industry (now called Intellect), which was submitted to the Independent Expert Group on Mobile Phones, better known as the Stewart panel. And the following year he wrote a report for the Australian Mobile Telecommunications Association, which was submitted to the Australian Senate. He has not disclosed how much money he was paid for these opinions, but in March 2001, Moulder told an Australian senate committee that, on average, 8–10% of his income was from the telecommunications industry alone.

Those Reporting “Positive” Results Attacked

Back in 2001 after Moulder had moved up to senior editor, he recruited Vijayalaxmi of the University of Texas in San Antonio to join the *Radiation Research* editorial board. A couple of years earlier they,

together with some colleagues from Washington University and the U.S. Air Force, had published a review paper that dismissed any possible connection between cell phones and cancer. This too was published in *Radiation Research*.

As shown in Table 2, Vijayalaxmi is the lead author on seven of the microwave-genotox papers. All were funded by the U.S. Air Force, Motorola or a combination of the two. Last year, while she was still an associate editor at *Radiation Research* (she stepped down soon afterwards), Vijayalaxmi together with Sheila Johnston, a long-time consultant to the mobile phone industry based in London, launched an aggressive assault against Lai and Singh and their work on genotoxicity. In an e-mail accompanying their analysis of Lai–Singh's research, Johnston wrote: "Lai's science has failed CONCLUSIVELY" [her emphasis]. The Vijayalaxmi–Johnston rant was so amateurishly written that it was largely ignored. What's harder to forget is the virulence of their attack. "They are not scientific statements," Singh told us at the time, "They are personal attacks. They do not want to solve problems, they want to eliminate us."

James McNamee of Health Canada in Ottawa is the new EMF specialist on the editorial board of *Radiation Research*. He has published three negative papers on microwave genotoxicity in *Radiation Research*. McNamee also has written a review paper with Moulder on cell phones and cancer.

Earlier this year, Vijayalaxmi, McNamee and Maria Scarfi, a researcher based in Naples, Italy, wrote an angry letter to *Mutation Research* warning of the questionable nature of two positive genotox papers—one by Elisabeth Diem ("Diem 05") of the University of Vienna and another by Sabine Ivancsits from the same lab on power-frequency EMFs). Vijayalaxmi, McNamee and Scarfi are authors on 14 of the 42 negative genotox papers, as well as one positive one. Ten of their 14 negative papers were published in *Radiation Research*, as shown in Table 6.

Genotox Studies on RF/Microwave Radiation (Table 6)

Papers by McNamee, Scarfi or Vijayalaxmi

Effect: Aitken (05); Baohong (05); Balode (96); Belyaev (05, 06); Buslieta (04); d'Ambrosio (02); Diem (05); Fucic (92); Gadhia (03); Gandhi (05a, 05b); Garaj-Vrhovac (90, 91, 92, 99); Haider (94); Lai (95, 96, 97a, 97b, 05); Maes (93, 96, 97); Markova (05); Mashevich (03); Narasimhan (91); Paulraj (06); Phillips (98); Sarimov (04); Sarkar (94); Semin (95); Sykes (01); Tice (02); Trosic (01, 02, 04, 06); (DY)Zhang (06); (MB)Zhang (02); Zotti-Martelli (00, 05).

No Effect: Antonopoulos (97); Bisht (02); Chang (05); Ciaravino (91); Garson (91); Gorlitz (05); Gos (00); Hook (04); Kerbacher (90); Komatsubara (05); Koyama (04); Lagrove (04a, 04b); Li (01); Maes (95, 00, 01, 06); Malyapa (97a, 97b, 98); McNamee (02a, 02b, 03); Meltz (90); Ono (04); Roti Roti (01); Sakuma (06); Scarfi (06); Stronati (06); Takahaski (02); Verschaeve (06); Vijayalaxmi (97a, 97b, 99, 00, 01a, 01b, 01c, 03); Zeni (03, 05).

Source: Adapted from Henry Lai

□ Papers from McNamee's, Scarfi's or Vijayalaxmi's labs.

Those published in *Radiation Research* are underlined.

The microwave-genotoxicity controversy is a mean and nasty business, made meaner and nastier by the unrelenting attacks on those who dare claim that such effects do exist. But with John Moulder at *Radiation Research*, the playing field is hardly level, especially when the journal does not disclose its senior editor's ties to industries whose fortunes depend on assuring the public that microwaves have no effect whatever on DNA.

At a time when potential conflicts of interest among authors of medical and scientific papers are front page news (see, for instance, the July 11, 2006 *Wall Street Journal* on a paper published by the *Journal of the American Medical Association*), and more and more journals are requiring full disclosure of ties to industry, it is surprising—no, astonishing—that a leading radiation journal allows such obvious conflicts to remain unacknowledged. An editorial in the *Sunday New York Times* on July 23, said that the "best hope" for the credibility of medical journals is for them "to try much harder to find authors free of

conflicts.” Surely the situation is even worse when a journal’s editor, who serves as the guardian charged with ensuring that contributors’ potential conflicts are fully disclosed, is mired in his or her own conflicts.

Do the Rules on Industry Bias Apply to EMFs?

What is it about EMF–health research that allows people to ignore the rules that govern other areas of biomedicine and public health? Why, for instance, did the World Health Organization turn a blind eye when told that Mike Repacholi was taking money from the wireless industry to pay for his EMF program in violation of the WHO rules? Was it really enough that Repacholi had engineered a scheme to launder the funds in Australia before they were forwarded to Geneva?

Similarly, Sara Rockwell of Yale medical school, the editor-in-chief of *Radiation Research*, and the officers of the Radiation Research Society, its publishers, must be aware of the conflicts posed by Moulder’s extensive consulting for industry. Yet Rockwell had no qualms about signing Moulder’s self-serving editorial, and none of them has felt the need to disclose Moulder’s long-standing ties to industry. *Radiation Research* has become a repository for negative papers and thus an important part of the industry and military strategy to neutralize those who dare to challenge the no-effects dogma. Their work had been made much easier with John Moulder on the inside to ease industry papers into print.”

Mr. Minister I believe you see where I’m going. As you notice the names of John Moulder, James McNamee, Michael Repacholi and Vijayalaxmi, all appear in the above article as they appeared in your response to my petition. Let’s add the names of G. Gajda and A. Thansandote, workmates of James McNamee who have vested interests in the status quo, namely their jobs with Health Canada.

You remember of course how often you referred to these men and their research. Of the 14 studies you referenced, Moulder was referenced once, Repacholi once, Vijayalaxmi once, Gajda six times, Thansandote seven times and McNamee eight times. Using a weight-of-evidence measurement, of 14 studies presented, there are at minimum 24 biased references.

I want to know who decides this weight-of-evidence measurement that your ministry compiles. Perhaps it is three or four men whose interest in the status quo is obvious, men who reject over 2000 studies I put forward but include studies funded by the cell phone industry.

Question 1) The crux of this long prologue is how is this weight-of-evidence measurement that is being used to evaluate the quantity and quality of studies used to formulate Safety Code 6? How is this measurement being applied in any way fairly, considering the biased nature of the evaluators from industry and HC?

Prologue to Question 2)

Let’s look at Dr. Repacholi, co-author of the first version of Safety Code 6 (SC6).

As you know Mr. Minister I maintain SC6 is outdated and based on incorrect premises. There was nothing in your previous petition response to disprove this statement. In fact it is obvious there cannot be an updated SC6 because current research would force you to invoke the precautionary principle.

Dr. Repacholi co-authored the first version of SC6. As referenced in my previous petition, industry money was funneled through the Royal Adelaide Hospital to fund his studies. Repacholi was co-author of SC6, chairman of the Royal Adelaide Hospital studies, the WHO studies and chairman emeritus of ICNRP. One would have to say he has had great influence on world-wide standards for EMFs and one would have to say he has ties to industry. So when you quote WHO or ICNRP or your own SC6, the tying thread is Repacholi. Repacholi’s longstanding industry involvement invalidates WHO, ICNRP and SC6.

Question 2) How valid can your citing of WHO or ICNRP be under these circumstances?

Prologue to Question 3)

Mr. Minister, it is too bad HC can't be on the cutting edge. Remember fluoroscopes, Thalidomide, smoking, asbestos, DDT, pesticides, midwifery, organ donation, carcinogens, tainted blood, SARS, urea-formaldehyde foam insulation (UFFI), Celebrex, chronic fatigue syndrome, post-traumatic stress disorder, fibromyalgia and the time when medical Doctors and Chiropractors were at loggerheads. Time has taught us that those things belong to the past and HC was out to lunch for each and every one of the issues.

Furthermore, "Senator Noel Kinsella initiated public hearings in Ottawa on December 7, 1999, to ascertain if the Health Protection Branch (HPB) is guilty of "contempt of parliament." In a democracy, such as ours struggles to be, that means "contempt of the Canadian people" and may carry a jail term. The investigation focuses on a reprimand and temporary job suspension meted out in 1999 to drug evaluator Dr. Shiv Chopra. Thanks to Drs. S. Chopra, M. Haydon, and their colleagues (and despite their superiors), Canada's milk and beef contains no BGH." http://kospublishing.com/html/dr_chopra.html As you remember Mr. Minister, in this case Health Canada tried for the longest time to maintain the status quo, a status quo again involving an industry giant.

It is this longstanding vested interest in the status quo that should penalize studies generated by the CCRPB on the weight-of-evidence scales.

Ergo, it is no wonder HC cannot undergo the much needed revision of SC6 because we know how ridiculed it would be.

Question 3) Is it fair to conclude that studies generated by HC should be removed from the weight-of-evidence scale due to the HC's long running history of maintaining the status quo? Is this also why S6 is not being updated?

Prologue to Question 4)

Cell Phone Biological Studies

	Effect	No Effect	Total
Industry Funded	27	69	96
	28%	72%	29%
Non-Industry Funded	154	76	230
	67%	33%	71%
Total	181	145	326
	56%	44%	

(7/11/06)

Dr. Henry Lai, Univ. of Seattle created this chart based on his research, a chart which clearly shows an industry bias. Therefore industry studies should be removed from the weight-of-evidence scale used by HC to decide policy (including a revision of SC6).

Question 4) Mr. Minister, do you agree with this chart? Can you provide alternative data?

Prologue to Question 5)

In the following conversation “Invisible Hazards in the Wireless Age - A conversation with Dr. George Carlo”, http://commonground.ca/iss/201/cg201_carlo.shtml you will find Mr. Minister the article raises several questions.

Dr. George Carlo is a leading authority on the dangers of radio frequency radiation and a world recognized medical scientist, author and lawyer. His career spans 30 years and more than 150 medical, scientific and public policy publications in the areas of public health, workplace safety and consumer protection.

Common Ground: Your experience with radio wave health risks goes back a long time. How did you first become involved?

Dr. Carlo: This goes back to 1993 in the US when questions were raised about mobile phones being a possible cause of brain cancer. The US Congress held open hearings and it became clear that cell phones had been exempted from premarket testing. Normally, a consumer device that emits radiation, such as a mobile phone or cell phone, would go through a process of pre-marketing testing that would include a series of in vitro and in vivo studies to evaluate predictions of risk to the population that would use them. Cell phones, however, were exempted from that testing based on pressure from the mobile phone industry in 1984. That input was based on science that was present in the public domain at the time that indicated that the only health effect that could follow from microwave exposure had to do with the heating of biological tissue. And because cell phones operated at very, very low power, they would not be able to heat tissue. They were, therefore, excluded from the onerous process of pre-market testing. That exemption was known as the “low power exclusion, and in retrospect, that one political mistake has put millions of people at risk of serious disease.

Question 5) Were cell phones tested in Canada prior to sales?

Prologue to Question 6) (interview continued)

Following the public hearing, Congress took serious issue with both the Food and Drug Administration, which was the agency of record responsible for these radiation emitting devices, as well as with the mobile phone industry itself. Congress put both on the spot and the mobile phone industry agreed to put up what became \$28.5 million dollars in research funding as long as the FDA did not ban mobile phones at the time. I was the person given the responsibility of overseeing and conducting that research. Between 1993 and 1999, with more than 200 doctors and scientists from around the world participating, and the Harvard School of Public Health reviewing more than 56 studies, we ran what still remains the largest program ever conducted in the world on the dangers of mobile telephony and wireless communications in general.

Question 6) Are any of the studies referred to by Dr. Carlo considered in the weight-of-evidence approach of Health Canada?

Prologue to Question 7) (interview continued)

CG: When you went public with your findings in 1999, it created great controversy. Your findings about cell phones increasing brain cancer are still dismissed by the industry and government regulatory agencies. How is this possible?

Dr. Carlo: This is not based on mere differences of opinion. Our findings in 1999 were the first to indicate increases in brain cancer among cell phone users and other studies have since corroborated those findings. In the peer-reviewed published literature today, more than 300 statistically significant findings show excess risk of brain cancer and other tumours among people who use mobile phones. We

have mechanistic studies that show how the cancer increase happens following exposure. That government agencies and the industry can deny the existence of those findings is astonishing.

Question 7) Are these 300 studies included in the weight-of-evidence approach used by Health Canada?

Prologue to Question 8) (interview continued)

CG: Standards adopted by the World Health Organization, our own Health Protection Agency and the International Commission on Non-Ionizing Radiation Protection suggest there is no problem with current levels of exposure from cell phones and base stations. What are your views on those limits set in relation to the sort of work you have been doing?

Dr. Carlo: Those standards are irrelevant. Remember, this is high technology and every six months the technology changes. It evolves so rapidly that the old days are three or four years ago. The ICNIRP guidelines came into being in 1998, and are based on information that was developed many years prior to that. In this particular area, that is ancient history. The ICNIRP guidelines are also based on thermal mechanism data based on heating. The heating mechanism, with regard to information-carrying radio waves, is mostly irrelevant to the situation we have today.

Question 8) Considering Dr. Repacholi's link to industry, ICNIRP, WHO and SC6, has SC6 been compromised?

Prologue to Question 9) (interview continued)

Our view is that this has now become a medical problem – we are beyond the time where discussing the science regarding “is there a problem” has public health value. We have patients in many countries who have these very obvious membrane sensitivity symptoms. Membrane sensitivity syndrome has been around for about 25 years. Originally, this type of condition was the result of a high level of exposure to chemicals; we used to call it chemical sensitivity. Now we have identified the same type of condition in patients who are exposed to various types of electromagnetic radiation. It is a medical problem because we have people who are sick and need medical attention.

People with membrane sensitivity syndrome can be in a room where somebody turns on a cell phone and they will end up having an immediate adverse and traumatic reaction. They develop internal bleeding and they will have blood in their stool. The condition is very debilitating. It prevents people from being able to work. They cannot earn a living; they have difficult relationships with their children and their spouses give up on them. Families are shattered. It is a very serious medical condition with wide ranging ramifications.

CG: Medically, how does this happen?

Dr. Carlo: The pathological mechanisms are the key to both understanding the problem and prescribing preventive and therapeutic interventions to solve the problem. All electromagnetic radiation in the electromagnetic spectrum is not created equal. We have done work that identifies at least four different effect windows with different mechanisms of harm that are very unique. One effect window is what you have from the extremely low-frequency electromagnetic field, the power line frequency, if you will. What happens at that part of the electromagnetic spectrum is that the magnetic field is dominant. In an electromagnetic field, there is always a magnetic field and an electric field traveling perpendicularly. The magnetic field produces an electric field and the electric field produces a magnetic field and the magnetic field produces an electric field. That is why it radiates – because it is a self-propagating system. But at the low end of the electromagnetic spectrum, the magnetic field is predominant.

When you have an ELF (Extremely Low Frequency) field that is pushed by high power, you have a direct magnetic impact on the local physiology of cells and tissues. We know that that mechanism involves disrupting what we call gap-junction communication between cells. I do not need to go into all

of that, but the fact is that we understand how it works. It is a direct magnetic effect and because magnetic fields have existed in nature since the beginning, we, as human beings, have developed compensatory mechanisms so that there is a threshold. There is a degree of magnetic field that we can sustain without being adversely affected. So unless you have a very high amount of power pushing that magnetic field, as you would have underneath a power line, for example, you do not cross the threshold for this direct magnetic effect. That is the ELF window.

At the other end of the spectrum, we have the ionizing radiation window and at the high end of the spectrum, with ionizing radiation, the electric field is so predominant that you have extremely high energy. Those electromagnetic waves up in the ionizing range – and they come from sunlight and lightning and a bunch of other natural sources as well – break apart chemical bonds.

Because that damage is so determinative or severe, we believe that, at least in terms of clinical manifestations, there is also a threshold. That means there is a safe level. In between, you have the radio frequency radiation window; that is the third window. What we have learned is this: a raw microwave signal, 1,900 megahertz, in other words, is oscillating at 1,900 million cycles per second. To put that in context with your heart, your heart beats at two hertz, two cycles per second. So a raw microwave is beating at 1,900 million cycles per second. That is too fast for your body to pick up; your body simply does not recognize it. The only time your body recognizes it is if you put 100 watts of power behind that signal and then you can heat tissue and meat like you would in a microwave oven. So when you put high power behind a microwave, you cause heating. That is the thermal window that the current government standards address.

Now, because the raw microwave is invisible to biological tissue unless pushed by high power, it is not a problem. However, with wireless communication, we must carry information and we have to be able to have that information deciphered at the other end of a phone call so that when we talk on the phone we want somebody to hear us talking. In order for that to happen, the information has to be packeted and it is bundled in packets based on amplitude modulation. Another factor is that for the phone companies to make money, they must have multiple people talking on one frequency band at the same time. So for that to happen, you have breaks in the modulation to make room for new calls. That is either going to be code domain breaks or time domain breaks, so that what you have is a circumstance where a packet of data moves and then it stops and then it moves and then it stops because of this multiple access. When that happens, it forms a secondary wave.

The best analogy we have been able to come up with for a secondary wave is the old clothesline, which would be on a pulley. An empty clothesline is like the raw microwave signal – the 1,900 megahertz carrier signal, for example. Putting clothes on the clothesline is the equivalent of these data packets and when you move the clothes through space on the clothesline, they wave back and forth: the secondary wave. That wave is what we call the information-carrying radio wave. The wave that is formed by the packeting of information oscillates in the hertz range and in the hertz range, the body can recognize it. Here is what happens: at the level of the cell membrane – whether it is a brain cell, a blood cell, a nerve cell, a liver cell, a bone cell or a skin cell – there are protein receptors on the cell membrane and their job is to keep track of what is going on in the environment around the cell. You have chemical receptors and you have vibrational receptors. The vibrational receptors are able to pick up radio signals that oscillate in the hertz to kilohertz range.

As the information-carrying radio wave comes in the vicinity of the cell, the vibrational protein recognizes it within milliseconds. But because in the beginning there were no information-carrying radio waves – they are not natural; they are completely manmade – the body interprets the information-carrying radio wave as a foreign invader. When that interpretation happens, a message goes inside the cell that says: “We are under siege; we need to protect ourselves.” First, the active transport channels, which are the avenues where nutrients pass into the cell and waste products pass out, begin to close down. As the active transport channels begin to close down, you have a circumstance where nutrients that are in the river between the cells are not able to get into the cell. When nutrients cannot get into the

cell, the cell becomes nutrient and energy deficient. When the cell becomes energy deficient, it is not able to communicate with surrounding cells, so that you have a disruption in what we call intercellular communication.

If you think about it, when cells are working together – talking to each other and working together – you have a tissue. When tissues are talking together and working together, you have an organ. When organs are talking together and working together, you have an organism, like a human. So when you disrupt intercellular communication, you are disrupting a fundamental physiological process. What happens is that intercellular communication is disrupted. Messages between cells cannot be sent because the cell does not have enough energy to do that. At the same time, because these active transport channels have closed down, waste product builds up inside the cell. When waste product builds up inside the cell, you have a very high concentration of highly reactive molecules called free radicals. Free radicals, like the free radicals in the 1960s, love a party. Inside the cell, the party is going on at the mitochondria, which is where all of the respiratory functioning of the cell takes place. The free radicals, preferentially, will go to the mitochondria and disrupt the functioning of the mitochondria. In disrupting the functioning of the mitochondria, you create cellular dysfunction, meaning that the cell is not able to do its job properly. That is why, for example, if you have a cell whose job is keeping the blood-brain barrier closed and that cell is now dysfunctional, the blood-brain barrier opens. Indeed, we and others have seen leakage in the blood-brain barrier as an effect.

Additionally, the free radicals interfere with DNA (deoxyribonucleic acid) repair inside the cell. We know this now because several studies from around the world have shown the formation of micronuclei following exposure to these information-carrying radio waves. A micronucleus is a piece of DNA that functions well enough to form a membrane around itself, but it has no other purpose. As long as it stays inside the cell it is okay, but when the cell is disrupted at the mitochondria level, it goes through a process that we call apoptosis, or programmed cell death. The cell actually commits suicide to make room for another cell to come in. This happens on a regular basis. Every six months or so, you turn over all of your cells because of apoptosis. When apoptosis happens, the cell membrane disintegrates and whatever is inside the cell goes into the space between the cells and the micronuclei go into the space in between the cells.

Under normal circumstances, a message would be sent to the immune system saying, “We have micronucleus here. Send some macrophages so we can get rid of it.” The problem is the intercellular communication has been disrupted and the message to the immune system does not get there. So now you have a micronucleus that is a piece of wild DNA sitting in a nutrient-rich environment and it is free to clone and proliferate. That is the mechanism for the development of a tumour. If you look at the biological cellular mechanism, we have a basis now to explain the diversity of symptoms that we see in the people in our registry. We published a paper late last year proposing a link between the increasing incidence of autism around the world and exposure to information-carrying radio waves (www.buergerwelle.de/pdf/emr_autism_acnem_final_1.pdf).

CG: So where do we go from here?

Dr. Carlo: Well there are a couple of things that are obvious. First, over the past 15 years, the issue has evolved from a scientific determination of whether or not there are health problems caused by wireless technology to the realization that we have an emerging medical crisis for people who are electro-hypersensitive. We have a potential link to autism and other serious health effects. Many of us believe that the threat posed by wireless technology is the most serious we will face in our lifetime. The top priority for us now is to address those medical concerns. Second, it is clear that government agencies will not be able to mobilize themselves fast enough to help. The inertia in those agencies prevents efficient adaptation and the problem is further complicated by the enormous political influence of the wireless industry compounding that inertia. It is going to be up to individuals to take steps to protect themselves and their families.

Question 9) Mr. Minister, would you please address what is wrong, in your opinion, with Dr. Carlo's statement, realizing whatever you omit must be taken as correct?

Prologue to Question 10-18)

Health Canada considers electromagnetic sensitivity (EMS) as psychosomatic. It wasn't that long ago that fibromyalgia was considered psychosomatic. At King's College Hospital <http://www.kch.nhs.uk/research/current-research/interface-of-psychiatry-and-medicine/> they have a department looking at **Medically unexplained syndromes**: chronic fatigue syndrome, fibromyalgia, irritable bowel syndrome, overlaps between syndromes. Doctors in Canada now know fibromyalgia is real. EMS is real but Doctors in Canada are not yet aware because of a reluctant Health Canada.

In my previous petition I used the head of the Consumer and Corporate Radiation Protection Bureau of Canada's Dr. Bradley's statement, "At this time, neither HC nor the WHO recognize that symptoms attributed to EHS from low-level RF fields (as located around cell towers) are causally related to RF field exposure."

So I asked: **13a) I ask HC to name 3 such studies.**

At this point I received 4 studies

- 1) Rubin GJ, Cleare AJ, Wessely S (2008). Psychological factors associated with self-reported sensitivity to mobile phones. *Journal of Psychosomatic Research*, 64, 1-9.
- 2) Rubin GJ, Hahn G, Everitt BS, Cleare AJ & Wessely S (2006). Are some people sensitive to mobile phone signals? Within participants double-blind randomised provocation study. *British Medical Journal*, 332, 886-889.
- 3) Rubin GJ, Das Munshi J & Wessely S (2005). Electromagnetic hypersensitivity: A systematic review of provocation studies. *Psychosomatic Medicine*, 67, 224-232.
- 4) Stacy Eltiti, Denise Wallace, Anna Ridgewell, Konstantina Zougkou, Riccardo Russo, Francisco Sepulveda, Dariush Mirshekar-Syahkal, Paul Rasor, Roger Deeble, Elaine Fox Does Short-Term Exposure to Mobile Phone Base Station Signals Increase Symptoms in Individuals Who Report Sensitivity to Electromagnetic Fields? A Double-Blind Randomized Provocation Study.

Please note Mr. Minister that Dr. Rubin is funded by industry. At this site <http://www.iop.kcl.ac.uk/departments/?locator=364&context=975> it states that the mobile phone research unit (Dr. Rubin) at King's College is funded by two research grants awarded by the UK Mobile Telecommunications and Health Research programme.

Also please note: **Note - A Systematic Review of Treatments for Electromagnetic Hypersensitivity**
G. James Rubin, Jayati Das Munshi, Simon Wessely - *Conclusions*: The evidence base concerning treatment options for EHS is limited and more research is needed before any definitive clinical recommendations can be made.

Also please note, the fourth study by Eltiti et. al.: Does Short-Term Exposure to Mobile Phone Base Station Signals Increase Symptoms in Individuals Who Report Sensitivity to Electromagnetic Fields? A Double-Blind Randomized Provocation Study reports that 12 sensitives withdrew after the first session and "during the open provocation, sensitive individuals reported lower levels of well-being in both the global system for mobile communication (GSM) and the universal mobile telecommunications system (UMTS) compared with sham exposure, whereas controls reported more symptoms during UMTS exposure. Sensitive individuals reported elevated levels of arousal when exposed to a UMTS signal."

Also please note: On the same site “Recent estimates of the prevalence of electrosensitivity vary from country to country. The following estimates are all based on the results of telephone or questionnaire surveys and represent the approximate percentage of people in that country who believe that they are particularly sensitive to electromagnetic fields.

Sweden: 1.5 per cent
California: 3.2 per cent
UK: 4 per cent
Switzerland: 5 per cent
Germany: 8 per cent

As you recall I asked the following questions:

13b) What part did industry play in these studies?, 13c) What was the background of the scientists running the study? Did any of them have a background in EHS?, 13d) Did any of the scientists suffer and therefore understand EHS?, 13e) Why would anyone with EHS put themselves through the pain of a study?, 13f) Were EHS sufferers consulted on the design of the study?, 13g) Most importantly, how many EHS dropped out of the study? How did these drop-outs influence the results of the study?

You may recall you did not respond to these questions.

And then I presented: In the report, “Electrohypersensitivity (EHS) in the Netherlands – A Questionnaire survey” by Hugo Schooneveld and Juliette Kuiper of the Dutch Electrohypersensitivity (EHS) Foundation, December 2007, they state “Some persons have become electrosensitive and respond to some specific EMFs in their environment and show some of the possible health effects induced by their personal stress system...One of the main problems is that many people with EHS symptoms have no idea which type of EMF –if any- is specifically annoying to him or her. This is caused by the length of time usually elapsing between EMF exposure and health effect: several hours is not unusual (Schooneveld and Arends-Zimmermann, 2006). One simply does not see the connection...The point never contemplated so far is that EHS is a problem of the individual, not of a group. We all tend to expect the classical picture of an illness: much like measles would make the skin of children appear reddish, and influenza would elevate body temperature, we expect a similar marker for EHS. An obvious marker apparently does not exist so far and we should perhaps stop looking for physically recognizable signs of EHS...There have been quite a few studies in which EMF sensitive and non-sensitive volunteers were exposed to high-frequency EMFs, signals mimicking those of GSM or UMTS transmitters. The question was whether EHS people could demonstrate –under controlled conditions- that they could ‘feel’ whether the transmitter was ‘on’ or ‘off’...The outcome was mostly negative and authors like Rubin et al. (2006) and others conclude that there was no evidence for an EMF-feeling talent. The present data show that the situation is more complex: not all EHS people will react to high-frequency EMFs. In future experiments, more attention should be paid to the specific conditions under which EHS can be demonstrated by individual volunteers...Therefore, it seems essential that volunteers participating in such studies should be selected with care and questioned in detail about their personal experiences. Exposure conditions should be adjusted to those individual preferences.”

Question 10) Mr. Minister, do you personally know anyone who suffers from fibromyalgia?

Question 11) Mr. Minister, do believe fibromyalgia is a medical condition?

Question 12) Mr. Minister, do you personally know anyone who suffers from EHS?

Question 13) Mr. Minister, do you see how EHS and fibromyalgia may both be medically unexplained syndromes?

Question 14) Why, in an attempt to prove to me that EHS is psychosomatic, would you quote studies that are funded by industry and have an implied bias?

Question 15) Why would you quote studies that recommend further research as opposed to definitive causality studies?

Question 16) Why did you not answer my questions 13(b through g) in my previous petition?

Question 17) Are you aware Mr. Minister that in the four studies you put forward none of the conditions as outlined in ,“Electrohypersensitivity (EHS) in the Netherlands – A Questionnaire survey” by Hugo Schooneveld and Juliette Kuiper of the Dutch Electrohypersensitivity (EHS) Foundation, December 2007, were met?

Question 18) Can you provide 5 EHS studies that fit the above criteria to prove your point?

Prologue to Question 19 and 20)

From St Catherine’s “The Standard” Tiffany Mayer Sat June 7/08

“But Magda Havas, an environmental toxicologist and professor at Trent University in Peterborough, said the federal agency is considering only one aspect of radio frequency exposure: short-term thermal effects. As long as the radiation emitted doesn’t raise body temperature one degree Celsius in six minutes, it’s considered safe.

Those guidelines are “woefully inadequate,” she said.

What Havas, who used cellphone research to pen a report on health and environmental effects of the proposed San Francisco wireless network, and other scientists studying the issue say is missing are guidelines for non-thermal or biological effects. There also aren’t guidelines governing long-term exposure.

What’s emitted from Wi-Fi, she said, is among the lowest forms of radiation but we also live close to it, with equipment in our homes and offices.

“You’re exposed two ways: you’re exposed from your computer, and that’s going to be the highest exposure, and you’re exposed because of the antenna that that computer is talking to,” she said. “The two concerns are the people who use the technology. They’re obviously going to get the highest dose of radiation. The next concern is people who live in close proximity to the antennas. Even though they’re not using this technology, they’re being exposed to it 24/7.”

Havas is used to detractors and those who say there’s no conclusive evidence of Wi-Fi’s health risks.

“The question of whether it’s conclusive or not is a judgment call, and your judgment and my judgment and some-one’s judgment who works for the cellphone industry are going to be quite different,” Havas said.

“What you’ve got to ask is, is there any evidence of harm? When you ask that question, the answer is a definite yes. There is harm. The next question you ask is, has every study showed harm? And the answer is no, but that’s normal in science.”

That’s when those scrutinizing the data need to look at how thorough the studies are and who’s funding them, she said.

Between 60 and 70 per cent of those not funded by the wireless industry show adverse health effects, such as cancer and electrohypersensitivity, Havas said. But so do about 30 per cent of those funded by the industry. The problem is, those results are down-played in study abstracts, the part that lay people are most likely to read, she said.”

Question 19) Mr. Minister, if between 60 and 70 per cent of those studies not funded by the wireless industry show adverse health effects, why do you insist on not taking them into account in your weight-of-evidence approach?

Question 20) If about 30 per cent of those studies funded by the industry show adverse health effects, such as cancer and electrohypersensitivity, why are these studies not reflected in your weight-of-evidence approach to the extent that the precautionary principle would be invoked?

Prologue to Question 21)

As you recall Mr. Minister, in my previous petition I quoted Devra Lee Davis, Ph.D., MPH in my question 54. She points out, “When it comes to sorting through the risks of cell phones, we have lately been assured that there are none based upon reports from what appear to be independent scientific reviewers. For example, researchers from the Danish Cancer Society reported in the *Journal of the National Cancer Institute* in 2006 that they found no evidence of risk in persons who had used cell phones. Headlines around the world boasted of this latest finding from an impeccable source published in a first tier scientific journal...

But let’s look at what the researchers actually studied.

They reviewed health records through 2002 of about 421,000 people who had first signed up for private use of cell phones between 1982 and 1995. A “cell phone user” in the study was anyone who made a single phone call a week for six months during the period 1981 to 1995. The study kicked out anyone who was part of a business that used cell phones, including only those who had used a cell phone for personal purposes for eight years.

This research design raises a lot of questions. Why did they not look at business users – those with far more frequent use of cell phones? Why lump all users together, putting those who might have made a single phone call a week with those who used the phones more often?

Why stop collecting information on brain tumors in 2002 when we know that brain tumors often take decades to develop and be diagnosed?

When you are looking at a large population to find an effect, generally the more people you study, the better your chance of finding something. But if you merge a large number of people with very limited exposure together with a small number of people with very high exposure, you dilute the high-exposure group and so lower your chances of finding any effect at all. It would be better to compare the frequent users with non-users, omitting the limited users altogether. Lumping all these various users together is like looking all over a city for a stolen car when you know it’s in a five-block radius. Perhaps you’ll find what you’re looking for, but the chances are greater that you won’t... The Danish study was designed to look definitely thorough – 421,000 people! – but in fact it was biased against positive findings from the start. Given how broadly cell signals now penetrate coffee shops, airports, and some downtown areas of major cities, it is very difficult to find any truly unexposed groups against which to compare results. Because cell phone use has grown so fast and its technologies change every year, it is as if we are trying to study the car in which we are driving.”

Question 21) Mr. Minister, in your weight-of-evidence protocol, can you assure Canadians such obvious study design failures that have so far slipped by your notice don’t continue to do so?

Prologue to Question 22)

I stated in the prologue to my question 41) "For brain tumors, people who have used a cell phone for 10 years or longer have a 20% increase in risk (when the cell phone is used on both sides of the head). For people who have used a cell phone for 10 years or longer predominantly on one side of the head, there is a 200% increased risk of a brain tumor. This information relies on the combined results of many brain tumor/cell phone studies taken together (a meta-analysis of studies)." Your response was, "Health Canada disagrees ..."

In June of this year, I received this information: Dr Vini Gautam Khurana is a Mayo Clinic-trained neurosurgeon with an advanced neurosurgery Fellowship in cerebral vascular and tumour microsurgery from the Barrow Neurological Institute in Phoenix, Arizona. He holds active medical registration with the Medical Boards of the Australian Capital Territory and the State of New South Wales, Australia. He is the only Australian medical graduate to have completed an entire neurosurgical training programme, PhD and Fellowship in the United States of America, where he trained and worked for 10 years. Dr. Khurana has written a research paper the aim of which is to: "[S]cientifically and objectively review data suggesting or refuting a relationship between mobile phone usage and the occurrence of malignant brain tumours. Following fourteen months of research involving a comprehensive review of over 100 sources in the recent medical and scientific literature in addition to the Press and Internet, the author concludes that there is a growing body of statistically significant evidence for a relationship between the overall length of use of a mobile phone and the delayed occurrence of a brain tumour on the same side of the head as the "preferred side" for mobile phone usage. The elevated risk (increased odds) appears to be in the order of 2 - 4 fold."

Question 22) Mr. Minister, if you take industry studies off the scale of weight-of-evidence, can you still, in all honesty, say there is absolutely no evidence that people who heavily use cell phones on one side of the head have no increased risk of a brain tumour on that side of the head?

Prologue to Question 23)

I asked in my question 42a) "*People who have used a cell phone for ten years or more have higher rates of malignant brain tumor and acoustic neuromas. It is worse if the cell phone has been used primarily on one side of the head. Does the Canadian government take this information into account when issuing guidelines?*" Your response was "...disagrees...However, several much larger studies from the WHO INTERPHONE program have failed to replicate these findings."

At, http://groups.google.com/group/mobilfunk_newsletter/browse_thread/thread/c848bde8f4f2b6ba, Lloyd Morgan writes, "A presentation titled, INTERPHONE STUDIES TO DATE, AN EXAMINATION OF POOR STUDY DESIGN RESULTING IN AN UNDER ESTIMATION OF THE RISK OF BRAIN TUMORS, was given at this year's Bioelectromagnetics Society (BEMS) meeting (San Diego, CA June 8-12).

The essence of the presentation was there are multiple design flaws in the Interphone Protocol, each resulting in an underestimation of tumor risk. As a result of these flaws, the examination of 10 Interphone studies on the risk of brain tumors from cellphone use, found 60 statistically significant protective results showing use of a cellphone protects the user from brain tumors.

Such results are prima facie evidence of the studies' incapacity to determine if there is a risk.

Nevertheless, as shown in the presentation, when the highest exposures are examined (>_10 years of use or use of the cellphone on the same side of the head as the tumor), the "protective" effect is substantially reduced; suggesting that an increased risk counteracts the design flaw. When these 2 highest exposures are combined, then the Interphone studies do find a risk!"

Mr. Morgan goes on to ask Elizabeth Cardis, the head of the entire 13-country Interphone study what was the total cost of the Interphone Study and what was industry's contribution? She responded 10M Euros overall; 3.2M from Industry.

As you are aware Mr. Minister, the Interphone study has been delayed and delayed, probably at the insistence of industry. Notwithstanding, if nearly 1/3 of the funding for the Interphone study came from industry, it would be fair to assume industry is affecting the weight-of-evidence of the findings.

Question 23) In light of Mr. Morgan's article and recent studies, if all industry funded studies are removed from the weight-of-evidence scale, do people who have used cell phones primarily on one side of the head for ten years or more have higher rates of malignant brain tumor and acoustic neuromas on that side of the head?

Prologue to Question 24)

I asked in my question 56) "Are the residents in the vicinity of the Union Street Water Tower Cell Tower in Simcoe, Ontario as safe today as they were before the cell tower was enabled?"

Your response was, "Any confident scientist would estimate it in percentages as approximately 99.99%. This reflects the fact that there is always some level of uncertainty in science. There is to date no convincing scientific evidence to support the occurrence of adverse health effects at levels below the exposure limits specified in Health Canada's Safety Code 6. This conclusion is based upon the bulk of scientific evidence from animal, *in-vitro* cellular and epidemiological studies that have been carried out worldwide, including at our own laboratory. There is no convincing evidence of increased risk of disease from exposure to radiofrequency (RF) electromagnetic fields from cell towers."

Question 24) As I have demonstrated Mr. Minister the mathematics of your designate(s) are incorrect. Using a weight-of-evidence scale that includes biased studies is a tipped scale. As shown previously, anywhere from 1.5% to 8% of the population suffers from EMS. $100\% - (1.5\% \text{ to } 8\%) = (98.5\% \text{ to } 92\%)$ and this is only scratching the surface. Would you consider changing your 99.99% stated above in light of this mathematical equation?

Question 25) Mr. Minister, should you remove all industry funded studies and studies from individuals with a vested interest in the status quo, the whole weight of your weigh-of-evidence method would be shifted towards implementing a precautionary approach towards electromagnetic radiation. Would you be willing to take such an approach?

June 20/2008.

Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

NOV 04 2008

Dear [REDACTED]

This is in response to your environmental petition no. 235-B of June 20, 2008, addressed to Mr. Scott Vaughan, the Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised concerns about radiation emitted from cellular antennas and towers.

I am pleased to provide you with the enclosed Health Canada response to your petition. I understand that the Minister of Industry will be responding separately to questions which come under the purview of his department.

I appreciate your interest in this important matter, and I hope that you will find this information useful.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Leona Aglukkaq'.

Leona Aglukkaq

Enclosure

c.c. Mr. Scott Vaughan, CESD
The Honourable Tony Clement, P.C., M.P.

Canada

**Health Canada Response to
Environmental Petition No. 235-B filed by [REDACTED]
under Section 22 of the *Auditor General Act*
Received June 24, 2008**

Radiation emitted from cellular antennas and towers

November 5, 2008

Minister of Health

1. *The crux of this long prologue is how this weight-of-evidence measurement that is being used to evaluate the quantity and quality of studies used to formulate Safety Code 6? How is this measurement being applied in any way fairly, considering the biased nature of the evaluators from industry and HC?*
3. *Is it fair to conclude that studies generated by Health Canada should be removed from the weight-of-evidence scale due to the HC's long running history of maintaining the status quo? Is this also why SC6 is not being updated?*
21. *Mr. Minister, in your weight-of-evidence protocol, can you assure Canadians such obvious design failures that have so far slipped by your notice don't continue to do so?*

Answer to Questions 1, 3 & 21:

In the past decades, there have been numerous studies conducted to assess the possible health effects of radiofrequency (RF) fields on human health and the results overwhelmingly indicate that there are no adverse effects observed when exposures remain below the safety limits recommended by science-based RF exposure standards, including Health Canada's Safety Code 6.

Health Canada's Safety Code 6 sets out safety requirements for the installation and use of radiofrequency (RF) and microwave devices that operate in the frequency range from 3 kHz to 300 GHz. It can be found at <http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/99ehd-dhm237/index-eng.php>.

The exposure limits for the general public, as specified in Health Canada's Safety Code 6, were designed to take into account individuals of all ages of varying health status (which include susceptible groups or individuals such as children, pregnant women and the aged) who are unaware of potential risks. Again, when exposures remain below the safety limits recommended by science-based RF exposure standards, including Health Canada's Safety Code 6, no adverse effects are anticipated.

Although the current version of Safety Code 6 was published in 1999, Health Canada scientists have continued to carry out internally funded studies on RF fields and to review the scientific literature on an ongoing basis either as participants in standard-setting bodies and international scientific meetings, as academic or peer reviewers for publications, or as part of a continuous program of literature surveillance. Based on information to date and the weight-of-evidence from this ongoing scientific review, the exposure limits specified in Safety Code 6 remain current and valid.

The health effects literature reviewed by Health Canada staff is the same as that reviewed by all other national and international standards organizations. It is important to point out that the limits outlined in Safety Code 6 are similar, if not more restrictive, than most other international safety guidelines.

2. *How valid can your citing of WHO or ICNIRP be under these circumstances?*

Both the World Health Organization (WHO) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) are highly reputable international science-based organizations which comprise a diverse set of esteemed scientists from around the world in a variety of disciplines.

4. *Mr. Minister, do you agree with this chart? Can you provide alternate data?*

Health Canada scientific staff does not consider this chart as an accurate reflection of the nature of the science. This chart reflects the opinion of one scientist which is not reflective of the consensus opinion of the majority of his international counterparts.

6. *Are any of the studies referred to by Dr. Carlo considered in the weight-of-evidence approach of Health Canada?*
7. *Are these 300 studies included in the weight-of-evidence approach used by Health Canada?*

Answer to Questions 6 & 7:

Yes. All credible peer-reviewed scientific literature is included in Health Canada's assessment. Health Canada considers all credible, peer-reviewed scientific studies and scientific evidence using a weight-of-evidence approach for assessing the possible health risks of radiofrequency fields. This takes into account both the quantity of studies on a particular endpoint (whether adverse or not), but also the quality of those studies. Poorly conducted studies (e.g. incomplete dosimetry or inadequate control samples) receive relatively little weight while properly conducted studies (e.g. all controls included, appropriate statistics, complete dosimetry) will receive more weight. There are numerous scientific flaws with the studies referenced by the petitioner; therefore these studies carry little weight in the risk assessment process.

8. *Considering Dr. Repacholi's link to industry, ICNIRP, WHO and SC6, has SC6 been compromised?*

No. As stated in the previous petition, Dr. Repacholi left Health Canada in 1983. As such, he played no part in the revision process of Safety Code 6 that resulted in the 1999 version.

9. *Mr Minister, would you please address what is wrong, in your opinion, with Dr. Carlo's statement, realizing whatever you omit must be taken as correct?*

Based upon current scientific evidence, there is no convincing scientific evidence of any adverse health effects at EMF exposure levels below the limits outlined in Safety Code 6.

10. *Mr. Minister, do you personally know anyone who suffers from fibromyalgia?*

11. *Mr. Minister, do you believe fibromyalgia is a medical condition?*

12. *Mr. Minister, do you personally know anyone who suffers from EHS?*
13. *Mr. Minister, do you see how EHS and fibromyalgia may both be medically unexplained syndromes?*

Answer to Questions 10 to 13:

The petitions process was established by Parliament to make sure Canadians can get answers from federal ministers on specific environmental and sustainable development issues that involve federal jurisdiction. Questions 10 to 13 are outside the purview of the requests that can be made under this process.

14. *Why, in an attempt to prove to me that EHS is psychosomatic, would you quote studies that are funded by industry and have an implied bias?*

All credible peer-reviewed scientific literature is included in the weight-of-evidence approach for assessing the possible health risks of EMF. Thus, both adverse and no effect studies are included as are those funded by industry or via other funding sources. The source of the research funding does not influence the evaluation process, only the quality and impact of the research outlined within the individual research papers are considered in the evaluation.

15. *Why would you quote studies that recommend further research as opposed to definitive studies?*

Generating a strong basis for health risk assessment requires independent validation and/or replication of reported bioeffects and a complete assessment of all possible factors that may be responsible for a particular effect, or lack thereof. As such, many, if not most, scientific papers often highlight the need for additional research in areas not studied in the current manuscript. It is important to re-iterate that no single study ever provides definitive proof, or lack thereof, of an effect. Only an evaluation of the scientific literature as a whole, using a weight-of-evidence approach, can provide the most accurate evaluation for the purposes of health risk assessment.

Health Canada scientists have continued to carry out internally funded studies on RF fields and to review the scientific literature on an ongoing basis either as participants in standard-setting bodies and international scientific meetings, as academic or peer reviewers for publications, or as part of a continuous program of literature surveillance.

16. *Why did you not answer my questions 13 (b through g) in my previous petition?*

Health Canada cannot speak on behalf of the authors of these studies. For more information, Health Canada suggests that the Petitioner contacts the authors directly.

17. *Are you aware, Mr. Minister that in the four studies you put forward none of the conditions as outlined in, "Electrohypersensitivity (EHS) in the Netherlands – A questionnaire survey" by Hugo Schooefeld and Juliette Kuiper of the Dutch Electrohypersensitivity (EHS) Foundation, December 2007, were met?*

18. *Can you provide 5 EHS studies that fit the above criteria to prove your point?*

Answer to Questions 17 & 18:

The reference the Petitioner provided represents the opinion of two individuals and does not constitute the official opinion or practice of any scientific organization for the proper conduct of scientific research on this topic. Health Canada's conclusions are based on internal scientific reviews of original relevant scientific studies that are published in internationally recognized peer-reviewed journals. For more information, please refer to references listed in Safety Code 6 <http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/99ehd-dhm237/index-eng.php>

19. *Mr. Minister, if between 60 and 70 per cent of those studies not funded by the wireless industry show adverse health effects, why do you insist on not taking them into account in your weight-of-evidence approach?*
20. *If about 30 per cent of those studies funded by the industry show adverse health effects, such as cancer and electrohypersensitivity, why are these studies not reflected in your weight-of-evidence approach to the extent that the precautionary principle would be invoked?*

Answer to Questions 19 & 20:

As stated previously, the numbers quoted were derived from the opinion of one scientist who expressed a minority opinion among his peers. Health Canada scientific staff disagree with these estimates. It is important to point out that all credible peer-reviewed scientific literature is included in the weight-of-evidence approach for assessing the possible health risks of EMF. Thus, both adverse and no effect studies are included as are those funded by industry or via other funding sources. The source of the research funding does not influence the evaluation process, only the quality and impact of the research outlined within the individual research papers are considered in the evaluation.

22. *Mr Minister, if you take industry studies off the scale of weight-of-evidence, can you still, in all honesty, say that there is absolutely no evidence that people who heavily use cell phones on one side of the head have no increased risk of a brain tumour on that side of the head?*
23. *In light of Mr. Morgan's article and recent studies, if all industry funded studies are removed from the weight-of-evidence scale, do people who have used cell phones primarily on one side of the head for 10 years or more have higher rates of malignant tumour and acoustic neuromas on that side of the head?*

Answer to Questions 22 & 23:

As indicated previously, all credible peer-reviewed scientific studies are included in a weight-of-evidence approach for risk assessment. The fact that some studies are either directly or indirectly funded, in whole or in part, from the wireless industry does not necessarily mean that the results are to be dismissed. This does not constitute a valid reason to dismiss these opinions or the research findings outright. The only scientifically justifiable approach is to evaluate all the

science based upon the merits and deficiencies of individual studies and then roll up the analysis using a weight-of-evidence approach.

Health Canada staff are aware that some epidemiological studies have reported an increased association between laterality of cell phone usage and years of usage (>10 years) with certain brain tumours. However, there are other (larger and scientifically more robust) studies which did not find similar results. The strengths and weaknesses of these studies are evaluated collectively using a weight-of-evidence approach in an ongoing fashion. The outcome of the final INTERPHONE data expected later this year should add a great deal to the collective pool of information available and strengthen the scientific literature.

24. *As I have demonstrated Mr. Minister the mathematics of your designate(s) are incorrect. Using a weight-of-evidence scale that includes biased studies is a tipped scale. As shown previously, anywhere from 1.5% to 8% o the population suffers from EMS. $100\% - (1.5\% \text{ to } 8\%) = (98.5\% \text{ to } 92\%)$ and this is only scratching the surface. Would you consider changing your 99.99% stated above in light of this mathematical equation?*
25. *Mr Minister, should you remove all industry funded studies and studies from individuals with a vested interest in the status quo, the whole weight of your weight-of-evidence method would be shifted towards implementing a precautionary approach towards electromagnetic radiation. Would you be willing to take such an approach?*

Answer to Questions 24 & 25:

Based upon current scientific evidence, there is no convincing scientific evidence that exposure to EMF below the limits outlined in Safety Code 6 is unsafe. If valid scientific evidence were to present itself indicating that the exposure limits in Safety Code 6 were in need of revision, steps would be taken to initiate a review and revise the guideline. Such action may or may not include precautionary measures.

Minister of Industry



Ministre de l'Industrie

Ottawa, Canada K1A 0H5

15/12/08



Dear]

I am writing to provide you with Industry Canada's response to Environmental Petition No. 235-B, dated June 20, 2008, regarding radio frequency (RF) exposure. This petition was forwarded to the Minister of Health and the Minister of Industry by the Commissioner of the Environment and Sustainable Development. I am pleased to respond to your questions that fall within Industry Canada's area of responsibility.

Question 5: Were cell phones tested in Canada prior to sale?

Currently, cell phones and other radiocommunication devices that are to be sold on the Canadian market must be certified under Industry Canada's Radio Standards Specification (RSS), which provides technical regulatory requirements. In addition, radio apparatus must comply with the requirements of RSS-102, entitled *Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)*, which incorporates the limits for such devices from Health Canada's Safety Code 6 guidelines, entitled *Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz*. All cell phone models currently sold in Canada must demonstrate compliance with RSS-102, including testing or computational modelling, as appropriate, unless specifically exempted by RSS-102 due to the device's low power.

.../2

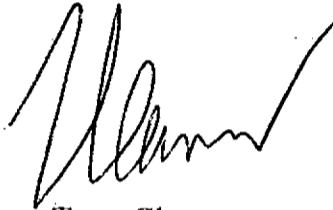
Canada

- 2 -

The first issue of RSS-102 was published in 1999. Prior to 1999, cell phones fell under the 7-watt exemption clause that existed at that time in Safety Code 6, and all cell phone models were tested prior to sale in a manner that ensured this limit was not exceeded. This exemption clause was removed in the 1999 version of Safety Code 6, after which RSS-102 testing was required prior to sale.

I appreciate this opportunity to respond to your petition, and trust that this information is of assistance.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Tony Clement', written in a cursive style.

Tony Clement

c.c.

[REDACTED]
Commissioner of the Environment
and Sustainable Development

February 2, 2009

September 16, 2008

The Auditor General of Canada
 Commissioner of the Environment and Sustainable Development
 240 Sparks St.
 Ottawa, ON
 K1A 0G6



Attn. Petitions.

Please accept the following petition under the Auditor General Act.

On May 20, 2008, I received a response to my petition no. 235 and on Nov 4, 2008 a response to petition 235-B from the Honourable Tony Clement, Minister at the time of Health for Canada. His answers to my questions lead me to believe his ministry did not take my petition seriously and by extension does not take the Auditor General seriously. Industry Canada (IC) fares no better. My petition 264 due on Jan 1 of this year is not in my possession at the time of writing, contravening the guidelines set out by the Auditor General.

Health Canada's (HC) response to my petitions is 180 degrees different from the following letter.

Columbia University, College of Physicians and Surgeons

Department of Physiology and Cellular Biophysics
 630 West 168 Street
 New York, NY 10032

Telephone: (212) 305-3644

Telefax: (212) 305-5775

EMAIL: mb32@columbia.edu

September 11, 2008

An open letter to
 Mayor Young and the Langford Council
 Langford, B.C.

Re: Health effects of cell tower radiation

I have been an active researcher on biological effects of electromagnetic fields (EMF) for over twenty five years at Columbia University. I was also one of the organizers of the 2007 online Bioinitiative Report on the subject. Because of this background, I have been asked to provide background information regarding current discussions about the proposed cell tower.

There is now sufficient scientific data about the biological effects of EMF, and in particular about radiofrequency (RF) radiation, to argue for adoption of precautionary measures. We can state unequivocally that EMF can cause single and double strand DNA breakage at exposure levels that are considered safe under the FCC guidelines in the USA. As I shall illustrate below, there are also epidemiology studies that show an increased risk of cancers associated with exposure to RF. Since we know that an accumulation of changes or mutations in DNA is associated with cancer, there is good reason to believe that the elevated rates of cancers among persons living near radio towers are probably linked to DNA damage caused by EMF. Because of the nature of EMF exposure and the length of time it takes for most cancers to develop, one cannot expect

'conclusive proof' such as the link between helicobacter gastric ulcer. (That link was recently demonstrated by Australian doctor who proved a link conclusively by the bacteria and getting the disease.) However, there is evidence of a plausible mechanism to link EMF increased risk of cancer, and therefore of a need to limit especially of children.

EMF have been shown to cause other potentially biological effects, such as leakage of the blood brain can lead to damage of neurons in the brain, increased

(DNA fragments) in human blood lymphocytes, all at exposure rates well below the limits in the current FCC guidelines. Probably the most convincing evidence of potential harm comes from living cells themselves when they start to manufacture stress proteins upon exposure to EMF. The stress response occurs with a number of potentially harmful environmental factors, such as elevated temperature, changes in pH, toxic metals, etc. This means that *when stress protein synthesis is stimulated by radiofrequency or power frequency EMF, the body is telling us in its own language that RF exposure is potentially harmful.*

There have been several attempts to measure the health risks associated with exposure to RF, and I can summarize the findings with a graph from the study by Dr. Neil Cherry of all childhood cancers around the Sutro Tower in San Francisco between the years 1937 and 1988. Similar studies with similar results were done around broadcasting antennas in Sydney, Australia and Rome, Italy, and there are now studies of effects of cellphones on brain cancer. The Sutro tower contains antennas for broadcasting FM (54.7 kW) TV (616 kW) and UHF (18.3 MW) signals over a fairly wide area, and while the fields are not uniform, and also vary during the day, the fields were measured and average values estimated, so that one could associate the cancer risk with the degree of EMF exposure.

The data in the figure are the risk ratios (RR) for a total of 123 cases of childhood cancer from a population of 50,686 children, and include a 51 cases of leukaemia, 35 cases of brain cancer and 37 cases of lymphatic cancer. It is clear from the results that the risk ratio for all childhood cancers is elevated in the area studied, and while the risk falls off with radial distance from the antennas, as expected, it is still above a risk ratio of 5 even at a distance of 3km where the field was $1\mu\text{W}/\text{cm}^2$. This figure is what we can expect from prolonged RF exposure. In the Bioinitiative Report, we recommended $0.1\mu\text{W}/\text{cm}^2$ as a desirable precautionary level based on this and related studies, including recent studies of brain cancer and cellphone exposure..

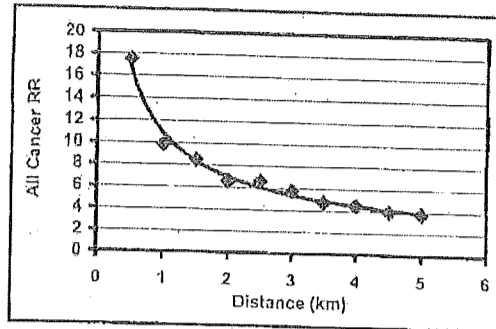
As I mentioned above, many potentially harmful effects, such as the stress response and DNA strand breaks, occur at nonthermal levels (field strengths that do not cause a temperature increase) and are therefore considered safe. It is obvious that the safety standards must be revised down to take into account the nonthermal as well as thermal biological responses that occur at much lower intensities. Since we cannot rely on the current standards, it is best to act according to the precautionary principle, the approach advocated by the European Union and used by the scientists involved in the Bioinitiative report. In light of the current evidence, the precautionary approach appears to be the most reasonable for those who must protect the health and welfare of the public.

Martin Blank, Ph.D.

Associate Professor of physiology and cellular biophysics

Q 1- What specifically does HC object to in the above letter?

Health Canada will deny the validity of the contents of the above letter as they deny the validity of the 2000 studies in the BioInitiative Report. Safety Code 6 (SC6), which is meant to protect Canadians from electromagnetic radiation, is incomplete and antiquated. In my previous petitions HC insisted SC6 is doing the job of protecting Canadians and they refer to a vague "weight of evidence" to prove it. One needs an active



pylori and the swallowing enough exposure to exposure,

harmful barrier that micronuclei

imagination to believe HC has a “weight of evidence” when in the BioInitiative Report alone there are 2000 studies. HC should do the math.

Furthermore, if HC’s biased studies and Industry’s biased studies are removed from their weight of evidence then SC6 is in need of an immediate overhaul. It is due diligence to recognize this and make changes. Their intransigence that the only possible harmful effect from electromagnetic radiation is heat is incredulous.

I intend to show.

- HC and IC show no respect for my inquiries and therefore no respect for the Auditor General’s environmental petition process.
- The Auditor General’s environmental petition process does not put an onus of responsibility on the authors of ministry responses.
- HC does not follow the Precautionary Principle as outlined by the Government of Canada.
- HC has a history of ignoring health warnings.
- HC displays a systemic bias for the status quo.
- HC is not properly staffed to appreciate recent electromagnetic radiation (EMR) science.
- HC is “dragging its feet” on bringing SC6 up to current science enabling Industry to make further inroads into Canadian society.

Health Canada (HC) has a history of being warned of problems and not taking the warnings seriously.

Some examples: fluoroscopes, Thalidomide, smoking, asbestos, DDT, pesticides, carcinogens, tainted blood, SARS, urea-formaldehyde foam insulation, Celebrex, Vioxx, Trasyol, Climacteron, Tequin, Prexige, Permax, Zelnorm, Mellatil, Bextra, chronic fatigue syndrome, post-traumatic stress disorder, fibromyalgia, lead in paints, piping and gasoline, PCB’s, food – (additives {including food dyes, sodium, refined sugar, trans fats, genetically modified foodstuffs}, inspection criteria, inspection process, labelling), x-rays, DEHP, safe drinking water for all Canadians, silicon breast implants, Dakon shield intrauterine device, mercury, emphasis on pharmaceutically driven approaches to cancer over the myriad approaches to prevention, c-difficile, pollution/smog related illnesses, reduced support for AIDS funding, opposition to safe injection sites and electromagnetic radiation and its effect on electromagnetic sensitivity.

It appears HC continues to support Industry products until there is enough public clamour to take action. Most notably HC took the side of Monsanto over their own scientist, Dr. S. Chopra, in the bovine growth hormone scandal. One could surmise from the Dr. Chopra case that HC has a vested interest in the status quo.

Q 2 - To date what is the estimated cost (to the nearest million) to Canadians due to Dr. Chopra’s court case, the Canadian Government’s time, the wrongful dismissal suit?

Q 3 - How many people were fired from HC because of Dr. Chopra’s case?

HC recently delayed the publication of a report on asbestos.

Q 4 – Was the delay of the report on asbestos another example of HC putting Industry before the health of Canadians and in this case the health of citizens of the world?

Q 5 – Was the delay of this report on asbestos further evidence of HC’s commitment to the status quo?

The term “Health Canada” implies a focus on the health of Canadians; the term implies working for the benefit of Canadians’ health, the term implies prevention of health issues and yet from the above examples it appears the title “Health Industry Canada” would be more appropriate.

Q 8 - When, like with smoking, the evidence mounts and it is widely recognized that electromagnetic radiation is harmful, those that defended will have assaulted and abused Canadians. Is there a process in place that

individuals within HC will be held responsible and accountable for their failure to protect Canadians from harmful electromagnetic radiation?

HC's close links to industry were exposed in a *Toronto Star* report on Friday, August 8, 2008, under the banner, "Ottawa Linked to Cell Phone Lobbyists." In this report by Linda Diebel, she states, "Government, business liaisons raise questions on who influences Ottawa on cell phone safety, and how..." and "Two senior government officials involved in determining safety standards for cell phone use sit on the health committee of a powerful group that lobbies the federal government on behalf of the telecommunications industry." The senior official from HC is Dr. Robert P. Bradley, the Director of the Consumer and Clinical Radiation Protection Bureau of Canada. He is responsible for the HC guideline called "Safety Code 6 (SC6)" which is supposed to protect Canadians from overexposure to electromagnetic radiation.

A group of my neighbours, including myself, have been waiting to meet with Dr. Robert P Bradley for months. Our MP, Ms. Diane Finley, Minister of Human Resources, has been asked to arrange a meeting. Dr. Robert P Bradley freely meets with industry on the Canadian dime but is not very accessible to Canadians who are in fear of their health from electromagnetic radiation.

Q 6 - Why is Dr. Bradley so hesitant to use government money to meet with citizens with genuine health concerns while he does not hesitate to meet with Industry on a regular basis?

My neighbours and I did get to see Dr. Robert P Bradley over 2 years ago. He spoke to our county council on the safety of cell towers. Even though his answers lacked technical depth and he was suffering from jet lag, he spoke of his anticipation of a study coming out of the WHO that would clarify the safety of cell technology. This study would be the WHO Interphone Study which has been delayed for 2 years. As referenced in my second petition, Elizabeth Cardis, the head of the entire 13-country Interphone study says the total cost of the Interphone Study was 10M Euros, 3.2M coming from Industry. One has to wonder if industry is trying to bury the WHO Interphone study as in the case of T-Mobile burying the Ecolog 2000 study. Dr. Bradley told the Norfolk County Council that this study was imminent and yet we are still waiting.

Q 7 - How many times has Dr. Bradley dissuaded further discussion on electromagnetic radiation by referring to the imminent WHO Interphone study?

FACTS ABOUT INTERPHONE STUDY

Members: Canada, Australia, Italy, Israel, Japan, Denmark, Sweden, France, Germany, Finland, New Zealand, Norway, United Kingdom.

Cancers studied: gliomas, meningiomas, acoustic neurinomas and parotid gland tumours.

Study period: 2000 to 2004.

Complete published analysis: Expected in 2006. Still waiting.

Age group studied: 39 to 50 year olds.

Countries that have published own results: Japan, Denmark, Sweden, France, Germany, Norway, United Kingdom, Finland.

Countries that haven't published: Canada, Israel, Australia, Italy, New Zealand.

Q 8 - Is HC in any way responsible for the delay of publication of the Interphone study?

Dr. Henry Lai, (Appendix 1) Univ. of Seattle created the following chart based on his research, a chart which clearly shows an industry bias.

Cell Phone Biological Studies

	Effect of EMR	No Effect of	Total
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		EMR	
Industry Funded	27	69	96
	28%	72%	29%
Non-Industry Funded	154	76	230
	67%	33%	71%
Total	181	145	326
	56%	44%	

(7/11/06)

This chart clearly indicates that when industry plays a part in a study, the results favour their position. The number of industry related studies generated concerning EMR outnumber private studies.

Q 9 - Is this the "weight of evidence" HC refers to?

HC displays an Industry bias. In a previous petition I used the head of the Consumer and Corporate Radiation Protection Bureau of Canada's Dr. Bradley's statement, "At this time, neither HC nor the WHO recognize that symptoms attributed to EHS from low-level RF fields (as located around cell towers) are causally related to RF field exposure."

So I asked: **13a) I ask HC to name 3 such studies.**

At this point I received the 4 studies listed.

- 1) Rubin GJ, Cleare AJ, Wessely S (2008). Psychological factors associated with self-reported sensitivity to mobile phones. *Journal of Psychosomatic Research*, 64, 1-9.
- 2) Rubin GJ, Hahn G, Everitt BS, Cleare AJ & Wessely S (2006). Are some people sensitive to mobile phone signals? Within participants double-blind randomised provocation study. *British Medical Journal*, 332, 886-889.
- 3) Rubin GJ, Das Munshi J & Wessely S (2005). Electromagnetic hypersensitivity: A systematic review of provocation studies. *Psychosomatic Medicine*, 67, 224-232.
- 4) Stacy Eltiti, Denise Wallace, Anna Ridgewell, Konstantina Zougkou, Riccardo Russo, Francisco Sepulveda, Dariush Mirshekar-Syahkal, Paul Rasor, Roger Deeble, Elaine Fox Does Short-Term Exposure to Mobile Phone Base Station Signals Increase Symptoms in Individuals Who Report Sensitivity to Electromagnetic Fields? A Double-Blind Randomized Provocation Study.

Please note that Dr. Rubin is funded by industry. At this site

<http://www.iop.kcl.ac.uk/departments/?locator=364&context=975> it states that the mobile phone research unit (Dr. Rubin) at King's College is funded by two research grants awarded by the UK Mobile Telecommunications and Health Research programme.

Also please note: Note - **A Systematic Review of Treatments for Electromagnetic Hypersensitivity (EHS)**
G. James Rubin, Jayati Das Munshi, Simon Wessely - *Conclusions*: The evidence base concerning treatment options for EHS is limited and more research is needed before any definitive clinical recommendations can be made.

Also please note, the fourth study by Eltiti et. al.: Does Short-Term Exposure to Mobile Phone Base Station Signals Increase Symptoms in Individuals Who Report Sensitivity to Electromagnetic Fields? A Double-Blind Randomized Provocation Study reports that 12 sensitives withdrew after the first session and "during the open provocation, sensitive individuals reported lower levels of well-being in both the global system for mobile communication (GSM) and the universal mobile telecommunications system (UMTS) compared with sham exposure, whereas controls reported more symptoms during UMTS exposure. Sensitive individuals reported elevated levels of arousal when exposed to a UMTS signal."

Also please note: On the same site "Recent estimates of the prevalence of electrosensitivity vary from country to country. The following estimates are all based on the results of telephone or questionnaire surveys and

represent the approximate percentage of people in that country who believe that they are particularly sensitive to electromagnetic fields.

Sweden: 1.5 per cent - California: 3.2 per cent - UK: 4 per cent - Switzerland: 5 per cent - Germany: 8 per cent. It is evident that HC relies heavily on Industry funded studies to accumulate their weight of evidence.

Q 10 – What percentage of studies cited by HC as “weight of evidence” was funded by industry?

As the Auditor General knows, one of the tried auditing tools is the smell “test”. When the smell test is applied to HC’s responses to my petitions, their responses stink.

In response to my petition 235, I wrote “The main thrust of your responses was “bulk of studies” or “majority of studies” or the 27 times you used “weight of evidence”. These responses are typified by your answer to my question 19.

‘Response: A weight-of-evidence approach is employed when assessing the possible health risks of RF fields. This takes into account both the quantity of studies on a particular endpoint (whether adverse or no effect), but also the quality of those studies. Poorly conducted studies (e.g. Incomplete dosimetry or inadequate control samples) receive relatively little weight while properly conducted studies (e.g. all controls included, appropriate statistics, complete dosimetry) will receive more weight. There are numerous concerns with the studies reference above; therefore, these studies have little weight in the risk assessment process.’

Appendix 2 is a letter to the WHO complaining of a weight of evidence problem that is the opposite of HC’s position.

Q 11 – How does HC account for this?

In my petition 235, I asked the following questions: 44a) A person like myself who lives 90% of his time within 300 metres of a cell tower is bombarded by microwaves day after day after day. What are the effects of such close bombardment? 44b) Does the bombardment bounce off the skin? Does the bombardment pass through the body? On average how much of the bombardment penetrates the skin? To what depth? Does it dissipate? Does it just sit there? Does it interact with the body in any way? Does it affect cellular structure? Is the bombardment benign? The response I received was as follows:

“At a frequency of 1.9 GHz and depending on the type of tissue, approximately 55% to 60% of the incident power density is reflected from the surface of the body. Of the remaining energy that penetrates into the tissues, 90% is absorbed in the first 2.5 – 4 cm.

This approximate evaluation indicates that energy deposition at cellular frequencies is largely superficial and does not pass completely through the body. Once in the body, the energy that is deposited is dissipated as heat, predominantly through molecular interactions with polar molecules, principally water. Provided that exposures are below the limits outlined in Safety Code 6, the heat is easily accommodated by the body’s thermoregulatory system. The scientific evidence that it affects cellular structure is overwhelmingly negative.”

Note the response is limited to heat. It is as though the responder was a physicist. Note there are no biological or genetic or oncological references in the response. It is certain the responder is not a biologist, nor an oncologist. Certainly the Minister was not the responder because of time restraints, inclination and lack of expertise. It would certainly fall to a physicist within the Consumer and Clinical Radiation Protection Bureau of Canada to respond.

Any physicist knows Newton’s law that for every action there is an equal and opposite reaction. It is incredible for any physicist to believe any energy penetrating the brain, whether 40%, or 4cm, or beyond does not simply

warm the brain. Who could believe this when everything we are learning about the environment is much more complicated and interrelated. When DDT is applied, a lot more happens than the killing of harmful insects, in fact, these insects come back with a vengeance because the DDT killed all their enemies, etc. etc.

Q 12 – Does HC believe the identity of the author of the above quote should be protected or should the author come forward to defend this statement?

The reason HC employees can hide behind “weight of evidence” is because the response to the Auditor General’s petition process comes under the name of the Minister. The Minister does not pen the letter but under his signature employees can hide under the Minister’s right of immunity. It would be much more open, transparent and ethical for the author(s) to affix their names to a response making responsibility inherent in the response.

Q 13– Does the Auditor General agree with this statement?

The cell tower within 300 metres of my home stands atop a water tower. The tower is within 15 metres of two buildings of two different property owners. The tower in question is not fully powered. There are four additional hook-ups awaiting greater power output. When Industry Canada took measurements at this tower, 92% of the radiation came from a paging system atop Norfolk General Hospital. Therefore should the local cell tower power up to full potential (SC6) and adding the hospital radiation, I would like to consider the brain of a newborn infant living in one of the two buildings within 15 metres of the cell tower.

Here is an article from the “Environment News Service”, entitled “Too Young for a Cell Phone” by Louis Slesin,

<http://www.ens-newswire.com/ens/jul2008/2008-07-25-01.asp>

“The brains of young children absorb twice as much as radio frequency energy from a cell phone as those of adults, according to a set of new calculations carried out by Joe Wiart's research group at France Telecom in the suburbs of Paris.

"[Our] analysis confirms that peripheral brain tissues of children seem to be higher exposed than the peripheral brain tissue of adults," Wiart concludes in a paper that appears in the July 7 issue of the journal "Physics in Medicine and Biology."

"Children are not simply small adults," Wiart explained in an interview with "Microwave News."

"Their skin and their skulls are thinner than those of adults, and their ears are smaller too," he said. "Given these differences, the higher SAR for children is not surprising."

SAR stands for specific absorption rate, a measure of the rate at which radio frequency energy is absorbed by the body.

These new findings apply to children who are eight years old or younger. Above the age of eight, the SARs in children are much like those of adults, according to Wiart.

"I agree with Joe," said Niels Kuster, the director of the IT'IS Foundation in Zurich. A team led by Kuster and Andreas Christ recently completed a project for the German Federal Office of Radiation Protection, which like Wiart, found that regions of the brains of young children can have exposures that are twice those of adults - or even higher.

Even more striking, Kuster and Christ concluded that the "exposure of the bone marrow of children can exceed that of adults by about a factor of ten."

They also report that children's eyes are more highly exposed than those of adults.

Whether or not children are at a greater health risk than adults has been debated since at least the year 2000, when a UK panel chaired by Sir William Stewart advised that parents limit their children's use of mobile phones.

Since then, other government groups, especially those in France and Germany, have issued similar precautionary recommendations.

The mobile phone industry has long disputed the possibility that children are at any greater risk. For instance, earlier this year after the French Ministry of Health reiterated concerns over children's use of cell phones, the MMF, an industry lobby group, issued an advisory stating that cell phones do not present health risks to any users "regardless of age."

The MMF has relied heavily on statements issued by the World Health Organization's EMF Project in Geneva, and the Health Council of the Netherlands.

For instance, in a paper published in 2004, the Health Council concluded that, "There is no convincing scientific data to assume a difference in the absorption of electromagnetic energy in heads of children and adults."

Q 14 – Would the author of the above “heat” response comment on this article?

Dr. Lennart Hardell is a professor of oncology for University Hospital in Orebro, Sweden, where he has conducted long-term studies of the health effects of cell phone use (hardell@orebroll.se)

He says, "It is both wise and timely to advocate for precautions in the use of both mobile and cordless phones as recently advised by the University of Pittsburgh Cancer Institute. Our research team in Sweden has raised similar concerns about long-term health effects from exposure to microwaves during cell phone use.

The brain has the highest exposure on the side where the phone is held. Furthermore, the brain of a child is more exposed to microwaves than the brain of an adult. The bone is thinner and a smaller brain permits deeper penetration. A recent French study showed that children might be twice as at risk as grown-ups, which is worrying.

Sweden was one of the countries first to adopt wireless technology in the early 1980s. Thus there are now persons who have used mobile and cordless phones long enough to evaluate long-term health effects, primarily the risk for brain tumors.

Our research was conducted for more than 10 years and we were the first to report an increased risk for brain tumors. In follow-up studies we were able to confirm the results.

By now, evaluating all international studies in this area, there is a consistent pattern of a nearly doubled risk for brain tumors (glioma and acoustic neuroma) on the side of the head where a mobile phone has been used for at least 10 years. Glioma is a usually lethal type of brain tumor and acoustic neuroma is a benign tumor on the hearing nerve that can cause tinnitus and ultimately deafness.

Little has so far been studied of long-term health effects from nearby microwave exposure during the use of wireless phones or distant exposure from base stations emitting microwaves. Since virtually whole populations are exposed, even small effects would have large public health implications.

Current emissions from wireless phones do not protect us from brain tumors in the long run. Prudent avoidance of exposure is necessary as we await safer technology."

Q 15 – Does HC agree with Dr. Hardell?

Dr. Devra L. Davis wrote, "University of Pittsburgh physics professor Eric Swanson doesn't use a cell phone (because he finds them annoying), but he assures us that cell phones cannot cause cancer mainly because cell phone radiation is not known to damage DNA ("Stop Freaking Out About Cell Phones!," Forum, Aug. 3). He is mistaken.

First of all, cancer can occur without direct damage to DNA. This is what happens with cancers arising from hormone replacement therapy and asbestos.

Second, more than a thousand studies find that cell signals can affect the ability of our genes to protect us, impairing responses to stress, heavy metals and toxic chemicals.

Contrary to what Mr. Swanson asserts, cell phones *might* cause cancer without directly damaging DNA or breaking chemical bonds. This is understood by the 23 renowned cancer biologists who recently signed a cautionary advisory on cell phones.

With half of the world using cell phones, no one seriously suggests that this revolutionary, life-saving tool should be put back into the bottle. But we need to be sure that this essential technology becomes as safe as possible.

It's better to be safe than sorry and to reduce direct exposure to cell phone radiation by using head sets and speakerphones. Meanwhile, electrical engineers can continue to lower the amount of radiation to which we are exposed and we scientists can more fully evaluate the impact of cell phones on public health.

Just last week the Israeli Health Ministry expanded on a previous public advisory by suggesting that children's use of cell phones be limited. This was based on the recent warning to UPMC staff from the highly respected Dr. Ronald B. Herberman, director of the University of Pittsburgh Cancer Institute. Health authorities in England, Germany and France have issued similar warnings.

I agree with Mr. Swanson that neurosurgeons are not necessarily qualified to conduct or opine on statistical studies, but neither are physicists like himself suited to disclaim theories of cancer offered by other scientists. When DNA is damaged, cells can get signals to grow uncontrollably, which can lead to more than 200 forms of cancer. But sometimes cancer occurs without direct damage to DNA. For instance, when asbestos is inhaled deeply into the lung, it can cause inflammation that triggers cancer several decades later. Prenatal hormonal stimulation can lead to cancer in middle age.

Yes, human studies on cell phone use and cancer are incomplete and inconsistent. But the cell phone industries' own studies show that the cell signal is absorbed deeply into the brains of children, and up to 2 inches into an adult skull. Most cell phone manuals, which are seldom read, recommend keeping the phone an inch from the ear and not directly against the body. Sensible precautions for those concerned about cell phones can be found on the Web sites of the Food and Drug Administration, the National Cancer Institute and the American Cancer Society.

Some studies of populations that have used cell phones for longer periods of time have found a doubled risk of serious brain tumors. Other studies have found subtle disturbances in brain chemistry and possibly lowered sperm count.

In 1990, about 1 in 10 Americans used cell phones for limited periods of time. Nine times more Americans use cell phones today, and for much longer periods. Brain cancer and other possible chronic ailments can take a decade or longer to develop.

The absence of definitive evidence in this instance should not be confused with proof of safety; rather, it reflects the hard realities of the modern world where we introduce new technologies before evaluating their potential impact on our lives.

Good public health practice requires that we take prudent precautions to limit exposure to cell phone radiation. Meanwhile, as engineers continue to refine the technology, research should proceed to clarify whether newer phones pose the same risk as older ones.

The full cooperation of the cell phone industry would help a great deal in pursuing this research.

Dr. Herberman and Dr. Elmer Huerta, the president of the American Cancer Society, have called for the release of encoded records of cell phone use to the National Institutes of Health, the American Cancer Society and independent university scientists for use in their research. Information about individuals already must be provided to the government when someone is suspected of threatening national security. Surely, the health and welfare of our children and grandchildren demand that cell phone companies provide confidentiality-protected cell phone records to independent scientists so that definitive studies can be carried out.

If this is done, within a decade we should know whether the risks found with older-style phones in Sweden and other nations also occur with the newer phones now widely used in the United States and around the world."

Q 16 – At the time of writing this petition I anticipate that HC will deny everything in this whole petition like they did in my first petition and second petitions. I believe they will say I have been 100% wrong even though I've quoted over 2000 studies in the BioInitiative Report itself and the words of Dr. Lai, Dr. Abe Liboft, Dr. Jerry Phillips, Dr. Joe Wiart, Dr. Neils Kuster, Dr. Andreas Christ, Dr. Lennart Hardell, and Dr. Devra Davis. My claim about HC and the status quo comes to mind. Can HC explain, without using "weight of evidence", how I could refer to all this research and be completely wrong?

SC6 is a linear document (radiation ----- heat). It is not a holistic document. For example, there does not appear to be any neurobiological point of view in the document. There does not appear to be a microbiological point of view. There does not appear to be a molecular biological point of view. There does not appear to be an oncological point of view. There does not appear to be a genetic point of view.

Q 17 - What percentage of the scientists referenced in SC6 were physicists?

Q 18 - What percentage of scientists were neurobiologists?

Q 19 - What percentage of scientists were microbiologists?

Q 29 - What percentage were molecular biologists?

Q 21 - What percentage were oncologists?

Q 22 - What percentage were geneticists?

Q 23 - In the Consumer and Clinical Radiation Protection Bureau of Canada what percentage of the PhD's are neurobiologists?

Q 24 - In the Consumer and Clinical Radiation Protection Bureau of Canada what percentage of the PhD's are microbiologists?

Q 25 - In the Consumer and Clinical Radiation Protection Bureau of Canada what percentage of the PhD's are molecular biologists?

Q 25 - In the Consumer and Clinical Radiation Protection Bureau of Canada what percentage of the PhD's are oncologists?

Q 27 - In the Consumer and Clinical Radiation Protection Bureau of Canada what percentage of the PhD's are geneticists?

Q 28 - Does it appear that the Consumer and Clinical Radiation Protection Bureau of Canada is top heavy with physicists?

Furthermore, physicists are not in a position to make decisions regarding electromagnetic exposure and health. Dr. A.R. Liboff, a professor of Physics at Oakland University in Rochester, Michigan, in response to the American Physical Society's statement advised the EMR Alliance, "Right thinking individuals must believe that the American Physical Society is not in a position to intelligently judge important questions in surgery, neurobiology, molecular biology, genetics, or microbiology. Is bioelectromagnetics somehow different? Its tenuous link to physics lies in the present inability to formulate a reasonable physical mechanism to explain the experimental results. Physicists have a very bad track record when it comes to describing biological mechanisms." (from <http://www.feb.se/Bridlewood/APS.HTM>)

Dr. James McNamee, also of HC's Consumer and Clinical Radiation Protection Bureau of Canada in Ottawa is an EMF specialist on the editorial board of *Radiation Research*. He has published negative papers on microwave genotoxicity in *Radiation Research*. <http://www.microwavenews.com/docs/mwn.7-06.RR.pdf> After reading this article one wonders about the Canadian Government's rules on conflict of interest for its employees.

Q 29 – Does Dr. McNamee’s involvement with this publication make his position with HC a conflict of interest?

In my petition 235-B, referring to the article in *Radiation Research*.

<http://www.microwavenews.com/docs/mwn.7-06.RR.pdf>

I wrote: “Mr. Minister I believe you see where I’m going. As you notice the names of John Moulder, James McNamee, Michael Repacholi and Vijayalaxmi, all appear in the above article as they appeared in your response to my petition. Let’s add the names of G. Gajda and A. Thansandote, workmates of James McNamee who have vested interests in the status quo, namely their jobs with Health Canada.

You remember of course how often you referred to these men and their research. Of the 14 studies you referenced, Moulder was referenced once, Repacholi once, Vijayalaxmi once, Gajda six times, Thansandote seven times and McNamee eight times. Using a weight-of-evidence measurement, of 14 studies presented, there are at minimum 24 biased references.”

Q 30 - Do the above statistics demonstrate a bias in HC towards the status quo?

In the conversation “Invisible Hazards in the Wireless Age - A conversation with Dr. George Carlo”, http://commonground.ca/iss/201/cg201_carlo.shtml (Appendix 3) is a line of reasoning without any references to heat.

“If you think about it, when cells are working together – talking to each other and working together – you have a tissue. When tissues are talking together and working together, you have an organ. When organs are talking together and working together, you have an organism, like a human. So when you disrupt intercellular communication, you are disrupting a fundamental physiological process. What happens is that intercellular communication is disrupted. Messages between cells cannot be sent because the cell does not have enough energy to do that. At the same time, because these active transport channels have closed down, waste product builds up inside the cell. When waste product builds up inside the cell, you have a very high concentration of highly reactive molecules called free radicals. Free radicals, like the free radicals in the 1960s, love a party. Inside the cell, the party is going on at the mitochondria, which is where all of the respiratory functioning of the cell takes place. The free radicals, preferentially, will go to the mitochondria and disrupt the functioning of the mitochondria. In disrupting the functioning of the mitochondria, you create cellular dysfunction, meaning that the cell is not able to do its job properly. That is why, for example, if you have a cell whose job is keeping the blood-brain barrier closed and that cell is now dysfunctional, the blood-brain barrier opens. Indeed, we and others have seen leakage in the blood-brain barrier as an effect.”

Q 31– How does HC reconcile Dr. Carlo’s response to the “heat” response given by HC mentioned above?

How do federal regulators determine whether a cell phone or cell phone tower is safe? To date, they rely only on models that predict the device's immediate effect on body temperature. But many other factors have been studied. A scientific model published decades ago by Allan Frey predicted how far different EMF frequencies penetrate into the brain. Frey found that the brain does not absorb low frequency radio waves. Microwaves, however, penetrate skin and bone and are absorbed by the brain. Frey's predictions have been supported by newer computer models and human experiments.

Several scientists have found that the barrier separating brain fluid from blood becomes permeable after limited cell phone exposure. In animals, damage to this barrier results in Alzheimer's-like disease. Some researchers are convinced that toxic chemicals in our environment are more damaging when microwaves are also present.

Studies have linked exposure to microwaves from cell phone towers with headaches, insomnia, infertility, and inability to concentrate. One study finds that second-hand exposure to cell phones doubles children's behavioral problems. Evidence of harm has been seen at molecular and cellular levels.

We recall that from 1938, when scientists began finding that smoking cigarettes can cause deadly harm, until 1964, when the Surgeon General of the United States issued its warning, the industry managed to cast doubt on the scientific findings. The number of people who became addicted to cigarettes quadrupled. Yet more decades

passed before the effects of second-hand smoke were considered and smoking in public was regulated. In July, after reviewing published and unpublished studies about the link between cell phone use and cancer, Dr. Ronald Herberman, director of the University of Pittsburgh's Cancer Institute, advised adults to reduce their cell phone use significantly and children to use cell phones only in emergencies. It's time to recognize that the current paradigm for determining microwave safety is completely inadequate. Increasing exposure to microwaves (with additional concealed cell phone antennas, for example) before conflicting studies on long term effects have been resolved gambles with the public's health -- without anyone's informed consent.

Q 32 – Is HC willing to talk about the effects of cell phones on people in terms other than heat? Explain.

Q 33 – After all the research listed and considering HC's earlier statement on page 6 regarding radiation entering the brain and dissipating as heat, what is HC's current position regarding an infant living within 15 metres of a cell tower for eighteen years? What effect would there be on this young Canadian's body?

I include in Appendices 4, 5, 6 and 7 articles which show there is a lot more research going on about the effects of electromagnetic radiation than "heat". I do this to also discredit HC's notion of "weight of evidence".

FEB 2, 2009

Appendix 1

An article in "Walrus" magazine agrees with Dr. Lai. <http://www.walrusmagazine.com/articles/2008.09-health-cellphone-brain-tumour-melinda-wenner/>

"The wireless industry adamantly denies the association. "The overwhelming majority of studies that have been published in scientific journals around the globe show that wireless phones do not pose a health risk," says a spokesperson for CTIA, a heavyweight international organization that represents the trillion-dollar wireless industry. Many scientists agree: the literature shows little evidence of a problem.

But what if the published science doesn't reflect what's really happening out there? And what if there has been a concerted effort to shield us from the evidence that does exist? Accounts from a handful of well-respected scientists suggest that since the mid-1990s wireless companies have been doing their best to bury worrying findings, discredit researchers who publish them, and design experiments that virtually guarantee the desired results. "Biological effects are undoubtedly there, no question, and it's a canard to suggest that they're not," says Abe Liboff, a research professor at Florida Atlantic University, and co-editor of the journal *Electromagnetic Biology and Medicine*. The cell phone industry, he insists, "will use any excuse to avoid the truth."

Even so, a new possibility is emerging. Although cell phones appear to be safe when used sporadically, individuals who use them frequently for more than a decade may be vulnerable. Eight population-based studies published since 1999 indicate that heavy users are twice as likely to develop certain types of brain tumours as infrequent users. Citing recall bias and memory loss on the subjects' parts, critics reject such suggestions. Still, since cancer often takes decades to develop, other scientists wonder whether these findings are the first faint whispers of a public health crisis. After all, with an estimated three billion users around the world, cell phones have become ubiquitous."

The same article in "Walrus" magazine refers to Dr. Lai. <http://www.walrusmagazine.com/articles/2008.09-health-cellphone-brain-tumour-melinda-wenner/>

"In 1995, Jerry Phillips, a biochemist at the Pettis Veterans Affairs Medical Center in Loma Linda, California, received a call from the head of his biomedical research group. He and his co-workers were doing contract work for Motorola and the US Department of Energy on the effects of electromagnetic radiation, and Motorola, he says, needed a favour: higher-ups had learned of a study just published by University of Washington scientists Henry Lai and N. P. Singh showing that radio frequency fields similar to those emitted by cell phones damaged

rats' brain cells, breaking their DNA structures after just two hours of exposure. The company, Phillips says, wanted to discredit the study.

To Motorola, it didn't make sense that a cell phone could break DNA. The ionizing radiation of X-rays and atomic bombs has enough energy to knock around electrons and cause genetic damage. But the radiation emitted by cell phones is non-ionizing, similar to radar, and thought to be too weak to do genetic harm. That is, while cell phone radiation fits within the microwave spectrum, it emits too little energy to significantly heat tissue. So how could cell phones, Motorola's reasoning went, possibly affect or harm the brain?

Nonetheless, Lai's research suggested they could, and his paper worried Motorola. Phillips recalls that the company asked him to "find ways to put a spin on it that was favourable to them and less favourable to Henry and N. P." He declined, but did agree to provide Motorola with comments on the study, and to conduct a similar trial if they were interested.

They were. Phillips designed a comparable experiment to investigate how radiation emitted by cell phones affected DNA in cells. He tested two slightly different radiation frequencies and exposure times, and found that in both cases the radiation did affect the cells' DNA, albeit in significantly different ways: sometimes it increased the base level of DNA damage typically seen in cells, and sometimes it lowered it. He wrote a report and sent it to Motorola with a note saying he wanted to publish the results and, if the company would fund him, design studies to further investigate his findings. A few days later, Mays Swicord, the director of electromagnetic research at Motorola, called him.

"He started questioning a lot of the results, pointing to what he called 'inconsistencies in data,'" Phillips recalls. "I pointed out that it's not unusual to see, with a single chemical agent, results go in one direction for one time period, and in the opposite direction for another." Phillips went on to explain to Swicord that long or heavy exposure to a toxin can initiate a cell's repair mechanisms, immediately fixing the damage. A shorter or lighter exposure might cause damage, but not enough to trigger the same repair mechanisms. In this manner, paradoxically, the lighter dose might be more dangerous.

Swicord, who has a background in bioelectromagnetics, wasn't convinced. "He suggested that I consider not publishing anything and that I do more work," Phillips says. "And I said no. I know when the project is done. I've been doing research for twenty-five years."

Their argument went on for weeks. Eventually, says Phillips, the head of his research group, Ross Adey, phoned him. Apparently under a lot of pressure, and worried that his group might lose Motorola's financial support if he didn't cooperate, Adey, says Phillips, "told me that if I didn't give Motorola what they wanted, it could be detrimental to my career." Phillips wouldn't back down. "This isn't about the group. It isn't about money," he told Adey. "It's about science."

Phillips refused to work on any further Motorola-funded projects, and in 1998, in the peer-reviewed journal *Bioelectrochemistry and Bioenergetics*, he published his DNA study, which would be one of his last. That same year, the Department of Energy stopped funding the group's work on electromagnetic radiation effects. Phillips left Loma Linda and moved to Colorado Springs. Today he's the director of the Science/ Health Science Learning Center at the University of Colorado.

Lai, the soft-spoken University of Washington scientist who published the study that inspired Phillips' research, has also felt outside pressure. In a 1994 Motorola memo — obtained and published by the New York-based *Microwave News* — a corporate communications employee discussed how the company could discredit Lai's findings. The memo concludes, "I think that we have sufficiently war-gamed the Lai-Singh issue, assuming the Scientific Advisory Group and CITA have done their homework."

Shortly thereafter, an anonymous call was made to the National Institutes of Health (NIH), the agency funding Lai's work. The person charged that Lai was performing experiments outside the scope of his grant. The NIH looked into the allegation but told Lai to continue his research. Then, he says, the scientific advisory group created by CITA to manage \$25 million (US) in industry-donated research money sent a letter to the president of the University of Washington demanding that Lai and Singh both be fired. Lai wasn't, but soon after, all non-industry funding for related research dried up in the US. Like Phillips, he left the field."

Appendix 2

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 BELGIUM
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 January 27, 2009

Copy to: Dr Margaret Chan, WHO General Director

W.H.O.'s position on epidemiological studies on mobile communication base stations

Dear Mrs Emilie van Deventer,

I wrote an open letter to you two and half years ago. Regrettably I never received an answer from you or your services, despite several courteous recalls. The same apparently happened with other researchers, such as for instance M. Henrik Eiriksson from www.mast-victims.org who has been addressing similar issues on many occasions without any answer despite oral promises.

I am therefore replicating and updating my previous demand. I would very much insist upon receiving a written reply from you **before** the coming SANCO-EMF-Workshop organized by the European Directorate Health & Consumers due to be held in Brussels on **11 and 12 February 2009**, and which I will be attending (http://ec.europa.eu/health/ph_risk/ev_20090211_en.htm).

To date FOURTEEN epidemiological studies on mobile telecommunication base stations have been published and are referenced either on the EMF WHO database and/or on PUBMED.

Out of these fourteen studies:

1 is a mere feasibility study,

3 studies (20%) found no increase in the symptoms being analyzed while

10 studies (70%) DID find significant increases in the symptoms being analyzed.

These studies comply with the following criteria's:

a) All these studies are published in peer-review journals and are referenced either on the **WHO database** or on **PUBMED**.

b) All these studies conformed to the **standards of scientific quality**, including their assessment criteria of consistency and replication.

c) Several of these studies provide **accurate RF exposure measurements**.

d) At least **three additional epidemiological studies** on chronic exposure to mobile phone bases stations with **POSITIVE** results have been published in peer-reviewed journals on animals.1

1 **Löscher W.**, Der praktische Tierarzt 84, Heft 11, 850-863 [2003]. Die Auswirkungen elektromagnetischer Felder von

Mobilfunksendeanlagen auf Leistung, Gesundheit und Verhalten landwirtschaftlicher Nutztiere: Eine Bestandsaufnahme [*Effects of EMF from phone masts on performances, health and behavior of cattle*];

Balmori A., Electromagnetic Biology and Medicine, 24: 109-119, 2005.

Possible Effects of Electromagnetic Fields from Phone Masts on a Population of White Stork (*Ciconia ciconia*),

Evaert J., A Possible Effect of Electromagnetic Radiation from Mobile Phone Base Stations on the Number of Breeding House Sparrows. Electromagnetic Biology and Medicine, 26: 63-72, 2007

World Health Organization

Dr Emilie van Deventer

International EMF Project

20, Avenue Appia

GENEVE - SWITZERLAND

REGISTERED LETTER

e) A PhD thesis (**Adang D., 2008**) 2 has been presented based on free moving rats being exposed (a mere!) two hours a day to RF radiations below the ICNIRP recommendations of 41 V/m at 900 Mhz for a period of 21 months. Non-exposed rats showed a standard death rate of 31%, whereas exposed rats showed a death rate of 59

%, i.e. a **doubling in mortality**. Even though replications is (urgently) needed, especially at 3 and 0,6 Volt per meter and care should be used before any extrapolation to humans, it should be noted that 21 months of life of a rat roughly corresponds to 65 years of life for a human.

f) **No other** epidemiological study on mobile communication base stations with NEGATIVE results has been published in peer-review journals.

g) An increasing number of people are being diagnosed as electrosensitive and the trend seems clearly to be increasing. 3

h) Additionally there are many more examples of epidemiological studies of radio and TV transmitters with POSITIVE results, also referenced on the WHO database and/or PUBMED, including the latest Altpeter et al. (2006) study⁴ – with evidence of decrease of melatonin secretion on exposed humans – which urge for a rapid and clear change of position from the WHO.

i) We are all aware on the continuous delay since 2006 in the publication of the WHO Interphone research project initiated in ... 1998, and now apparently due for late 2009, if not yet again postponed.

On the same time, quite shamefully, **no such effort has been made to conduct an integrated epidemiological research on low intensity chronic exposure to base stations**. This relates to the fact that “WHO”(or at least those in charge of the EMF project) continues to refute the idea that low energy RF can affect health at all (as exemplified in the May 2006 WHO fact sheet #304).

This is unfortunately based on a **very selective analysis of the available literature**.⁵ In this paper, which you wrote with the former head of WHO-EMF project, M. Repacholi, all the a/m published epidemiological studies with POSITIVE results are simply left out from your review.

Based on this and the many other papers published on cell culture, plants and animals, statements like: “*the weight of scientific opinion is that there is no substantiated evidence that living near a mobile phone base station causes adverse health effect*”, can no longer be accepted by independent researchers and scientists.

I hope that this short review will contribute to change your view on this MAJOR issue. The quality of life of hundred of millions of people is at stake.

I would appreciate to reading your detailed comments on this **before February 11, 2009** and to discuss the issue during the Brussels workshop on February 11, 2009 which I hope you will be attending.

Yours respectfully,

Jean-Luc Guilmot

Bio-Engineer

www.001.be.cx

Enclosure:

10 out of 14 peer-reviewed studies on base stations found significant increases in symptoms

2 **Adank D.**, An Epidemiological Study on Low-level 21-month Microwave Exposure of Rats, Catholic University of Louvain, Applied Sciences, Hyperfrequencies Laboratory & Animal Biology Laboratory, Submitted June 23, 2008

3 **Hallberg O, Oberfeld G.**, Electromagnetic Biology and Medicine, Vol. 25: 189-191, 2006, Letter to the Editor: Will We All Become Electrosensitive?

4 **Altpeter ES et al.** Bioelectromagnetics. 2006 Feb;27(2):142-50. Effect of short-wave (6-22 MHz) magnetic fields on sleep quality and melatonin cycle in humans: the Schwarzenburg shut-down study

5 **Repacholi M. & Van Deventer E.**, Base Stations and Wireless Networks, Radiofrequency (RF) Exposures and Health Consequences, Environ Health Perspect. 2007 Mar;115(3):416-24. Epub 2006 Nov 6

Appendix 3

In the following conversation “Invisible Hazards in the Wireless Age - A conversation with Dr. George Carlo”, http://commonground.ca/iss/201/cg201_carlo.shtml you will find a line of reasoning without any references to heat.

Dr. George Carlo is a leading authority on the dangers of radio frequency radiation and a world recognized medical scientist, author and lawyer. His career spans 30 years and more than 150 medical, scientific and public policy publications in the areas of public health, workplace safety and consumer protection.

“Dr. Carlo: The pathological mechanisms are the key to both understanding the problem and prescribing preventive and therapeutic interventions to solve the problem. All electromagnetic radiation in the electromagnetic spectrum is not created equal. We have done work that identifies at least four different effect windows with different mechanisms of harm that are very unique. One effect window is what you have from the extremely low-frequency electromagnetic field, the power line frequency, if you will. What happens at that part of the electromagnetic spectrum is that the magnetic field is dominant. In an electromagnetic field, there is always a magnetic field and an electric field traveling perpendicularly. The magnetic field produces an electric field and the electric field produces a magnetic field and the magnetic field produces an electric field. That is why it radiates – because it is a self-propagating system. But at the low end of the electromagnetic spectrum, the magnetic field is predominant.

When you have an ELF (Extremely Low Frequency) field that is pushed by high power, you have a direct magnetic impact on the local physiology of cells and tissues. We know that that mechanism involves disrupting what we call gap-junction communication between cells. I do not need to go into all of that, but the fact is that we understand how it works. It is a direct magnetic effect and because magnetic fields have existed in nature since the beginning, we, as human beings, have developed compensatory mechanisms so that there is a threshold. There is a degree of magnetic field that we can sustain without being adversely affected. So unless you have a very high amount of power pushing that magnetic field, as you would have underneath a power line, for example, you do not cross the threshold for this direct magnetic effect. That is the ELF window.

At the other end of the spectrum, we have the ionizing radiation window and at the high end of the spectrum, with ionizing radiation, the electric field is so predominant that you have extremely high energy. Those electromagnetic waves up in the ionizing range – and they come from sunlight and lightning and a bunch of other natural sources as well – break apart chemical bonds.

Because that damage is so determinative or severe, we believe that, at least in terms of clinical manifestations, there is also a threshold. That means there is a safe level. In between, you have the radio frequency radiation window; that is the third window. What we have learned is this: a raw microwave signal, 1,900 megahertz, in other words, is oscillating at 1,900 million cycles per second. To put that in context with your heart, your heart beats at two hertz, two cycles per second. So a raw microwave is beating at 1,900 million cycles per second. That is too fast for your body to pick up; your body simply does not recognize it. The only time your body recognizes it is if you put 100 watts of power behind that signal and then you can heat tissue and meat like you would in a microwave oven. So when you put high power behind a microwave, you cause heating. That is the thermal window that the current government standards address.

Now, because the raw microwave is invisible to biological tissue unless pushed by high power, it is not a problem. However, with wireless communication, we must carry information and we have to be able to have that information deciphered at the other end of a phone call so that when we talk on the phone we want somebody to hear us talking. In order for that to happen, the information has to be packeted and it is bundled in packets based on amplitude modulation. Another factor is that for the phone companies to make money, they must have multiple people talking on one frequency band at the same time. So for that to happen, you have breaks in the modulation to make room for new calls. That is either going to be code domain breaks or time domain breaks, so that what you have is a circumstance where a packet of data moves and then it stops and then it moves and then it stops because of this multiple access. When that happens, it forms a secondary wave.

The best analogy we have been able to come up with for a secondary wave is the old clothesline, which would be on a pulley. An empty clothesline is like the raw microwave signal – the 1,900 megahertz carrier signal, for example. Putting clothes on the clothesline is the equivalent of these data packets and when you move the clothes through space on the clothesline, they wave back and forth: the secondary wave. That wave is what we call the information-carrying radio wave. The wave that is formed by the packeting of information oscillates in the hertz range and in the hertz range, the body can recognize it. Here is what happens: at the level of the cell membrane – whether it is a brain cell, a blood cell, a nerve cell, a liver cell, a bone cell or a skin cell – there are protein receptors on the cell membrane and their job is to keep track of what is going on in the environment around the cell. You have chemical receptors and you have vibrational receptors. The vibrational receptors are able to pick up radio signals that oscillate in the hertz to kilohertz range.

As the information-carrying radio wave comes in the vicinity of the cell, the vibrational protein recognizes it within milliseconds. But because in the beginning there were no information-carrying radio waves – they are not natural; they are completely manmade – the body interprets the information-carrying radio wave as a foreign invader. When that interpretation happens, a message goes inside the cell that says: “We are under seige; we need to protect ourselves.” First, the active transport channels, which are the avenues where nutrients pass into the cell and waste products pass out, begin to close down. As the active transport channels begin to close down, you have a circumstance where nutrients that are in the river between the cells are not able to get into the cell. When nutrients cannot get into the cell, the cell becomes nutrient and energy deficient. When the cell becomes energy deficient, it is not able to communicate with surrounding cells, so that you have a disruption in what we call intercellular communication.

If you think about it, when cells are working together – talking to each other and working together – you have a tissue. When tissues are talking together and working together, you have an organ. When organs are talking together and working together, you have an organism, like a human. So when you disrupt intercellular communication, you are disrupting a fundamental physiological process. What happens is that intercellular communication is disrupted. Messages between cells cannot be sent because the cell does not have enough energy to do that. At the same time, because these active transport channels have closed down, waste product builds up inside the cell. When waste product builds up inside the cell, you have a very high concentration of highly reactive molecules called free radicals. Free radicals, like the free radicals in the 1960s, love a party. Inside the cell, the party is going on at the mitochondria, which is where all of the respiratory functioning of the cell takes place. The free radicals, preferentially, will go to the mitochondria and disrupt the functioning of the mitochondria. In disrupting the functioning of the mitochondria, you create cellular dysfunction, meaning that the cell is not able to do its job properly. That is why, for example, if you have a cell whose job is keeping the blood-brain barrier closed and that cell is now dysfunctional, the blood-brain barrier opens. Indeed, we and others have seen leakage in the blood-brain barrier as an effect.

Additionally, the free radicals interfere with DNA (deoxyribonucleic acid) repair inside the cell. We know this now because several studies from around the world have shown the formation of micronuclei following exposure to these information-carrying radio waves. A micronucleus is a piece of DNA that functions well enough to form a membrane around itself, but it has no other purpose. As long as it stays inside the cell it is okay, but when the cell is disrupted at the mitochondria level, it goes through a process that we call apoptosis, or programmed cell death. The cell actually commits suicide to make room for another cell to come in. This happens on a regular basis. Every six months or so, you turn over all of your cells because of apoptosis. When apoptosis happens, the cell membrane disintegrates and whatever is inside the cell goes into the space between the cells and the micronuclei go into the space in between the cells.

Under normal circumstances, a message would be sent to the immune system saying, “We have micronucleus here. Send some macrophages so we can get rid of it.” The problem is the intercellular communication has been disrupted and the message to the immune system does not get there. So now you have a micronucleus that is a piece of wild DNA sitting in a nutrient-rich environment and it is free to clone and proliferate. That is the mechanism for the development of a tumour.

Appendix 4

From: <http://www.walrusmagazine.com/articles/2008.09-health-cellphone-brain-tumour-melinda-wenner/>

“The industry has indeed funded a number of trials on the potential effects of cell phone radiation, but the results of those studies differ markedly from those funded by the government or other public agencies. In short, industry-funded research tends to show no cause for concern; the findings of other studies suggest a need for precaution.

In a paper published last year in *Environmental Health Perspectives*, Swiss researchers reported that of the studies published between 1995 and 2005, which investigated whether controlled exposure to radio frequency radiation affected humans, 82 percent of those funded by public agencies, and 71 percent of those funded by a combination of industry and public money, reported that there were effects; only 33 percent of the solely

industry-funded studies did. The authors point out that scientists funded by public agencies may have an interest in finding a response in order to secure additional funding, but Lai doesn't buy this argument. Having shifted his research focus to finding cancer cures, he still follows the literature on cell phones, and has done his own analysis of 336 published papers. Industry-funded studies, he says, are roughly twice as likely as government-funded ones to conclude that cell phones are harmless. Phillips is also convinced that the industry either cherry-picks its data or designs studies to show nothing. "A lot of the studies that are done right now are done purely as PR tools for the industry," he says.

Recent epidemiological (population-based) studies comparing the cell phone habits of people with brain tumours to healthy individuals suggest that the frequency — and length — of use may indeed play a role in tumour development. "There's no indication, for people who use their phones for less than ten years, of an association between mobile phone use and these particular cancers," says Lawrie Challis, former chairman of the UK's Mobile Telecommunications and Health Research Programme. But "knowing what happens in the short term tells you nothing about what happens in the long term."

Indeed, of thirteen epidemiological studies published since 1999 on cell phone use for more than ten years, eight suggest a two- to threefold risk increase.

Just the same, it's hard to publish convincing results from studies like these. For one thing, cell phones have only been popular for a decade or so, making it difficult to find enough subjects who've used them for long periods of time. Add to this the fact that brain tumours are rare, and it becomes almost impossible to produce data that show definitive statistics. Of the eight epidemiological studies that suggest a positive association, for instance, only three are large enough to be considered "statistically significant."

One way to circumvent these problems and acquire enough reliable data is to pool results from multiple trials. This is the idea behind Interphone, the largest study of its kind to date, coordinated by the International Agency for Research on Cancer in Lyons, France. Led by Canadian scientist Elisabeth Cardis, the project has analyzed some 6,400 tumours in thirteen countries. Here, too, however, mystery abounds. While results from some of the individual countries have been published, the pooled results — scheduled for release in 2006 — have not; Cardis says, "The interpretation isn't clear." In the January/ February issue of *Microwave News*, editor Louis Slesin writes, "The code of silence about Interphone must end. Public health demands it."

Early this year, Siegal Sadetzki, a scientist at the Chaim Sheba Medical Center in Israel, and a participant in the Interphone study, published her country's arm of the findings. Their report suggests that heavy cell phone users have a 50 percent increased risk of developing parotid gland tumours near the side of the head against which they hold their phones. "Significant risk is shown, and we should take this into consideration, because this technology is really, really, really prevalent," she says.

While Sadetzki advocates caution (noting "usually it takes a long time to develop solid cancers; ten years is really only the minimum"), others maintain that a two- or threefold increase actually does not represent a large overall risk. Malignant brain tumours are rare — about one in 14,000 North Americans is diagnosed with one each year — and even a doubling of the risk for individuals who use cell phones for a decade means only about one in 7,000 people. But what about those who use cell phones for thirty years, or kids who start using them when they're eight? No one knows.

Clearly, epidemiological studies in which scientists monitor the health and cell phone habits of large groups of people over extended periods of time are required. Properly constructed, such studies would solve problems of memory loss, recall bias, and other research-related challenges.

If the debate over whether cell phones are harmful is controversial, *how* they might be is even more so. Because cell phone radiation can't knock around electrons enough to cause dna damage or heat tissue, its biological effects are probably due to something heat independent or "non-thermal." However, no one knows yet how the radiation could do this, and many dispute that it does. Of the approximately 400 laboratory studies that have investigated whether exposure to radio frequency radiation affects dna in cells and/or animals, only about half report any effects.

Leif Salford, chair of neurosurgery at Lund University in Sweden, has repeatedly shown that exposure to two hours of cell phone radiation opens the bloodbrain barrier and causes brain-cell damage in rats. Other studies have shown that radiation affects biological pathways important for metabolism and stress responses. But what

does this have to do with cancer? Although cell phone radiation, unlike uranium or plutonium, may not be powerful enough to cause tumours directly, it might, as Jerry Phillips suggests, indirectly lead to cancer by preventing dna repair mechanisms from working properly, and by producing free radicals, highly reactive molecules that can interact with dna in cancer-causing ways.

It may also be that cell phones don't seed new tumours, but instead promote or accelerate the growth of existing ones. In other words, cell phone radiation could be what is called a "tumour promoter," which would require less energy than tumour initiation. (Also, as people are already being bombarded by dozens of known environmental carcinogens, something that helps cancers grow is potentially a big problem.) In the first study Phillips conducted for Motorola, he used a chemical to make a tiny tumour and then looked at how radio frequency fields influenced its growth. "It did appear that these fields could affect already initiated tumours," he says. According to University of Massachusetts Amherst toxicologist Edward Calabrese, animals and cells respond differently and inconsistently to low-level toxic exposures, so varied findings are not surprising. At low levels, he says, the way a body reacts to exposures can be counterintuitive, just as in Phillips' experiment, where low exposures appeared to cause more damage than higher ones.

Probing these issues requires funding, but outside of the Interphone study interest seems to be flagging. The US government, which didn't participate in Interphone, has not announced any plans to fund epidemiological studies. The National Toxicology Program has provided \$22 million (US) for a series of trials to be performed at the Illinois Institute of Technology, but these animal studies will investigate only whether healthy rats and mice exposed to cell phone radiation develop brain cancer — and they may not, if cell phones are only tumour promoters.

This is certainly not the first time a ubiquitous product has become a potential public health threat, and the big question is, how will it all play out? The cell phone industry could follow in the steps of Big Tobacco and continue to cast doubt on legitimate studies. Or it could adopt the science-minded approach of the automobile industry, which has responded to obvious public health dangers by engineering new technologies — the airbag, for instance — that minimize risk and attract the public's support."

Appendix 5

Another: "Adverse Health Concerns of Mobile Phones by Alasdair Philips EMC Consultant & Director of the Powerwatch Network" <http://frontpage.simnet.is/vgv/alist.htm>

"... Cancer implications

In fact, there is little recent evidence that brain tumours are a likely outcome. If there are long term cancer implications, then they will most likely be myeloid leukaemias and multiple melanomas. Back in the early 1980s Sam Milham reported excess leukaemias among amateur radio operators, with deaths from acute and chronic myeloid leukaemias nearly three times higher than expected.

In 1980, Dr John Holt had a letter published [2]. This showed that between 1951-59, 50% of patients with CML in Queensland survived 55 months. In 1960 and 1961 three large TV broadcast stations were commissioned in the area. In the period 1963-67, 50% of patients with CML only survived 21 months. This dramatic change could not be explained by any medical personnel or therapy changes.

In the mid-1980s Stanislaw Szmigielski reported that Polish military personnel exposed to RF energy showed elevated leukaemia levels. He has just published a 1996 update. [3] This is a study of all Polish military personnel for 15 years (1971-85), approximately 128,000 people each year. Of these about 3700 (3%) were considered to be occupationally exposed to radio-frequency and / or microwave radiation.

The largest increasing were found for chronic myelocytic leukaemia (CML), with an astounding odds ratio (OR) of 13.9 (95%CI 6.72-22.12, $p < 0.001$), acute myeloblastic leukaemia (AML) with an OR of 8.62 (95%CI 3.54-13.67, $p < 0.001$), and non-Hodgkin lymphomas with an OR of 5.82 (95%CI 3.54-13.67, $p < 0.001$).

The 1996 paper by Lai & Singh, showing single and double DNA strand breaks in brain cells of rats exposed to 2.45GHz SARs of 1.2 W/Kg (comparable with levels in the heads of mobile phone users), also gives rise to concern. [4]

If someone is completely healthy, and has a strong immune system, then mobile-phone use may well not give them long-term health problems. Some people can smoke twenty cigarettes per day for fifty years and not

develop lung cancer, and yet the dangers of smoking are now generally accepted. It has been repeatedly shown that a few minutes exposure to cell phone type radiation can transform a 5% active cancer into a 95% active cancer for the duration of the exposure and for a short time afterwards. [5]

I postulate that if there is a cancer connection with the use of mobile phones, it is likely to be seen in these leukaemias. Adult leukaemias take many years to appear and be diagnosed, taking maybe between 10 and 30 years after the initial cell transformation. It is therefore unlikely that the trend will start to be seen for at least another five, probably ten, years. I hope the industry has good insurance cover!

Short term exposure of rats is no answer. Cancer is being increasingly recognised as an organizational systems problem, and no short term speeded up animal experiments are likely to give the same results as extended period chronic exposure to the human bio-system.

Are there problems that occur in the short term?

I would answer "Yes, there are". Following the BBC TV Watchdog programme and various media articles, Powerwatch has been receiving calls from mobile phone users who believe that they are experiencing problems.

Following a magazine article, we recently received calls from British Telecom engineers who had been issued with GSM phones. These are people who are generally very skeptical of EMF adverse health effects. They are reporting: Headaches, poor short term memory and concentration, tingling / burning/ or twitching skin on the side of their face nearest the phone, eye problems including 'dry eye' causing irritation with blinking of the eyelid, and buzzing in their ears not only while actually using the phone, but also on waking up during the night.

These symptoms bear a close resemblance to those in a study of a Latvian pulsed radio location station at Skrunda. This emits short 0.8 milliseconds pulses of 154 - 162MHz every 41ms, giving a rate of 24 pulses per second. In a study of 966 children aged 9-18 years old, motor function, memory and attention were significantly worse in the exposed group. Children living in front of the station had less developed memory and attention, their reaction time was slower and their neuromuscular endurance was decreased. The RMS field levels at their houses were typically only 1V/m, and a maximum level of 6 V/m or 10(W/cm²). [6]

Reports linking RF energy with asthenias had been reported by Charlotte Silverman back in 1973, and again in 1980, as what she called "radio wave sickness". [7]

In another study near the Latvian radio station, differences in micronuclei levels in peripheral erythrocytes were found to be statistically significant in the exposed and control groups. This is evidence of genetic changes caused by athermal (non-thermal) levels of pulsed radio-frequency radiation.[8]

Maximum exposure levels

When maximum exposure levels were set in the 1950s, they were based on the field levels the human body could withstand without causing a significant rise (1°C) in body temperature. The possibility of non-thermal effects was discounted. Despite considerable evidence in published scientific literature, this still continues to be the case. However, the conclusions section of the NRPB "Doll Report", on non-ionizing radiation effects, states: "Animal studies conducted at frequencies above about 100kHz have provided some evidence for effects on tumour incidence...". [9] At cellular telephone frequency bands of 900MHz and 1.8GHz, the current U.K. NRPB investigation levels had the effect of raising the U.K. permitted levels to 10 Watts per Kg in the head. The 1991 USA ANSI/IEEE C95.1 guidelines set the SAR at 1.6 W/Kg, and the CENELEC pre-standard states 2 W/Kg for the public. It has been shown that cellular-phones can deliver well over 2 W/Kg into head tissue during their output pulses, but they are said to comply because over each second the average power is only one-eighth of the pulse power (GSM and PCN digital phones).

Unlike the earlier analogue-phones, the new digital GSM ones emit a series of 546(s radio-frequency (RF) pulses at a repetition rate of 217Hz. Pulsed microwaves have been shown to be more biologically active than continuous radiation of the same frequency and power level. Take an operating digital GSM mobile-phone near an ordinary medium wave radio and you will hear a "rattle-clatter " buzzing noise. These pulses are also picked up and detected by the cells inside the user's and other nearby people's heads. In fact, up to 50% of the transmitted power can be absorbed by the user's head, which means that their brain cells are being "hit" by these radiation pulses two hundred and seventeen times every second.

The NRPB, and others, average the power from a digital phone over 1 second, and so divide the pulse power by eight. They correctly argue that the tissue has time to cool down between pulses, and then go on to deduce that no damage will therefore take place. This is similar to saying that placing a hammer on a "cell" (an egg, for example) exerting a small steady force, will produce the same effect as hitting the egg, using eight times the force briefly once a second. As well as being an electronics engineer, I am a qualified Agricultural Engineer - and I know that, when trying to loosen a stuck nut and bolt, the effect of constant pressure on the spanner is FAR less than when tapping the spanner with a hammer. At the same time (1993) as the NRPB raised its permitted microwave levels, two military research bases in the USA reduced their permitted levels of radio frequency exposure (30MHz to 100GHz) from 100W/m² down to 1W/m², (0.1mW/cm² or 100µW/cm²). This is because they acknowledge that there is now an overwhelming body of published evidence of the positive existence of non-thermal biological effects of high-frequency radiation. [10]

Some non-thermal effects

Important non-thermal biological effects have been demonstrated which could account for the development of cancer, asthma and the lowering of male fertility. Dr John A.G. Holt was the first Medical Director of the Institute of Radiotherapy and Oncology of Western Australia.

Cancerous tissue has increased conductivity compared with normal tissue. In 1974, Dr. Holt and Dr. Nelson were able to show that the specific effect of RF energy on cancer was to radio-sensitize a malignancy. Some cancers could have their radio-sensitivity increased by a factor exceeding 100 times. Since non electrical heating of cancer to 41.8°C increased radio-sensitivity by a factor of 2 to 3 and 434 MHz increased sensitivity by 100 to 150 times at less than 38°C, this is a non thermal effect. Every cancer demonstrated an increase in sensitivity but in those that were normally treated with radiotherapy this was at its maximum, whereas in those not usually treatable by X-ray Therapy it was minimal. [11]

Dr Peter French, Principal Scientific Officer in the Centre for Immunology, St Vincent's Hospital, Sydney, Australia, has been carrying out experiments on a range of human and animal cell lines using 835MHz exposure at 4.9mW/cm², 3 times per day for 7 days. He has shown effects on cell growth (some cells show an increased growth rate and some, including gliomas, show a decreased growth rate), cell shape, secretion of histamine and on gene transcription. These studies were funded by Dr John Holt, and now Dr French is seeking Australian government funding to continue these early, preliminary experiments. The work is currently submitted for publication to peer-reviewed scientific journals, and more details will be available after it has been accepted for publication. Dr French is the Immediate Past President of the Australia and New Zealand Society for Cell Biology. [12]

These key new areas of work are not being funded or supported by industry.

Microshield Industries launched a new EMF shielding mobile phone case range earlier this year. It received quite a lot of media publicity, and claims of "worthless" from the cellular phone industry. However, it does reduce the power absorbed by the user's head by some 10 to 20dBm (i.e. by a factor of between 10 and 100). Many purchasers of these Microshield cases are now expressing delight at having found a way of using their phones without experiencing the adverse side effects.

Base station masts

There is currently growing public concern about the number of base station masts that are being erected, and the effect these may have on both health and on property values. The field strengths from masts is low and it is unlikely to be more of a problem than any other form of RF data communications, however increasing worries are surfacing about all levels of RF energy, especially when digital signal bursts are transmitted.

In the Australian Government's media release, announcing the \$4.5 million project, the Minister for Health and Family Services, Dr. Michael Woolridge states: "While there is no substantiated evidence available to date of adverse health effects associated with RF EME (radio frequency electromagnetic energy) exposure within the standards that apply in Australia and overseas..."

Where is Dr. Woolridge getting the information from?... According to the press release, it must be from the EME (electromagnetic energy) Advisory Committee.

When one looks at what few epidemiological studies that have been done to date on RF/MW human exposure, there is ample evidence of adverse health effects to warrant concern.

The catch word in Dr. Woolridge's statement is "substantiated" evidence. This essentially means proven evidence. To use the term "proven" or "substantiated" is somewhat misleading. Epidemiological studies on human populations do not look for "proof" or "substantiation" but increases in incidence of a disease, or relative risk ratios.

Epidemiological studies on tobacco and asbestos did not "substantiate" that these carcinogens cause cancer, they do show, however, a significant increased risk of developing cancer from exposure. This is not "substantiation", but that did not prevent the health authorities from taking corrective action. It is unfortunate that with electromagnetic radiation however industry and its supporters insist an absolute connection must be found before correction action be taken.

The following recent studies do not "substantiate" anything in relation to exposure to RF/MW; they are dealing with the increase in incidence of adverse health effects such as cancer. These relevant which should be of interest to anyone involved in EME health issues and who is concerned with a possible association with the human population:

a) The recent Bruce Hocking preliminary study compared cancer rates in three municipalities within a 4km radius of Sydney TV towers with rates in adjacent areas further away. The study found children living within the 4km. radius had a relative risk of 1.61 for leukaemia, compared with the control group. The relative risk for mortality was higher at 2.25, and highest at 2.84 for fatal lymphoblastic leukaemia. [13]

The calculated power density levels within the 4 km. area were calculated to be in the order of 0.02 to 8 microwatts/ sq.cm., up to 1000 times less than the Australian RF/MW safety standard of 200 microwatts/sq.cm.

b) In 1987, a similar study identified higher rates of cancer among those living near the TV and radio broadcast towers in Honolulu, Hawaii. Drs. Bruce Anderson and Alden Henderson of the Hawaii Department of Health found in a study of several thousand people in residential areas with about 12 communication towers in the midst, a relative risk for cancer, including leukaemia, of 1.375 (37.5% increase). This study was never followed up. [14]

c) An earlier study in 1982, conducted by Dr. William Morton of the University of Oregon's Health Science Centre in Portland, Oregon found parallel trends in his study of cancer and broadcast radiation in Portland. [15]

d) Dr. Stanislaw Szmigieski, a leading epidemiologist with the Centre for Radiobiology and Radiation Safety at the Military Institute of Hygiene and Epidemiology, Warsaw, Poland has been the team leader for an on-going study of the health effects of RF/MW exposure of military personnel in Poland for the whole military population. His research found that young military personnel exposed to RF/MW radiation had more than eight times the expected rate of leukaemia and lymphoma. Careful surveys of exposure revealed that 80 - 85% of the personnel were exposed to an average of less than 42 microwatts/sq. cm., with a median point near microwatts/sq. cm. [3]

e) Ouellet-Hellstrom and Stewart (1993) found a statistically significant 3.3 fold increase of miscarriage amongst U.S. physiotherapists using microwave diathermy compared to a non-exposed control group. The incidence increased with the number of monthly treatments, which could suggest a cumulative effect. At an average of about 10 treatments per month the estimated exposure was about 0.04 to 0.56 microwatts/sq. cm. [16]

f) Shandala et. al. (1979) found that calcium ion efflux varies in living animal cells at 10 micro watts/sq.cm. and this level also produces brain activity changes. [17]

g) von Klitzing (1995) found changes to human brain EEG with a signal of 217 Hz modulation on a 150 megahertz (MHz) carrier with an external exposure of about 2.5 microwatts/sq.cm. [18]

h) Dr. John Goldsmith, Professor of Epidemiology at Burn Gurion University of the Negev, Israel has collected evidence of several occupational and military exposures to microwaves which produced elevated risks of a wide range of cancers, including childhood leukaemia in children of staff, and cancers in the staff and partners at the U.S. Embassy in Moscow and other eastern European U.S. embassies. These cancers were associated with a reported maximum exposure of between 5 and 15 microwatts. sq.cm. and mean exposures between 1 and 2.4. microwatts/sq.cm., recorded near the outside walls of the embassy. Exposures inside the building should be somewhat smaller than these readings. [19]

i) To quote from Dr. Neil Cherry's (New Zealand) recent paper of March 1996 Potential and Actual Adverse

Effects of Cellsite Microwave Radiation: [20]

"With these and dozens of other epidemiological studies of large populations and large numbers of workers occupationally exposed to RF/MW radiation, showing statistically significant increases of a wide spectrum of cancers, there can be little or no doubt that chronic low level exposure to RF/MW radiation produces increased cancer risk."

j) The Latvian pulsed radar station study mentioned earlier in this talk. [6]

Considering these studies and the evidence of an increased cancer risk, at levels well below the current Australian RF/MW standard of 200 microwatts/ sq.cm., for Dr. Wooldridge to state that "there is no substantiated evidence available to date of adverse health effects..." indicates that he is not getting proper advice.

Who can the public turn to for advice? Part of my remit was to answer the question whether the public should be suspicious of soothing statements from people responsible for advice on these matters.

Dr. Alastair McKinlay, of the UK NRPB, is the vice-Chair of an "Expert Group" set up by the European Commission. He is recently quoted as stating: What is now required is a lot more research in the microwave frequency part of the electromagnetic spectrum, where mobile phones operate. This is not because there is concern about health effects, but that such research makes sense to quell any public concern. [21]

In nearly every living organism, there is a special protection launched by cells when they are under attack from environmental toxins or adverse environmental conditions. This is called a stress response, and what are produced are stress proteins (also known as heat shock proteins).

Plants, animals and bacteria all produce stress proteins to survive environmental stressors like high temperatures, lack of oxygen, heavy metal poisoning, and oxidative stress (a cause of premature aging). We can now add ELF and RF exposures to this list of environmental stressors that cause a physiological stress response."

Appendix 6

Taken from:

http://www.buergerwelle.de/pdf/cell_phone_radiation_poses_a_serious_biological_and_health_risk.pdf

7th May 2001

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Cancer Epidemiology:

Increase the incidence of many types of cancer, including leukaemia, brain tumor, testicular cancer, genitourinary and breast cancer, Robinette et al. (1980), Milham (1985, 1988), Szmigielski (1996), Hocking et al. (1996), Dolk et al. (1997 a, b), Beall et al. (1996), Grayson (1996), Thomas et al. (1987), Lilienfeld et al. (1978), Zaret (1989), Davis and Mostofl (1993), Hayes et al. (1990), Tynes et al. (1996), Cantor et al. (1995), and many others.

These biological and health effects are consistent with the biological understanding that brains, hearts and cells are sensitive to electromagnetic signals because they use electromagnetic signals for their regulation, control and natural processes, including those processes monitored by the EEG and ECG. There is overwhelming evidence that EMR is genotoxic, alters cellular ions, neurotransmitters and neurohormones, and interferes with brain and heart signals, and increases cancer.

Cell Phone Radiation Research:

For years the cell phone companies and government authorities have assured us that cell phone are perfectly safe. For example, they claim that the particular set of radiation parameter associated with cell phones are not the same as any other radio signal and therefore earlier research does not apply. They also mount biased review teams who falsely dismiss any results that indicate adverse biological and health effects and the flawed pre-assumption that the only possible effect is tissue heating. There is a very large body of scientific research that challenges this view. Now we have published research, primarily funded by governments and industry that shows that cell phone radiation causes the following effects:

Neurological Activity:

Alters brain activity including EEG, Von Klitzing (1995), Mann and Roschkle (1996), Krause et al. (2000).

Disturbs sleep, Mann and Roschkle (1996), Bordely et al. (1999).

Alters sleep EEG after awake exposure, Huber et al. (2000).

Alters human reaction times, Preece et al. (1999), Induced potentials, Eulitz et al. (1998), slow brain potentials, Freude et al. (1998),

Response and speed of switching attention (need for car driving) significantly worse, Hladky et al. (1999).

Altered reaction times and working memory function (positive), Koivisto et al. (2000), Krause et al. (2000).

Brain cortex interaction as shown by significantly altered human EEG by cellphone radiation, during a 15 minute exposure, Lebedeva et al. (2000).

Weakens the blood brain barrier ($p < 0.0001$): Persson, B.R.R., Salford, L.G. and Brun, A., 1997.

A Fifteen minute exposure, increased auditory brainstem response and hearing deficiency in 2 kHz to 10 kHz range, Kellenyi et al. (1999).

While driving, with 50 minutes per month with a cell phone, a highly significant 5.6-fold increase in accident risk, Violanti et al. (1996); a 2-fold increase in fatal accidents with cell phone in car, Violanti et al. (1998); impairs cognitive load and detection thresholds, Lamble et al. (1999). In a large Canadian study Redelmeier and Tibshirani (1997) the risk of collision when using a cellphone was 4 time higher, RR = 4.3, 95%CI 3.0-6.5. Calls close to the time of collision has RR = 4.8 for 5 minutes and RR = 5.9, $p < 0.001$, for 15 minutes.

Significant changes in local temperature, and in physiologic parameters of the CNS and cardiovascular system, Khdnisskii, Moshkarev and Fomenko (1999).

Causes memory loss, concentration difficulties, fatigue, and headache, in a dose response manner, (Mild et al. (1998)). Headache, discomfort, nausea, Hocking (1998).

Cardiac Activity:

Cardiac pacemaker interference: skipped three beats, Barbaro et al. (1996); showed interference, Hofgartner et al. (1996); significant interference, $p < 0.05$ Chen et al. (1996); extremely highly significant interference, $p = 0.0003$, Naegeli et al. (1996); $p < 0.0001$, Altamura et al. (1997); reversible interference, Schlegal et al.

(1998); significantly induced electronic noise, Occhetta et al. (1999); various disturbances observed and warnings recommended, Trigano et al. (1999)

Significantly increases blood pressure, Braune et al. (1998).

Hormone Activity:

Reduces the pituitary production of Thyrotropin (Thyroid Stimulating Hormone, TSH):

Reduces melatonin significantly, Burch et al. (1997, 1998). A GSM cellphone reduces melatonin, but not significantly in a very small sample (N=18) of subjects, de Seze et al. (1999).

A reported but yet to be published Australian Study, EMRAA News, June 2000, used a Clot Retention Test on blood samples to detect hormonal changes. A group of 30 volunteers used a Nokia 6150 cellphone for 10 minutes on each of two consecutive days. The CRT test showed significant changes in the thyroid, pancreas, ovaries, testes and hormonal balance.

Reproductive Activity:

Decreases in sperm counts and smaller tube development in rat testes, Dasdag et al. (1999).

Increases embryonic mortality of chickens, Youbicier-Simo, Lebecq and Bastide (1998).

Genotoxic Activity:

Breaks DNA strands, Verschaeve et al. (1994), Maes et al. (1997), which is still extremely significant $p < 0.0001$, at 0.0024 W/kg ($1.2 \square \text{ W/cm}^2$), Phillips et al. (1998).

Produces an up to three-fold increase in chromosome aberrations in a dose response manner from all cell phones tested, Tice, Hook and McRee, reported in Microwave News, March/April 1999. The findings were the same when the experiment was repeated and Dr Tice is quoted as stating: "There's no way you're going to get positive results twice over four different technologies as a chance result."

Doubles c-fos gene activity (a proto oncogene) for analogue phones and increases it by 41 % for digital phones, Goswami et al. (1999), altered c-jun gene, Ivaschuk et al. (1997), Increased hsp70 messenger RNA, Fritz et al. (1997).

Increases Tumour Necrosis Factor (TNF), Fesenko et al. (1999).

Increases ODC activity, Penafiel et al. (1997).

DNA synthesis and cell proliferation increased after 4 days of 20 min for 3 times/day exposure. Calcium ions were significantly altered, French, Donnellan and McKenzie (1997). Decreased cell proliferation, Kwee and Raskmark (1997), Velizarov, Raskmark and Kwee (1999)

Doubles the cancer in mice, Repacholi et al. (1997).

Increases the mortality of mobile phone users compared with portable phone users, RR = 1.38, 95%CI: 1.07-1.79, p=0.013, Rothman et al. (1996).

Increases human brain tumor rate by 2.5 times (Hardell et al. (1999)). Associated with an angiosarcoma (case study), Hardell (1999)

Hardell et al. (2000), for analogue phones OR = 2.62, 95%CI: 1.02-6.71, with higher tumour rates at points of highest exposure.

Significantly increases the incidence of eye cancer (Uveal Melanoma), by between OR = 4.2, 95%CI: 1.2-14.5, and OR = 10.1, 95%CI: 1.1-484.4, Stang et al. (2001).

United States, Motorola Study Morgan et al. (2000)

High Exposure RR = 1.07 (0.32-2.66) n = 3

Moderate Exposure RR = 1.18 (0.36-2.92) n = 3

High/Mod vs Low RR = 1.13 (0.49-2.31) n = 6

This project underestimated cancer rates by using a high cancer reference group.

Carlo and Schram (2001) report that in the industry funded WTR (Wireless Technology Research) programme Dr Joseph Roti Roti confirmed the Tice, Hook and McRee research showing that cellphone radiation significantly damaged DNA through observed micronuclei formation.

Muscat et al. (2000) report elevated brain cancer in cellphone users in the United States, with cerebral tumors occurring more frequently on the side of the head where the mobile phone had been used, (26 vs 15 cases, p=0.06) and for a rare brain cancer, neuroepitheliomatous, OR = 2.1, 95%CI: 0.9-4.7. Mean use of cell phones was 2.5 years for cases and 2.2 years for controls, showing that a small increase in cellphone use (0.3 years) produces a large increase in brain cancer risk.

Cell phone users in Denmark Johansen et al. (2001)

Duration of digital subscription <1 yr 1-2yrs □ 3 yrs

Relative to reference group SIR 0.7 0.9 1.2

Relative to <1 yr group RR 1.0 1.29 1.71

Other cancers are set out in "Table 2" below. Over 67 % of phone users had used their phones for 2 years or less. The reference group had a higher than average cancer rate than the age range of cell phone users, underestimating the cancer rates. This is shown by Standard Incidence Ratios (SIR) of some groups being as little as 0.6. For example SIR for users for <1 year is 0.7.

Table two shows that even with little cellphone use, and even with the use of a high cancer reference group, there are several elevated cancers approaching significance: Testicular cancer SIR = 1.12, 95%CI: 0.97-1.30,

Cervical cancer, SIR = 1.34, 95%CI: 0.95-1.85, Female Pharynx cancer, SIR 2.43, 95%CI: 0.65-6.22, Esophagus cancer, SIR = 1.53, 95%CI: 0.31-4.46 and female breast cancer, SIR = 1.08, 95%CI: 0.91-1.26.

Conclusions:

To date (2001) over 50 studies have shown adverse biological or human health effects specifically from cell phone radiation. These research results to date clearly show that cell phones and cell phone radiation are a strong risk factor for all of the adverse health effects identified for EMR because they share the same biological mechanisms. The greatest risk is to cell phone users because of the high exposure to their heads and the great sensitivity of brain tissue and brain processes. DNA damage accelerates cell death in the brain, advancing neurodegenerative diseases and brain cancer. Brain tumour is already an identified risk factor. Cell phones are carried on people's belts and in breast pockets. Hence liver cancer, breast cancer and testicular cancer became probable risk factors.

Altered attention and cognition, as well as the diversion of talking on a phone while driving is a significant risk factor for accidents and fatal accidents.

Some cardiac pacemakers are susceptible to active cell phone signals, recommending keeping cell phones away from hearts and pacemakers.

Because the biological mechanisms are shown and EMR has been observed to significantly increase the following effects, there is extremely strong evidence to conclude that cell phones are a risk factor for breast, liver, testicular and brain cancer. It is also probable that we will observe a very wide range of other effects including cardiac, neurological and reproductive illness and death. Since cell phone radiation cause many cell damages including DNA and chromosome damage, all of these effects will also be caused by cell sites.

Dose-response studies of neurological, cardiac, reproductive and cancer effects in human populations all point to a near zero exposure level of no effect, Cherry (2000). Since cellphone radiation mimics RF/MW radiation effects which mimics ELF biological and health, the adverse effects occur across the spectrum and includes cellphone radiation, with a safe exposure level of zero.

Appendix 7

“Adverse Health Concerns of Mobile Phones by Alasdair Philips EMC Consultant & Director of the Powerwatch Network” <http://frontpage.simnet.is/vgv/alist.htm>

“... Cancer implications

In fact, there is little recent evidence that brain tumours are a likely outcome. If there are long term cancer implications, then they will most likely be myeloid leukaemias and multiple melanomas. Back in the early 1980s Sam Milham reported excess leukaemias among amateur radio operators, with deaths from acute and chronic myeloid leukaemias nearly three times higher than expected.

In 1980, Dr John Holt had a letter published [2]. This showed that between 1951-59, 50% of patients with CML in Queensland survived 55 months. In 1960 and 1961 three large TV broadcast stations were commissioned in the area. In the period 1963-67, 50% of patients with CML only survived 21 months. This dramatic change could not be explained by any medical personnel or therapy changes.

In the mid-1980s Stanislaw Szmigielski reported that Polish military personnel exposed to RF energy showed elevated leukaemia levels. He has just published a 1996 update. [3] This is a study of all Polish military

personnel for 15 years (1971-85), approximately 128,000 people each year. Of these about 3700 (3%) were considered to be occupationally exposed to radio-frequency and / or microwave radiation.

The largest increasing were found for chronic myelocytic leukaemia (CML), with an astounding odds ratio (OR) of 13.9 (95%CI 6.72-22.12, $p < 0.001$), acute myeloblastic leukaemia (AML) with an OR of 8.62 (95%CI 3.54-13.67, $p < 0.001$), and non-Hodgkin lymphomas with an OR of 5.82 (95%CI 3.54-13.67, $p < 0.001$).

The 1996 paper by Lai & Singh, showing single and double DNA strand breaks in brain cells of rats exposed to 2.45GHz SARs of 1.2 W/Kg (comparable with levels in the heads of mobile phone users), also gives rise to concern. [4]

If someone is completely healthy, and has a strong immune system, then mobile-phone use may well not give them long-term health problems. Some people can smoke twenty cigarettes per day for fifty years and not develop lung cancer, and yet the dangers of smoking are now generally accepted. It has been repeatedly shown that a few minutes exposure to cell phone type radiation can transform a 5% active cancer into a 95% active cancer for the duration of the exposure and for a short time afterwards. [5]

I postulate that if there is a cancer connection with the use of mobile phones, it is likely to be seen in these leukaemias. Adult leukaemias take many years to appear and be diagnosed, taking maybe between 10 and 30 years after the initial cell transformation. It is therefore unlikely that the trend will start to be seen for at least another five, probably ten, years. I hope the industry has good insurance cover!

Short term exposure of rats is no answer. Cancer is being increasingly recognised as an organizational systems problem, and no short term speeded up animal experiments are likely to give the same results as extended period chronic exposure to the human bio-system.

Are there problems that occur in the short term?

I would answer "Yes, there are". Following the BBC TV Watchdog programme and various media articles, Powerwatch has been receiving calls from mobile phone users who believe that they are experiencing problems.

Following a magazine article, we recently received calls from British Telecom engineers who had been issued with GSM phones. These are people who are generally very skeptical of EMF adverse health effects. They are reporting: Headaches, poor short term memory and concentration, tingling / burning/ or twitching skin on the side of their face nearest the phone, eye problems including 'dry eye' causing irritation with blinking of the eyelid, and buzzing in their ears not only while actually using the phone, but also on waking up during the night.

These symptoms bear a close resemblance to those in a study of a Latvian pulsed radio location station at Skrunda. This emits short 0.8 milliseconds pulses of 154 - 162MHz every 41ms, giving a rate of 24 pulses per second. In a study of 966 children aged 9-18 years old, motor function, memory and attention were significantly worse in the exposed group. Children living in front of the station had less developed memory and attention, their reaction time was slower and their neuromuscular endurance was decreased. The RMS field levels at their houses were typically only 1V/m, and a maximum level of 6 V/m or 10(W/cm²). [6]

Reports linking RF energy with asthenias had been reported by Charlotte Silverman back in 1973, and again in 1980, as what she called "radio wave sickness". [7]

In another study near the Latvian radio station, differences in micronuclei levels in peripheral erythrocytes were found to be statistically significant in the exposed and control groups. This is evidence of genetic changes caused by athermal (non-thermal) levels of pulsed radio-frequency radiation.[8]

Maximum exposure levels

When maximum exposure levels were set in the 1950s, they were based on the field levels the human body could withstand without causing a significant rise (1°C) in body temperature. The possibility of non-thermal effects was discounted. Despite considerable evidence in published scientific literature, this still continues to be the case. However, the conclusions section of the NRPB "Doll Report", on non-ionizing radiation effects, states: "Animal studies conducted at frequencies above about 100kHz have provided some evidence for effects on tumour incidence...". [9] At cellular telephone frequency bands of 900MHz and 1.8GHz, the current U.K. NRPB investigation levels had the effect of raising the U.K. permitted levels to 10 Watts per Kg in the head. The 1991 USA ANSI/IEEE C95.1 guidelines set the SAR at 1.6 W/Kg, and the CENELEC pre-standard states 2 W/Kg for the public. It has been shown that cellular-phones can deliver well over 2 W/Kg into head tissue during their output pulses, but they are said to comply because over each second the average power is only one-eighth of the pulse power (GSM and PCN digital phones).

Unlike the earlier analogue-phones, the new digital GSM ones emit a series of 546(s radio-frequency (RF) pulses at a repetition rate of 217Hz. Pulsed microwaves have been shown to be more biologically active than continuous radiation of the same frequency and power level. Take an operating digital GSM mobile-phone near an ordinary medium wave radio and you will hear a "rattle-clatter" buzzing noise. These pulses are also picked up and detected by the cells inside the user's and other nearby people's heads. In fact, up to 50% of the transmitted power can be absorbed by the user's head, which means that their brain cells are being "hit" by these radiation pulses two hundred and seventeen times every second.

The NRPB, and others, average the power from a digital phone over 1 second, and so divide the pulse power by eight. They correctly argue that the tissue has time to cool down between pulses, and then go on to deduce that no damage will therefore take place. This is similar to saying that placing a hammer on a "cell" (an egg, for example) exerting a small steady force, will produce the same effect as hitting the egg, using eight times the force briefly once a second. As well as being an electronics engineer, I am a qualified Agricultural Engineer - and I know that, when trying to loosen a stuck nut and bolt, the effect of constant pressure on the spanner is FAR less than when tapping the spanner with a hammer. At the same time (1993) as the NRPB raised its permitted microwave levels, two military research bases in the USA reduced their permitted levels of radio frequency exposure (30MHz to 100GHz) from 100W/m² down to 1W/m², (0.1mW/cm² or 100μW/cm²). This is because they acknowledge that there is now an overwhelming body of published evidence of the positive existence of non-thermal biological effects of high-frequency radiation. [10]

Some non-thermal effects

Important non-thermal biological effects have been demonstrated which could account for the development of cancer, asthma and the lowering of male fertility. Dr John A.G. Holt was the first Medical Director of the Institute of Radiotherapy and Oncology of Western Australia.

Cancerous tissue has increased conductivity compared with normal tissue. In 1974, Dr. Holt and Dr. Nelson were able to show that the specific effect of RF energy on cancer was to radio-sensitize a malignancy. Some cancers could have their radio-sensitivity increased by a factor exceeding 100 times. Since non electrical heating of cancer to 41.8°C increased radio-sensitivity by a factor of 2 to 3 and 434 MHz increased sensitivity by 100 to 150 times at less than 38°C , this is a non thermal effect. Every cancer demonstrated an increase in sensitivity but in those that were normally treated with radiotherapy this was at its maximum, whereas in those not usually treatable by X-ray Therapy it was minimal. [11]

Dr Peter French, Principal Scientific Officer in the Centre for Immunology, St Vincent's Hospital, Sydney, Australia, has been carrying out experiments on a range of human and animal cell lines using 835MHz exposure at 4.9mW/cm², 3 times per day for 7 days. He has shown effects on cell growth (some cells show an increased

growth rate and some, including gliomas, show a decreased growth rate), cell shape, secretion of histamine and on gene transcription. These studies were funded by Dr John Holt, and now Dr French is seeking Australian government funding to continue these early, preliminary experiments. The work is currently submitted for publication to peer-reviewed scientific journals, and more details will be available after it has been accepted for publication. Dr French is the Immediate Past President of the Australia and New Zealand Society for Cell Biology. [12]

These key new areas of work are not being funded or supported by industry.

Microshield Industries launched a new EMF shielding mobile phone case range earlier this year. It received quite a lot of media publicity, and claims of "worthless" from the cellular phone industry. However, it does reduce the power absorbed by the user's head by some 10 to 20dBm (i.e. by a factor of between 10 and 100). Many purchasers of these Microshield cases are now expressing delight at having found a way of using their phones without experiencing the adverse side effects.

Base station masts

There is currently growing public concern about the number of base station masts that are being erected, and the effect these may have on both health and on property values. The field strengths from masts is low and it is unlikely to be more of a problem than any other form of RF data communications, however increasing worries are surfacing about all levels of RF energy, especially when digital signal bursts are transmitted.

In the Australian Government's media release, announcing the \$4.5 million project, the Minister for Health and Family Services, Dr. Michael Woolridge states: "While there is no substantiated evidence available to date of adverse health effects associated with RF EME (radio frequency electromagnetic energy) exposure within the standards that apply in Australia and overseas..."

Where is Dr. Woolridge getting the information from?... According to the press release, it must be from the EME (electromagnetic energy) Advisory Committee.

When one looks at what few epidemiological studies that have been done to date on RF/MW human exposure, there is ample evidence of adverse health effects to warrant concern.

The catch word in Dr. Woolridge's statement is "substantiated" evidence. This essentially means proven evidence. To use the term "proven" or "substantiated" is somewhat misleading. Epidemiological studies on human populations do not look for "proof" or "substantiation" but increases in incidence of a disease, or relative risk ratios.

Epidemiological studies on tobacco and asbestos did not "substantiate" that these carcinogens cause cancer, they do show, however, a significant increased risk of developing cancer from exposure. This is not "substantiation", but that did not prevent the health authorities from taking corrective action. It is unfortunate that with electromagnetic radiation however industry and its supporters insist an absolute connection must be found before correction action be taken.

The following recent studies do not "substantiate" anything in relation to exposure to RF/MW; they are dealing with the increase in incidence of adverse health effects such as cancer. These relevant which should be of interest to anyone involved in EME health issues and who is concerned with a possible association with the human population:

a) The recent Bruce Hocking preliminary study compared cancer rates in three municipalities within a 4km radius of Sydney TV towers with rates in adjacent areas further away. The study found children living within the 4km. radius had a relative risk of 1.61 for leukaemia, compared with the control group. The relative risk for

mortality was higher at 2.25, and highest at 2.84 for fatal lymphoblastic leukaemia. [13]

The calculated power density levels within the 4 km. area were calculated to be in the order of 0.02 to 8 microwatts/ sq.cm., up to 1000 times less than the Australian RF/MW safety standard of 200 microwatts/sq.cm.

b) In 1987, a similar study identified higher rates of cancer among those living near the TV and radio broadcast towers in Honolulu, Hawaii. Drs. Bruce Anderson and Alden Henderson of the Hawaii Department of Health found in a study of several thousand people in residential areas with about 12 communication towers in the midst, a relative risk for cancer, including leukaemia, of 1.375 (37.5% increase). This study was never followed up. [14]

c) An earlier study in 1982, conducted by Dr. William Morton of the University of Oregon's Health Science Centre in Portland, Oregon found parallel trends in his study of cancer and broadcast radiation in Portland. [15]

d) Dr. Stanislaw Szmigieski, a leading epidemiologist with the Centre for Radiobiology and Radiation Safety at the Military Institute of Hygiene and Epidemiology, Warsaw, Poland has been the team leader for an on-going study of the health effects of RF/MW exposure of military personnel in Poland for the whole military population. His research found that young military personnel exposed to RF/MW radiation had more than eight times the expected rate of leukaemia and lymphoma. Careful surveys of exposure revealed that 80 - 85% of the personnel were exposed to an average of less than 42 microwatts/sq. cm., with a median point near 7 microwatts/sq. cm. [3]

e) Ouellet-Hellstrom and Stewart (1993) found a statistically significant 3.3 fold increase of miscarriage amongst U.S. physiotherapists using microwave diathermy compared to a non-exposed control group. The incidence increased with the number of monthly treatments, which could suggest a cumulative effect. At an average of about 10 treatments per month the estimated exposure was about 0.04 to 0.56 microwatts/sq. cm. [16]

f) Shandala et. al. (1979) found that calcium ion efflux varies in living animal cells at 10 micro watts/sq.cm. and this level also produces brain activity changes. [17]

g) von Klitzing (1995) found changes to human brain EEG with a signal of 217 Hz modulation on a 150 megahertz (MHz) carrier with an external exposure of about 2.5 microwatts/sq.cm. [18]

h) Dr. John Goldsmith, Professor of Epidemiology at Burn Gurion University of the Negev, Israel has collected evidence of several occupational and military exposures to microwaves which produced elevated risks of a wide range of cancers, including childhood leukaemia in children of staff, and cancers in the staff and partners at the U.S. Embassy in Moscow and other eastern European U.S. embassies. These cancers were associated with a reported maximum exposure of between 5 and 15 microwatts. sq.cm. and mean exposures between 1 and 2.4. microwatts/sq.cm., recorded near the outside walls of the embassy. Exposures inside the building should be somewhat smaller than these readings. [19]

i) To quote from Dr. Neil Cherry's (New Zealand) recent paper of March 1996 Potential and Actual Adverse Effects of Cellsite Microwave Radiation: [20]

"With these and dozens of other epidemiological studies of large populations and large numbers of workers occupationally exposed to RF/MW radiation, showing statistically significant increases of a wide spectrum of cancers, there can be little or no doubt that chronic low level exposure to RF/MW radiation produces increased cancer risk."

j) The Latvian pulsed radar station study mentioned earlier in this talk. [6]

Considering these studies and the evidence of an increased cancer risk, at levels well below the current Australian RF/MW standard of 200 microwatts/ sq.cm., for Dr. Wooldridge to state that "there is no substantiated evidence available to date of adverse health effects..." indicates that he is not getting proper advice.

Who can the public turn to for advice? Part of my remit was to answer the question whether the public should be suspicious of soothing statements from people responsible for advice on these matters.

Dr. Alastair McKinlay, of the UK NRPB, is the vice-Chair of an "Expert Group" set up by the European Commission. He is recently quoted as stating: What is now required is a lot more research in the microwave frequency part of the electromagnetic spectrum, where mobile phones operate. This is not because there is concern about health effects, but that such research makes sense to quell any public concern. [21] In nearly every living organism, there is a special protection launched by cells when they are under attack from environmental toxins or adverse environmental conditions. This is called a stress response, and what are produced are stress proteins (also known as heat shock proteins).

Plants, animals and bacteria all produce stress proteins to survive environmental stressors like high temperatures, lack of oxygen, heavy metal poisoning, and oxidative stress (a cause of premature aging). We can now add ELF and RF exposures to this list of environmental stressors that cause a physiological stress response."

Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

JUN 22 2009

Dear

This is in response to your environmental petition no. 235-C of February 2, 2009, addressed to Mr. Scott Vaughan, the Commissioner of the Environment and Sustainable Development (CESD).

In your petition you raised concerns about the electromagnetic radiation emitted from cellular phone towers.

I am pleased to provide you with the enclosed Health Canada response to your petition.

I appreciate your interest in this important matter, and I hope that you will find this information useful.

Sincerely,

A handwritten signature in black ink, appearing to read 'Leona Aglukkaq'.

Leona Aglukkaq

Enclosure

c.c. Mr. Scott Vaughan, CESD



Canada

**Health Canada Response to
Environmental Petition No. 235-C Filed by
under Section 22 of the *Auditor General Act*
Received February 26, 2009**

Electromagnetic radiation emitted from cellular phone towers

June 26, 2009

Minister of Health

- Q1. What specifically does HC object to in the above letter?*
- Q14. Would the author of the above "heat" response comment on this article?*
- Q15. Does HC agree with Dr. Hardell?*
- Q31. How does HC reconcile Dr. Carlo's response to the "heat" response given by HC mentioned above?*

Answer to Questions 1, 14, 15 and 31:

As indicated in Petitions 235 and 235B, other researchers are able to express their own opinions. It is, however, the opinion of Health Canada scientific staff that there is no convincing evidence of any adverse health effects at electromagnetic field (EMF) exposure levels below the limits outlined in Safety Code 6.

- Q2. To date what is the estimated cost (to the nearest million) to Canadians due to Dr. Chopra's court case, the Canadian Government's time, the wrongful dismissal suit?*
- Q3. How many people were fired from HC because of Dr. Chopra's case?*

Answer to Questions 2 and 3

The dismissal of Dr. Chopra is currently before the Public Service Staff Relations Board and, consequently, it is not appropriate to provide any comments related to this matter.

- Q4. Was the delay of the report on asbestos another example of HC putting Industry before the health of Canadians and in this case the health of citizens of the world?*
- Q5. Was the delay of this report on asbestos further evidence of HC's commitment to the status quo?*

Answer to Questions 4 and 5

Given the complexity of the issues, Health Canada took the necessary time to carefully review the findings of the report, and to consult with its federal and provincial partners.

- Q6. Why is Dr. Bradley so hesitant to use government money to meet citizens with genuine health concerns while he does not hesitate to meet with industry on a regular basis?*
- Q7. How many times has Dr. Bradley dissuaded further discussion on electromagnetic radiation by referring to the imminent WHO Interphone study?*

Answer to Questions 6 and 7:

Minister Findlay wrote to the Director of the Consumer and Clinical Radiation Protection Bureau (CCRPB) on behalf of a constituent asking that the Director meet with this constituent. A meeting was scheduled and subsequently cancelled by the constituent, due to a personal matter. While the Director did follow-up, the constituent did not request to reschedule the meeting.

With respect to meetings with industry, the Director of the CCRPB has been invited once a year to attend a joint meeting between the Industry Association and the University of Ottawa staff of the McLaughlin Institute. This is the only meeting to which the Director is invited, the last one being November 20, 2007. Like the previous annual meetings, it was held in Ottawa, and no expenses were incurred.

Regarding the World Health Organization's Interphone Study, this study has the potential for providing excellent information regarding adverse health effects from the use of cell phones. Whether reference to this project has in any way dissuaded further discussion on electromagnetic radiation is unknown.

Q8. Is HC in any way responsible for the delay of publication of the Interphone study?

No. Health Canada has no involvement with this study.

Q9. Is this the weight of evidence HC refers to?

Q10. What percentage of studies cited by HC as "weight of evidence" was funded by industry?

As explained in the response to Question 4 of Petition 235B, Health Canada scientific staff does not consider the chart provided by the petitioner to be an accurate reflection of the nature of the science. This chart reflects the opinion of one scientist and is not representative of the consensus opinion of the majority of his international counterparts.

All credible peer-reviewed scientific literature is included in the weight-of-evidence approach for assessing the possible health risks of EMF. Thus, both adverse and no effect studies are included as are those funded by industry or via other funding sources. It is only the quality and impact of the research outlined within the individual research papers that is considered in the evaluation. Industry-funded studies comprise only a small portion of the entire scientific literature.

Q11. How does HC account for this?

Q16. At the time of writing this petition I anticipate that HC will deny everything in this whole petition like they did in my first and second petitions. I believe that they will say I have been 100% wrong even though I've quoted over 2000 studies in the Bioinitiative report itself and the words of Dr. Lai, Dr. Abe Liboff, Dr. Jerry Phillips, Dr. Joe Wiart, Dr. Niels Kuster, Dr. Andreas Christ, Dr. Lennart Hardell, and Dr. Devra Davis. My claim about HC and the status quo comes to mind. Can HC explain, without using "weight of evidence", how I could refer to all this research and be completely wrong?

Answer to Questions 11 and 16

The European Commission has recently stated that (*Report of the workshop on EMF and Health: Science and Policy to address public concerns*, February 2009), “in order for scientific studies to be used for a proper assessment of health effects, their quality has to be assessed first. Bad studies must be disregarded irrespective of whether they are “positive” or “negative.” The mere respective numbers of “positive” and “negative” studies, without any further information on their quality, are irrelevant.”

Effectively, it is the consideration of the complete body of science with due regard for the quality of individual studies and the repeatability/reproducibility of the results that must be considered in reaching any scientifically sound conclusions.

Q12. Does HC believe the identity of the author of the above quote should be protected or should the author come forward to defend this statement?

As explained in previous petition responses, this statement reflects the scientific opinion and position of Health Canada.

Q13. Does the Auditor General agree with this statement?

Health Canada cannot comment on behalf of the Auditor General.

Q17. What percentage of the scientists referenced in SC6 were physicists?

Q18. What percentage of scientists were neurobiologists?

Q19. What percentage of scientists were microbiologists?

Q20. What percentage of scientists were molecular biologists?

Q21. What percentage of scientists were oncologists?

Q22. What percentage of scientists were geneticists?

Answer to Questions 17, 18, 19, 20, 21 and 22

As indicated in Health Canada’s response to Petition 235, Safety Code 6 was written as a technical guidance document which outlined maximal human exposure limits for radiofrequency (RF) fields and included information regarding how to evaluate the intensity of RF fields. This document was not intended to be a scientific review of the current state of biological evidence of RF field bio-effects. As such, the majority of references in this document were citations related to the conduct of RF field measurements and surveys. The precise breakdown of the specialties of the individual authors within the citations listed in Safety Code 6 is not known, but

presumably this would include a large number of physicists and engineers due to the technical subject matter of the document.

- Q23. *In the Consumer and Clinical Radiation Protection Bureau of Canada what percentage of the Ph.D's are neurobiologists?*
- Q24. *In the Consumer and Clinical Radiation Protection Bureau of Canada what percentage of the Ph.D's are microbiologists?*
- Q25. *In the Consumer and Clinical Radiation Protection Bureau of Canada what percentage of the Ph.D's are molecular biologists?*
- Q26. *In the Consumer and Clinical Radiation Protection Bureau of Canada what percentage of the Ph.D's are oncologists?*
- Q27. *In the Consumer and Clinical Radiation Protection Bureau of Canada what percentage of the Ph.D's are geneticists?*
- Q28. *In the Consumer and Clinical Radiation Protection Bureau of Canada what percentage of the Ph.D's are physicists?*

Answer to Questions 23, 24, 25, 26, 27 and 28

At present, the CCRPB has 10 staff members with Ph.Ds held in the following disciplines:

Biology:	6	(radiobiology, molecular biology, pharmacology, photobiology, neurobiology and molecular toxicology)
Chemistry:	1	(physical chemistry)
Engineering:	2	(electrical, aeronautical)
Physics:	1	(medical)

Four of those individuals also hold Adjunct positions at Canadian Universities. In addition to staff within the Bureau, the CCRPB seeks out expertise within other sections of Health Canada and academia to assist as necessary in the completion of any of the research projects undertaken by the Bureau.

- Q29. *Does Dr. McNamee's involvement with this publication make his position with HC a conflict of interest?*

Health Canada staff are required to adhere to the "Values and Ethics Code for the Public Service" and make declarations of conflicts of interest as required. It is common practice for Health Canada scientists to act as Editors or Associate Editors for scientific journals based upon their extensive knowledge of certain subject matters. It is important to note that Health Canada staff and scientists involved in the health risk assessment of EMF have no ties to industry and have never been funded either directly or indirectly by the wireless industry.

Q30. Do the above statistics demonstrate a bias in HC towards the status quo?

Health Canada prides itself on the professionalism of its staff and is confident in their ability to perform objective reviews of the relevant science. The health effects literature reviewed by Health Canada staff is the same as that reviewed by all other national and international standards organizations. It is important to note that the limits outlined in Safety Code 6 are similar, if not more restrictive, than most other international safety guidelines.

Q32. Is HC willing to talk about the effects of cell phones on people in terms other than heat? Explain?

Health Canada's Safety Code 6 takes into account all possible biological and/or health effects of RF fields, including short-term heating effects, non-thermal effects and/or long-term effects. It should also be noted that the exposure standards of Safety Code 6 are applicable for continuous, uninterrupted exposure (24 hrs. per day, 7 days per week) and not only for short-term or intermittent exposure.

Q33. After all the research listed and considering HC's earlier statement on page 6 regarding radiation entering the brain and dissipating as heat, what is HC's current position regarding an infant living within 15metres of a cell tower for eighteen years? What effect would there be on this young Canadian's body?

Based upon current knowledge, there is no convincing evidence that exposure to RF fields at levels below the limits outlined in Safety Code 6 causes any short-term or long-term adverse health effects. This opinion is shared by other international science-based organizations such as the Institute of Electrical and Electronics Engineers, the International Commission on Non-Ionizing Radiation Protection, the Scientific Committee on Emerging and Newly Identified Health Risks, and the World Health Organization.



The Auditor General of Canada
Commissioner of the Environment and Sustainable Development
Attention: Petitions
240 Sparks Street
Ottawa, Ontario
K1A 0G6

May 22, 2008

Dear Auditor General,

This is a petition being submitted under the Auditor General Act.

I am affected by and concerned about the harmful effects of electro magnetic radiation (EMR) to me. my neighbors and other residents of Canada and maintain existing federal legislation is inadequate protection for the health and safety of citizens. I am petitioning for a review and changes.

My History

I reside in a forty year old residential apartment rental building twenty-four stories high. I have lived on the eighth floor, north side for twenty-seven years and previously enjoyed excellent health. Eight years ago I was diagnosed with Idiopathic Environmental Intolerance. A Rogers cellular relay station was installed on my rooftop within the past eight years. There was no consultation or notification by the landlord. I suffer from symptoms specific to Electro Magnetic Radiation sensitivity. Lately I have experienced a significant increase in headaches, nausea, heaviness in my chest, swollen glands, fatigue, racing heart, body aches and dizzy spells. They are triggered by Electro Magnetic Radiation emissions and have become much more frequent and intense since the placement of the cellphone tower.

Scientific research indicates the devices are causing serious environmental problems and the population has not been made aware of the possible dangers from such installations. An elementary school, other residences and a nursing home are just across the street from my building..

Although the City of Toronto is sufficiently concerned to have recently passed a resolution to look further into siting of mast towers, the city remains powerless. The authority is with the Government of Canada.

Scientific research has increased since 1999 indicating unhealthy effects associated with electromagnetic emissions and radiation from cellphone towers, cell phones, microwave devices and WIFI transmission. Environmental illness is increasing and those afflicted are being harmfully impacted. Why hasn't the Canadian Government revised existing standards to keep us safe?

Safety Code 6 from 1999 is outdated. Health studies do appear on the biological effects of towers in neighbourhoods like mine, although Health Canada claims that "no studies exist"

Health Studies

Six Studies Showing Ill-Health Effects From Masts
Document produced by Dr Grahame Blackwell 21st Feb 2005, updated 2/5/05

study of the health of people living in the vicinity of mobile phone base stations.

Santini et al.

Pathol Biol (Paris) [Pathologie Biologie (Paris)] 2002; 50: 369 – 73

Found significant health effects on people living within 300 metres of mobile phone base stations.

Conclusions include the recommendation:

“... it is advisable that mobile phone base stations not be sited closer than 300meters to populations”

Netherlands Organization for Applied Scientific Research (TNO)

Study for the Netherlands Ministries of Economic Affairs, Housing, Spatial Planning and the Environment, and Health, Welfare and Sport

“Effects of Global Communications System Radio-Frequency Fields On Well Being and Cognitive Function of Human Subjects With and Without Subjective Complaints”

(September 2003)

Found significant effects on wellbeing, according to a number of internationally-recognised criteria (including headaches, muscle fatigue/pain, dizziness etc) from 3G mast emissions well below accepted ‘safety’ levels (less than 1/25,000th of ICNIRP guidelines). Those who had previously been noted as ‘electrosensitive’ under a scheme in that country were shown to have more pronounced ill-effects, though others were also shown to experience significant effects.

THE MICROWAVE SYNDROME - FURTHER ASPECTS OF A SPANISH STUDY

Oberfeld Gerd(1), Navarro A. Enrique(3), Portoles Manuel(2), Maestu Ceferino(4), GomezPerretta Claudio(2)

1) Public Health Department Salzburg, Austria

2) University Hospital La Fe. Valencia, Spain

3) Department of Applied Physics, University Valencia, Spain

4) Foundation European Bioelectromagnetism (FEB) Madrid, Spain

Presented at an International Conference in Kos (Greece), 2004

This study found significant ill-health effects in those living in the vicinity of two GSM mobile phone base stations. They observed that:

“The strongest five associations found are depressive tendency, fatigue, sleeping disorder, difficulty in concentration and cardiovascular problems.”

As their conclusion the research team wrote:

“Based on the data of this study the advice would be to strive for levels not higher than 0.02 V/m for the sum total, which is equal to a power density of 0.0001 $\mu\text{W}/\text{cm}^2$ or 1 $\mu\text{W}/\text{m}^2$, which is the indoor exposure value for GSM base stations proposed on empirical evidence by the Public Health Office of the Government of Salzburg in 2002.”

INCREASED INCIDENCE OF CANCER NEAR A CELL-PHONE TRANSMITTER STATION.

Ronni Wolf MD(1), Danny Wolf MD(2)

The Dermatology Unit, Kaplan Medical Center, Rechovot, and

the Sackler Faculty of Medicine, Tel-Aviv University, Tel-Aviv, ISRAEL.

The Pediatric Outpatient Clinic, Hasharon Region, Kupat Holim, ISRAEL.

Published in:

International Journal of Cancer Prevention Volume 1, No. 2, April 2004

This study, based on medical records of people living within 350 metres of a long-established phone mast, showed a fourfold increased incidence of cancer generally compared with the general population of Israel, and a tenfold increase specifically among women, compared with the surrounding locality further from the mast.

Waila Study, Germany (November 2004)

Report by researchers (five medical doctors)

Following the call by Wolfram König, President of the Bundesamt für Strahlenschutz (Federal Agency for radiation protection), to all doctors of medicine to collaborate actively in the assessment of the risk posed by cellular radiation, the aim of our study was to examine whether people living close to cellular transmitter antennas

were exposed to a heightened risk of taking ill with malignant tumors.

The basis of the data used for the survey were PC files of the case histories of patients between the years 1994 and 2004. While adhering to data protection, the personal data of almost 1.000 patients were evaluated for this study, which was completed without any external financial support. It is intended to continue the project in the form of a register.

The result of the study shows that the proportion of newly developing cancer cases was significantly higher among those patients who had lived during the past ten years at a distance of up to 400 metres from the cellular transmitter site, which has been in operation since 1993, compared to those patients living further away, and that the patients fell ill on average 8 years earlier.

In the years 1999-2004, i.e. after five years' operation of the transmitting installation, the relative risk of getting cancer had trebled for the residents of the area in the proximity of the installation compared to the inhabitants of Naila outside the area.

Austrian Study

Press Release 1st May 2005

The radiation of a cell phone base station at a distance of 80 metres causes significant changes of the electrical currents in the brains of testees (measured by electroencephalogram, EEG). All the testees said they felt unwell during the radiation, some of them seriously.

That is the result of an investigation by a team of Austrian scientists. They measured alpha 1 (8 to 10 Hz), alpha 2 (10 to 12 Hz) and beta waves (13 to 20 Hz). A small density of GSM 900 and GSM 1800 radiation already caused several significant changes in these three frequency ranges. This means the body is stressed - temporarily this may have some positive effect, in the long run however stress certainly reduces the quality of life, capacity for work and state of health.

The results of the research will be published in international scientific magazines and confirmed by replication. The research was financed by Land Salzburg in Austria. The testees were nine women and three men between 20 and 78, who considered themselves 'electrosensitive'. They were invited to sit in a chair, eyes covered and ears plugged. Of course they were not aware of the sequence of the tests.

The side of the room directed at the cell phone base station was shielded against radiation, except for a small part which could be (un)shielded easily. In the first phase, the radiation density near the head was 26 mikroWatt/m², in the second phase 3327 mikroWatt/m² and in the third phase 26 mikroWatt/m² again. Several other environmental parameters were measured to be sure they could not influence the results, such as radiation by television and FM-radio, noise, CO₂, temperature, relative humidity, low frequency magnetic fields and soherics (electrical discharges in the atmosphere, possibly causing radiation).

During the second phase the parameters of all the brainwaves, measured by EEG, changed significantly. Afterwards the testees were asked to describe their experiences. All of them felt unwell during the second phase. They reported symptoms like buzzing in the head, palpitations of the heart, unwellness, lightheadedness, anxiety, breathlessness, respiratory problems, nervousness, agitation, headache, tinnitus, heat sensation and depression.

According to the scientists, this is the first worldwide proof of significant changes of the electrical currents in the brain by a cell phone base station at a distance of 80 metres. It has been scientifically established before that the radiation of cell phone base stations leads to unwellness and health complaints.

The scientists involved were Dr. Med. Gerd Oberfeld (Land Salzburg, dept. of environmental medicin), Dr. Hannes Schimke (Salzburg University, EEG-measurements, psychophysiology, statistics) and Prof. Dr. Günther Bernatzky (Salzburg University, neurodynamics and neurosignalling). The research was supported by Dr. Med. Univ. Gernot Luthringshausen (permanent member of the ethical commission of Land Salzburg, neurology and psychiatry).

NOTE: These are the only studies known of that specifically consider the effects of masts on people. All six of these studies show clear and significant ill-health effects. There are no known studies relating to health effects of masts that do not show such ill-health effects.

In this respect, any statement by industry or official sources that claims (or suggests) that:

(a) There is no evidence of ill-health effects from masts;

or

**(b) The overwhelming evidence is that masts do not cause ill-health effects;
is completely and blatantly untrue.**

Radiologist Professor Dr. Eckel from the Bundesärztekammer is now scientific adviser to hese-uk.

13-01-2007

The interview given below was published by the 'Schwabischen Post' on 7.12.06.

In Hüttlingen, a community near to Ellwangen, the residents are, just as in other places, fighting against a planned mobile telecommunications transmitter.

MOBILTELECOMMUNICATIONS / Interview with the Radiologist Professor Dr. Eckel from the Bundesärztekammer (equivalent to the BMA in the UK)

"The cell nucleus is mutating."

Professor Dr. Heyo Eckel is a radiation expert. He is a radiologist, lecturer at Göttingen University, vice chairman of the Health and Environment Committee of the German Medical Association [Ausschusses Gesundheit und Umwelt der Bundesärztekammer], Chairman of the Niedersachsen province charity for "Chernobyl Children". And because he also still has family connections in Hüttlingen, we spoke with him about electromagnetic radiation.

BY MARKUS LEHMANN HÜTTLINGEN/GÖTTINGEN

For Radiologists there are two areas: the scientific-formal-legal and the emotional.

His scientific conclusion: Electromagnetic, pulsed waves from transmitter masts and mobile phones affect and deform the cell nucleus. Comparable with those of X-rays. As long as the harmlessness of mobile telecommunications is not proven, everything must be done to protect the population against potential health damage.

Q. Are electromagnetic waves dangerous for humans?

These waves deform and damage the cell nucleus. That is proven and has resulted in experiments "in vitro" (in laboratory studies). The cell nucleus can also mutate as a result of natural occurrences. However, one has no control over that. But changes due to the influence from electromagnetic waves are definitely documented.

Q. And this technology is deployed across the country?

According to the present state of scientific knowledge there is no alarming health risk. Out of the many thousand of reports, there are only 400 to 500, which comply with purely scientific protocol and thus must be taken seriously. But one must consider: The mobile telecommunications technology is still relatively new, but yet it is now deployed across the whole country. Consequential damage is hard to ascertain, not yet and maybe only after years. Like in bygone days with X-Ray radiation.

Q. You are also involved in the Chernobyl problem.....

Yes. And the injuries that result from radioactive radiation are identical with the effects of electromagnetic radiation. The damages are so similar that they are hard to differentiate

Q. So you are saying, that there is a potential or suspected danger. What is your suggestion?

One must act politically. The politicians refer constantly to safe limits. There must be an agreement with the industry on a minimum distance from base stations, as in Switzerland,. Above all there must be further research on how these electromagnetic waves effect humans. This radiation does not taste, it does not smell. And one does not hear it. It is not discernable through our senses. And, that's why people are afraid of it.

Q. What do you advise citizens who have fears about a transmitter in their vicinity ?

Legally, one cannot do much. One can advise, that people unite together. In order to exert pressure - moral - pressure on the local politicians, the provincial and federal government politicians. Because they have a duty of care to avert presumed or perceived damage to citizens.

RF dangers are outlined in this report about a high school in Ossining, N.Y. in the U.S.: <http://www.cyburban.com/~jplachta/safeweb2.htm>

Questions Relating to EMR Sensitivities:

1. Will **Industry Canada** and **Health Canada** re-examine the health impact of Electro Magnetic and Microwave Radiation since 1999 or conduct its own study?
2. Will the Canadian Government track the health effects of people in close long term proximity to cell towers after their installation?
3. Will the Canadian Government pass new regulations mandating safer siting of cellphone towers?
4. Will the Canadian Government order removal of existing cellphone towers in specific areas that contain hospitals, schools, nursing homes and residences?
5. What is being done to help people who suffer adverse effects from other forms of microwave radiation and electro magnetic radiation?
6. Where can people go to be free of the Electro Magnetic and Microwave Radiation from cell towers etc?
7. What kind of medical assistance is currently available for victims of Electro Magnetic Radiation?
8. When will safe housing not exposed to high and dangerous levels of Electro Magnetic and Microwave Radiation be made available?
9. When will specific areas be designated that are safe from Electro Magnetic and Microwave Radiation?

10. Will the government mandate labeling of Electro Magnetic and Microwave Radiation levels of everyday products so that people who need to can avoid exposures?

11. Will the Canadian Government pay for the expenses incurred by victims of Electro Magnetic and Microwave Radiation?

12. Will the government advise at what distance from a cell tower there is a guarantee of no negative health effects ?

- for 30 minute exposure a day, (ie in transit)
- for 2 hours a day (ie medical appointments or shopping or a movie)
- for 8 hours a day (ie work or school or daycare)
- for 24 hours a day (ie disabled, children, elderly, or exposures at work and at home

13. Is the Canadian Government aware that other countries have moratoriums on the installation of towers near residential areas, schools and hospitals?

14. Will the government mandate that cell phone relay stations and towers be sited a minimum of 500 meters from any residence, school, daycare, hospital, or place of employment and from any place where people or animals spend more than 30 minutes a day?

15. Will the government order removal of existing cell phone towers and relay stations from residential buildings like mine near hospitals, schools, nursing homes and in places of employment?

16. Will the government prohibit **WIFI pollution** in public areas?

17. Why won't the Canadian Government recognize how much more are we exposed to radiation from wireless technology compared to the year 1999?

18. Is the Canadian Government aware that TMOBILE buried a massive peer reviewed study done by ECOLOG an independent scientific institute? TMOBILE was the sponsor of the study, a study that showed adverse health effects?

19. Is the Canadian Government aware that the cellular industry commissioned a study in China and then again buried it after the study determined DNA breaks?

20. Is the Canadian Government aware of The Naila Study which states that in the years 1999-2004, i.e. after five years operation of the transmitting installation, the relative risk of getting cancer had trebled for the residents of the area in the proximity of the mast tower installation compared to the inhabitants of Naila outside this area.

21. Has the Canadian Government read the following?

http://www.newmediaexplorer.org/sepp/2006/04/20/mobile_and_wireless_largest_biological_experiment.htm

Summary:

Cell phone relay stations were installed on our rooftop without notification or consultation. Although they conform to existing standards imposed in 1999, they pose a health risk. Those standards do not address existing inappropriate siting of cellphone towers and relay stations, The more recent legislation of 2008 should be amended to have relay stations removed from locations stated above instead of just limiting new installations. What will the Canadian Government do to make people

safe from Electro Magnetic and Microwave Radiation in their own homes and when they will do it?

Minister of Health and the Minister
for the Federal Economic Development
Initiative for Northern Ontario



Ministre de la Santé et Ministre de
l'Initiative fédérale du développement
économique dans le Nord de l'Ontario

Ottawa, Canada K1A 0K9

SEP 26 2008



Dear 


This is in response to your environmental petition no. 247 of May 2, 2008, addressed to Mr. Ronald C. Thompson, the former Interim Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised concerns about the effects of electromagnetic radiation.

I am pleased to provide you with the enclosed joint Health Canada and Public Health Agency of Canada response to your petition.

I appreciate your interest in this important matter, and I hope that you will find this information useful.

Yours sincerely,



Tony Clement

Enclosure

c.c. Mr. Scott Vaughan, CESD
The Honourable Jim Prentice, P.C., M.P.

Canada

**Health Canada Response to
Environmental Petition 247 filed by [REDACTED]
under Section 22 of the *Auditor General Act*
Received June 5, 2008**

Safety of electromagnetic and microwave radiation

October 3, 2008

**Minister of Health and the Minister for the Federal Economic
Development Initiative for Northern Ontario**

1. *Will Industry Canada and Health Canada re-examine the health impact of Electro Magnetic and Microwave Radiation since 1999 or conduct its own study?*

Health Canada's Safety Code 6 sets out safety requirements for the installation and use of radiofrequency (RF) and microwave devices that operate in the frequency range from 3 kHz to 300 GHz. It can be found at <http://www.hc-sc.gc.ca/ewh-sent/pubs/radiation/99ehd-dhm237/index-eng.php>.

The current version of the Safety Code was published in 1999; however, Health Canada scientists continue to carry out studies on RF fields and to review the latest scientific literature on an ongoing basis, including by participating in international scientific fora, sitting on standards and oversight committees, and peer reviewing publications. Based on information to date and the weight-of-evidence from this ongoing scientific review, the exposure limits specified in Safety Code 6 remain current and valid, and no adverse health effects are expected from these exposure limits.

2. *Will the Canadian Government track the health effects of people in close long term proximity to cell towers after their installation?*

Conclusions for a World Health Organization expert workshop, published in 2007, state that public exposures to permissible radiofrequency (RF) levels from mobile telephone and base stations are not likely to adversely affect human health. The Public Health Agency of Canada does not track information related to the health of individuals in long-term proximity to cell towers.

5. *What is being done to help people who suffer adverse effects from other forms of microwave radiation and electro magnetic radiation?*

Over 50 years of research have not produced convincing scientific evidence to suggest that exposure to low-level electromagnetic field (EMF) (e.g. below the limits outlined in Health Canada's Safety Code 6) cause any short- or long-term health effects.

With respect to the concern of "electromagnetic hypersensitivity" (EHS), numerous scientific studies have failed to demonstrate any association between claims of EHS and EMF exposure. In provocation studies where subjects were intentionally exposed to EMF, EHS sufferers were unable to detect whether EMFs were present any better than by pure chance (Rubin GJ, Munshi JD, Wessely S. Electromagnetic Hypersensitivity: A systematic Review of provocation studies. *Psychosomatic Medicine* 67:224-232, 2005). While the symptoms experienced by EHS sufferers are real and in some cases debilitating, there is no scientific evidence that these symptoms are caused by exposure to EMFs.

7. *What kind of medical assistance is currently available for victims of Electro Magnetic Radiation?*

Health Canada encourages individuals who suffer any health complications to seek medical attention from a physician. However, there is no scientific evidence to suggest that exposure to

low-level EMF (e.g. below the limits outlined in Health Canada's Safety Code 6) cause any short- or long-term health effects.

10. *Will the government mandate labeling of Electro Magnetic and Microwave Radiation levels of everyday products so that people who need to can avoid exposures?*

Under the *Radiation Emitting Devices Act*, Health Canada enforces the labelling of microwave ovens. The labelling of licensed and license-exempt telecommunication and broadcast devices is enforced by Industry Canada.

Everyday electrical products such as appliances, electric lighting, house wiring, etc. also emit electric and magnetic fields in the normal course of their operation. The strength of the fields produced by these devices depends on a large number of parameters, the most important of which, is the distance from the device. To label the exposure level at a range of distances for each individual item would be a practical impossibility and unjustifiable based upon the lack of any credible scientific evidence that such exposures cause any adverse health effects.

11. *Will the Canadian Government pay for the expenses incurred by victims of Electro Magnetic and Microwave Radiation?*

Health Canada is a population-based health protection and promotion organization, and is not engaged in the personal health care of individual citizens. Questions about how a particular province delivers health care services should be directed to that province's department of health.

In addition, it should be reiterated that there is no scientific evidence to suggest that exposure to low-level EMF (e.g. below the limits outlined in Health Canada's Safety Code 6) cause any short- or long-term health effects.

12. *Will the government advise at what distance from a cell tower there is a guarantee of no negative health effects?*
- *for 30 minute exposure a day, (ie in transit)*
 - *for 2 hours a day (ie medical appointments or shopping or a movie)*
 - *for 8 hours a day (Ie work or school or daycare)*
 - *for 24 hours a day (ie disabled, children, elderly, or exposures at work and at home)*

As part of the procedure set forth by Industry Canada for the licensing and commissioning of cell towers, it must be proven to the satisfaction of Industry Canada that all possible exposures are within the Safety Code 6 general public limits in all areas accessible to the public. These limits allow for continuous exposure 24 hours per day.

Studies conducted by Health Canada, Industry Canada and scientific laboratories elsewhere indicate that actual exposures from cell towers are typically thousands of times below the general public limits specified in Safety Code 6. Adherence to the licensing requirements for public exposure is usually by a wide margin.

As a result, Health Canada has no scientific reason to consider that the radiofrequency electromagnetic radiation exposure experienced by the public from cell towers causes adverse health effects. This conclusion is based upon the bulk of scientific evidence from animal, in-vitro and epidemiological studies that have been carried out worldwide, including at our laboratory.

17. *Why won't the Canadian Government recognize how much more are we exposed to radiation from wireless technology compared to the year 1999?*

While it is recognized that the proliferation of wireless communications and consumer products has increased dramatically since 1999, there is no reason to suspect that combined exposure levels in our living spaces exceed the general public limits in Safety Code 6. Exposures from radio communications have always been and remain controlled by Industry Canada. Their regulations stipulate that the combined exposures from all service providers must not exceed the general public limits outlined in Safety Code 6 in all areas accessible by the public.

18. *Is the Canadian Government aware that TMOBILE buried a massive peer reviewed study done by ECOLOG an independent scientific institute? TMOBILE was the sponsor of the study, a study that showed adverse health effects?*
19. *Is the Canadian Government aware that the cellular industry commissioned a study in China and then again buried it after the study determined DNA breaks?*
20. *Is the Canadian Government aware of The Naila Study which states that in the years 1999-2004, i.e. after five years operation of the transmitting installation, the relative risk of getting cancer had trebled for the residents of the area in the proximity of the mast tower installation compared to the inhabitants of Naila outside this area.*
21. *Has the Canadian Government read the following?*
http://www.newmediaexplorer.org/sepp/2006/04/20/mobile_and_wireless_largest_biological_experiment.htm

Answer to Questions 18, 19, 20 & 21:

Health Canada scientific staff is aware of the studies and references you have described. Health Canada considers all credible, peer-reviewed scientific studies and scientific evidence using a weight-of-evidence approach for assessing the possible health risks of radiofrequency fields. This takes into account both the quantity of studies on a particular endpoint (whether adverse or not), and also the quality of those studies. Poorly conducted studies (e.g. incomplete dosimetry or inadequate control samples) receive relatively little weight while properly conducted studies (e.g. all controls included, appropriate statistics, complete dosimetry) will receive more weight. There are numerous scientific flaws with the studies you referenced above; therefore these studies carry little weight in the risk assessment process.

- A) *Why hasn't the Canadian government revised existing standards to keep us safe? Safety Code 6 from 1999 is outdated. Health studies do appear on the biological effects of*

towers in neighbourhoods like mine, although Health Canada claims that "no studies exist".

It is important to point out that the vast majority of studies and scientists in this field do not consider low-level RF field exposures (e.g. levels below the limits outlined in Safety Code 6) to cause any adverse health effects. There are numerous scientific reviews on this issue by independent scientists and by government institutions around the world which share this scientific consensus (see below). Based on information to date and the weight-of-evidence from this ongoing scientific review, the exposure limits specified in Safety Code 6 remain current and valid.

Krewski D, Glickman BW, Habash RW, Habbick B, Lotz WG, Mandeville R, Prato FS, Salem T, Weaver DF. Recent advances in research on radiofrequency fields and health: 2001-2003. *J Toxicol Environ Health B Crit Rev.* 10:287-318 (2007).

Valberg PA, van Deventer TE, Repacholi MH. Workgroup report: base stations and wireless networks-radiofrequency (RF) exposures and health consequences. *Environ Health Perspect.* 115:416-424 (2007).

Moulder JB, Foster KR, Erdreich LS, McNamee JP. Mobile phones, mobile phone base stations and cancer: a review. *Int J Radiat Biol.* 81:189-203 (2005).

Vijayalaxmi, Obe G. Controversial cytogenetic observations in mammalian somatic cells exposed to radiofrequency radiation. *Radiat Res.* 162:481-496 (2004).

Ahlbom A, Green A, Kheifets L, Savitz D, Swerdlow A; ICNIRP (International Commission for Non-Ionizing Radiation Protection) Standing Committee on Epidemiology. Epidemiology of health effects of radiofrequency exposure. *Environ Health Perspect.* 112:1741-1754 (2004).

WHO Fact Sheet on RF fields: www.who.int/mediacentre/factsheets/fs304/en/index.html

WHO Fact Sheet on EHS:
www.who.int/mediacentre/factsheets/fs296/en/index.html

Royal Society of Canada:
www.rsc.ca/index.php?lang_id=1&page_id=120

- B) *These are the only studies known of that specifically consider the effects of masts on people. All six of these studies show clear and significant ill-health effects. There are no known studies relating to health effects of masts that do not show such ill-health effects. In this respect, any statement by industry or official sources that claims (or suggests) that: (a) There is no evidence of ill-health effects from masts; or (b) The overwhelming evidence is that masts do not cause ill-health effects; Is completely and blatantly untrue.*

The claim that only six studies have evaluated the health effects of radiofrequency field exposures from masts (e.g. cell towers) on people is erroneous. Dozens of studies have assessed a wide range of possible health outcomes in individuals living in close proximity to cell towers and other broadcast antenna. Overwhelmingly, the data indicate no convincing evidence of any adverse human health effect, provided the exposure levels do not exceed those outlined in Safety Code 6 and other international science-based safety limits. Please see the response to the previous question for a list of some of the relevant references.

C) *What will the Canadian government do to make people safe from Electro Magnetic and Microwave Radiation in their own homes and when will they do it?*

Over the past decade, Health Canada has been an active international partner in the global effort to understand and elucidate potential health risks from exposure to radiofrequency (RF) electromagnetic fields (EMF), such as those from cell phone antennas. Health Canada scientists continually monitor the scientific literature, conduct in-house research to evaluate the possible health effects of these fields, and participate in the International EMF Project coordinated by the World Health Organization, a description of which can be found at: <http://www.who.int/peh-emf/project/en/>.

Health Canada scientists also participate in, organize and attend international scientific meetings in order to share knowledge of new scientific research.

As you may be aware, Industry Canada enforces the compliance of cell phone antennas with a safety standard which must be met by all cell phone service providers. This standard is Health Canada's Safety Code 6—Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz. The objective of Safety Code 6 is to establish guidelines for limiting the RF exposures of both workers and the general public. Prior to its publication, the Code was reviewed by federal and provincial health authorities, as well as by a number of experts on the effects of electromagnetic radiation on human health. In addition, at the request of Health Canada, the Royal Society of Canada assembled an expert panel on radiofrequency fields to conduct an independent review of the guidelines for safe exposure limits set out in the Code. The report, which is available on the Society's website at: www.rsc.ca/index.php?lang_id=1&page_id=120, concluded that the exposure limits set out in Safety Code 6 are adequate for the protection of the general public from adverse health effects. Subsequent to this review, several of the original panel members have undertaken two additional reviews each time looking at the literature published in consecutive two year periods. In both cases, there was no new information published that caused them to change their original assessment.

It is important to note that Safety Code 6, and all other codes and guidelines produced by Health Canada, rely on an understanding and assessment of the entire body of science, not just selected studies. This is the only approach that is justifiable and defensible in dealing with matters related to health and safety of the Canadian public. Health Canada scientists are aware of some studies or reports claiming that biological effects may occur at RF fields below the Safety Code 6 limits. However, these biological effects are not well established, and thus their implications for human health are questionable.

In summary, at this time, there is no convincing scientific evidence of adverse health effects from exposure at levels below the limits specified in Safety Code 6. In view of this fact, there is no scientific reason to change the current limits (threshold values of exposure) at this time. Notwithstanding this current position, Health Canada scientists will continue with their research and to examine information from other research and regulatory agencies. If new information indicates that modifications are needed, the process to so amend the Safety Code would be initiated.

Minister of Industry



Ministre de l'Industrie

Ottawa, Canada K1A 0H5

15/12/08



Dear

I am writing to provide you with Industry Canada's response to Environmental Petition No. 247, dated May 22, 2008, concerning the effects of electromagnetic radiation on Canadians. On June 5, 2008, this petition was forwarded by the Commissioner of the Environment and Sustainable Development to the Minister of Health and the Minister of Industry. I am pleased to respond to your questions that fall within Industry Canada's area of responsibility. A number of your questions relate to the mandate of Health Canada and will be answered separately by the Minister of Health.

Question 3: Will the Canadian Government pass new regulations mandating safer siting of cellphone towers?

Question 10: Will the government mandate labeling of Electro Magnetic and Microwave Radiation levels of everyday products so that people who need to can avoid exposures?

Industry Canada has adopted guidelines, developed by Health Canada, for the purpose of protecting the general public and has no intention of introducing new regulations. Health Canada has established safety guidelines, which include recommendations for the labelling of devices and for exposure to radio frequency fields, in its Safety Code 6 publication, entitled *Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz*. The guidelines for the protection of the general public are consistent with other international jurisdictions established by competent authorities and the

.../2

Canada

World Health Organization. Industry Canada's Client Procedures Circular (CPC)-2-0-03, entitled *Radiocommunication and Broadcasting Antenna Systems*, sets out the requirement that all radiocommunication installations must comply with Safety Code 6 on an ongoing basis so as to ensure that the general public is protected.

Question 4: Will the Canadian Government order removal of existing cellphone towers in specific areas that contain hospitals, schools, nursing homes and residences?

Question 13: Is the Canadian Government aware that other countries have moratoriums on the installation of towers near residential areas, schools and hospitals?

Question 14: Will the government mandate that cell phone relay stations and towers be sited a minimum of 500 meters from any residence, school, daycare, hospital, or place of employment and from any place where people or animals spend more than 30 minutes a day?

Question 15: Will the government order removal of existing cell phone towers and relay stations from residential buildings like mine near hospitals, schools, nursing homes and in places of employment?

Industry Canada requires that all proponents of radiocommunication and broadcasting installations comply on an ongoing basis with Health Canada's Safety Code 6 guidelines for the protection of the general public. These guidelines are written for pregnant women, seniors, children, the chronically ill and persons with disabilities, as well as certain members of the general public who may be more susceptible than others, including their protection while in schools, hospitals and nursing homes. Safety Code 6 incorporates a safety factor to provide for all possible conditions under which the exposure might occur, and is based on the rationale that the exposure to the public in their residences is potentially 24 hours a day, seven days a week. A moratorium on the installation of new towers, or an order for the removal of existing towers, near these areas is not necessary.

Industry Canada, through its approval processes and conditions of authorization as well as certification standards, ensures that all radiocommunication installations and devices are installed and operated in a manner that complies with the general public requirements set out in

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Safety Code 6. As appropriate, Industry Canada will require operators of radio apparatus to take immediate corrective measures to ensure compliance with Safety Code 6, such as reducing transmitter power, relocating an antenna or restricting public access.

Question 6: Where can people go to be free of the Electro Magnetic and Microwave Radiation from cell towers etc?

Question 8: When will safe housing not exposed to high and dangerous levels of Electro Magnetic and Microwave Radiation be made available?

Question 9: When will specific areas be designated that are safe from Electro Magnetic and Microwave Radiation?

Question 16: Will the government prohibit WIFI pollution in public areas?

People cannot be totally free of electromagnetic radiation, as it is a naturally occurring phenomenon (lighting, solar radiation, cosmic rays) and is, therefore, part of our daily lives. In order to control man-made radiation, Health Canada has established safety guidelines, which include recommendations for the labelling of devices and for exposure to radio frequency fields, in its Safety Code 6 publication. The radiation level from cell towers will diminish greatly as distance from the source increases.

Industry Canada is responsible for the management of the radio frequency spectrum, including the orderly development and efficient operation of radiocommunication in Canada. Radio antennas and facilities, which are essential components of radiocommunication, are owned and operated by a wide variety of users, both licensed and licence-exempt. Across Canada, there is a significant number of different types of radiocommunication installations, each operating with its own technical characteristics, including frequency bands and power levels.

Examples of licensed users include police, fire and ambulance; cellular telephone networks; air traffic control and navigation; and broadcasting and businesses requiring radio dispatch mobile communications. In addition to licensed devices, there are other devices that use the radio frequency spectrum but operate on a licence-exempt basis. These include such radiocommunication devices as garage door openers;

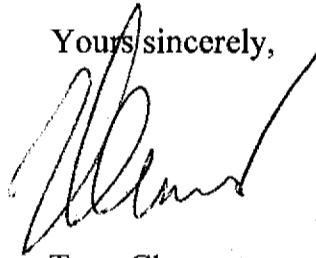
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remote baby monitors; remote control devices; wireless alarms; amateur radios; and family radio service walkie talkies. Also, there are licence-exempt devices that use the radio frequency spectrum for purposes other than radiocommunication or broadcasting, that is, for industrial, scientific or medical purposes. Examples of these types of devices include microwave ovens and radio frequency heat sealers. Industry Canada does not keep a record of licence-exempt devices; which are, for the most part, low-power consumer devices.

Industry Canada becomes involved in antennas and antenna supporting structures, including cell towers, through carrying out certain responsibilities under the *Radiocommunication Act*. The department's interest relates primarily to managing the radio frequency spectrum, which is generally recognized as a limited resource. Again, Industry Canada requires that all proponents of radiocommunication and broadcasting installations comply on an ongoing basis with Health Canada's Safety Code 6 guidelines for the protection of the general public.

I appreciate this opportunity to respond to your petition, and trust that this information is of assistance.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Tony Clement', written over a white background.

Tony Clement

c.c. Mr. Scott Vaughan
Commissioner of the Environment
and Sustainable Development

*Environmental Petition submitted to the
Auditor General of Canada, June 2008*



Request that first generation DECT Phones be Banned in Canada

Name of Petitioner:	
Address of Petitioner:	
Telephone Number:	
Email Address:	
Signature:	
Date:	<u>19 June 2008</u>
Document:	16 pages

*Environmental Petition submitted to the
Auditor General of Canada, June 2008*

Request that first generation DECT Phones be Banned in Canada

COMMUNICATIONS WITH HEALTH CANADA REGARDING DECT PHONES

On March 9, 2007, I sent an email to Robert P. Bradley, Director of the Consumer and Clinical Radiation Protection Bureau, Product Safety Programme, Health Canada asking that he consider banning DECT phones in Canada.

Dr. Bradley responded on March 26, 2007 and told me he was unaware of DECT technology and that after receiving my email, he did a "google" search and also had a brief discussion with research staff of the Electromagnetic Division. He stated that he would have his staff look further into this technology. He also advised me that banning such devices came under the jurisdiction of Industry Canada. He went on to write:

"We provide advice regarding the potential health issues arising from any of the technologies that they regulate. This advice is considered in the decisions to allow or disallow any device for use in the Canadian market. Should our review of the DECT systems, or any other wireless devices in the future, lead us to believe them not to be safe you can be assured that we will so inform Industry Canada."

Five months later, on August 19, 2007, I contacted Dr. Bradley again, via email, and asked for an update on progress to review the literature on DECT phones. Dr. Bradley failed to respond to that email. That was 10 months ago.

BACKGROUND INFORMATION ON DECT PHONES

DECT is an acronym for (Digitally Enhanced Cordless Technology, previously known as Digital European Cordless Telephony). It is a technology that originated in Germany and has spread to other countries, including Canada.

DECT phones operate at 2.4 and 5.8 GHz and provide a digital signal that is both powerful and clear. DECT phones can be used up to 300 meters from their base station (cradle that holds the phone). Several manufacturers including Panasonic, GE, Motorola, AT&T, and V-Tech use this technology.

Unlike other types of cordless phones, DECT cordless phones continuously emit microwave radiation at full power as long as the base station is plugged into an electrical outlet. These phones emit radiation 24/7 whether they are being used or sitting idle in their cradle. This exposes people to unnecessary microwave radiation and has been raised as a potential health concern by scientists and doctors in Germany and Austria.

CHRONIC EXPOSURE TO RADIATION FROM THE DECT PHONE BASE (CRADLE)

I own a DECT phone (which I no longer use). It is a 2.4 GHz phone made by AT&T. On June 16th, 2008 I measured the radiation coming from this phone while it was in idle. I used an Electrosmog Meter with an omni-directional antenna. This meter has an operating range of 50 MHz to 3.5 GHz. Background level (6-minute maximum) in my home immediately prior to testing was 0.000 microW/cm². Clearly in parts of my home there is no radio frequency radiation within the 50 MHz to 3.5 GHz range. I then measured the radiation at various distance from the base of the phone. Values in Figure 1 represent a 6-minute maximum near the phone. The values decrease with $1/x^2$, with "x" representing the distance in cm.

I then compared the values I obtained for my DECT phone to studies in the literature that document adverse health effects from radio frequency radiation and superimposed the data (Figure 2).

What Figure 2 shows is that at a distance just beyond 3 meters from my DECT phone base unit (according to studies of RF radiation) EEG brain waves are altered. At 2.8 meters motor function, memory and attention of children are affected. At 1.7 meters sleep is disturbed. How many people have DECT phones near their bed? At 30 cm memory is impaired and at closer distances the immune system is affected, REM sleep is reduced, insulin levels drop, and there are pathological changes in the blood brain barrier. Studies also show that there is 100% increase in adult leukemia between 45 and 130 cm from the phone and a similar increase in childhood leukemia between 35 and 260 cm.

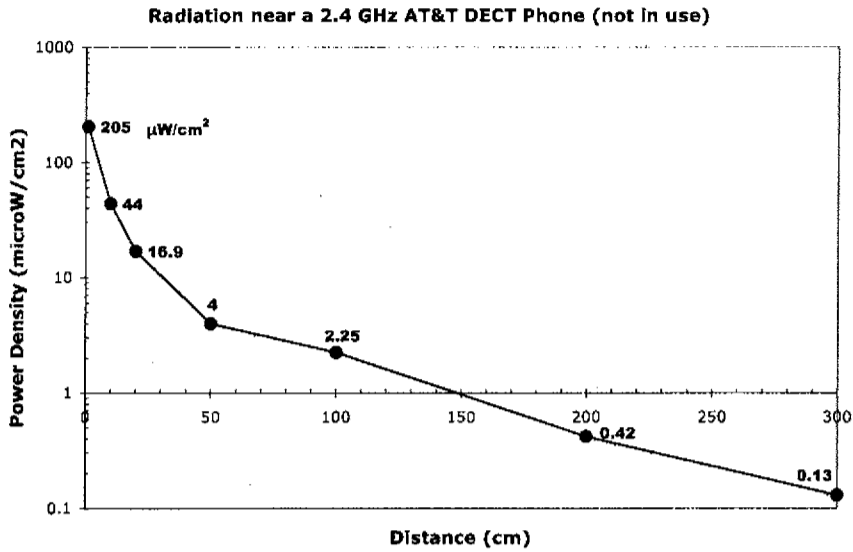


Figure 1. Radiation near a 2.4 GHz AT&T DECT phone while the phone was not in use.

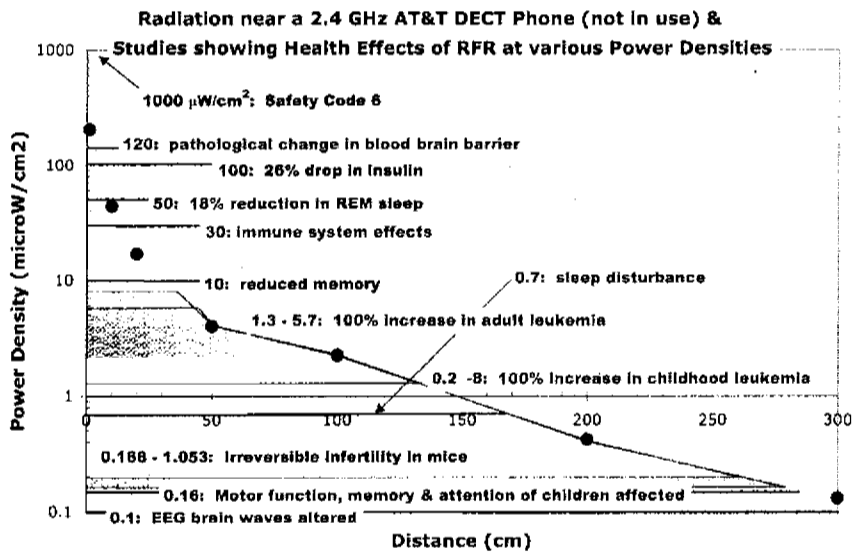


Figure 2. Studies showing health effects of radio frequency radiation (RFR) at various power densities superimposed on radiation from a DECT phone (2).

What Figure 2 also shows is that all of these effects are well below Health Canada's Safety Code 6 (1000 microW/cm²), which suggests that Safety Code 6 is failing to protect the health of Canadians.

Children are sensitive to DECT phones according to Dr. Leberecht von Klitzing, a German medical physicist and researcher at the University of Luebeck and one of the medical physicists who signed the Freiburger Appeal (1,3). His research on blood

samples taken from children in the vicinity of DECT phones showed that the red blood corpuscles did not 'ripen out properly' (a direct translation). The physical signs were listlessness and/or aggression, pallor, and sleeplessness. These symptoms could be reversed with the removal of the phone.

Symptoms of 356 people under long time home exposure to high frequency pulsed electromagnetic fields associated with DECT phones and/or mobile phone base stations were evaluated (Appendix A). At levels *well below* those in Figure 1, the following symptoms increased with increasing power density: sleep disturbance, fatigue, depression, headaches, restlessness, dazed state, irritability, difficulty concentrating, forgetfulness, learning difficulties, difficulty finding words, frequent infections, Frequent infections, sinusitis, lymph node swellings, joint and limb pains, nerve and soft tissue pains, numbness or tingling, allergies, tinnitus, hearing loss, sudden hearing loss, giddiness, impaired balance, visual disturbances, eye inflammation, dry eyes, tachycardia, episodic hypertension, collapse, hormonal disturbances, thyroid disease, night sweats, frequent urge to urinate, weight increase, nausea, loss of appetite, nose bleeds, skin complaints, tumours, and diabetes. Many of these are the symptoms now associated with electrohypersensitivity (EHS).

Based on these studies DECT phones should not be in bedrooms or near children, who are likely to be more sensitive to this form of radiation.

Because DECT phones are so powerful and because the radiation can penetrate through walls people can be exposed to this radiation even if they do not own a DECT phone. If their neighbours have one they can also be exposed.

I have neighbours who have DECT phones and I can measure radiation from their phones coming into my home in the rooms nearest their phone. Homes in my neighbourhood are approximately 10 meters apart. Imagine living in an apartment building with a DECT phone on the other side of an adjacent wall.

Indeed a few years ago I visited a person in Toronto who was electrically sensitive. I measured the radiation in her home and found high readings in her bedroom. We traced the source to a DECT phone in her neighbour's apartment. Without knowing it and without having any control over her own exposure, this person was exposed to microwave radiation while sleeping. Indeed she complained of sleep difficulties and often slept on the couch in the living room where levels of radiation were much lower. It is possible that her exposure to the DECT phone contributed to her electrical sensitivity.

A recent study reported that some young people who use mobile phones at least 15 times daily were more prone to have difficulty falling asleep, disrupted sleep, restlessness, stress and fatigue than those who used them less than 5 times a day (Appendix B).

Second and third generation DECT phones, with lower radiation levels, are now available in Germany but have not yet crossed the Atlantic to Canada. Furthermore, there are digital phones on the market that do not use DECT technology. So it is possible for people to have the benefits of digital mobile phones without being constantly exposed to

microwave radiation. Unless the current generation of DECT phones is banned in Canada, there will be no incentive for Canadians to buy cordless phones that does not radiate continuously. In the meantime, Canadians will be unnecessarily exposed to these microwave frequencies.

HOW OTHER JURISDICTIONS ARE RESPONDING TO DECT PHONES

In 2002, a group of Physicians signed the Freiburger Appeal, which requests that *immediate measures and transitions steps* be taken to ban mobile phone use and digital cordless (DECT) phones in preschools, schools, hospitals, nursing homes, event halls, public buildings and vehicles. They go on to state that DECT standards for cordless telephones be revised with the goal of reducing radiation intensity (3).

In 2005, Dr. Gerd Oberfeld, MD with the Salzburg Region Public Health Department in Austria, wrote an open letter to teachers, parents about wireless technology and stated the following (4):

“The official advice of the Public Health Department of the Salzburg Region is not to use WLAN and DECT in Schools or Kindergartens.”

In 2006, the German Federal Agency For Radiation Protection (Bundesamt für Strahlenschutz – BfS) issued a health warning concerning DECT phones in their Press Release dated 31 January 2006 (5):

A cordless phone of DECT standard is often the strongest source of high frequency electromagnetic radiation in a private home. To renounce your cordless phone as a precautionary measure will contribute to minimise your personal radiation exposure . . .

Cordless landline telephones of DECT standard have no output control to regulate power output according to the actual power needed. Therefore, the base station and the handset are permanently emitting radiation at the same power level during a call, no matter whether the user holding the handset is one meter or 300 meters away from the base station . . .

To prevent possible health risks, the BfS recommends minimizing personal radiation exposure. The following tips will help you if you are not prepared to completely give up the benefits of a cordless phone: Put the base station in a place where you do not spend much time, for example in the hall. Do not put it directly on your desk. Only make short phone calls. Use the latest generation of phones, which are emission free when the handset is connected to the base station.

INFANTS RESPOND TO DECT PHONES AND DECT BABY MONITORS

According to Powerwatch in the UK (6):

“Over the past five years we, with the help of parents, have measured a variety of baby monitors and the DECT pulsing ones seem to be far more disruptive of the infant's sleep and state of contentment (causing restlessness, irritability and crying). The old wired ones and the older "analogue" cordless ones do not seem to cause the same problems if kept at least one metre from the cot / bed.

We have had a number of reports from parents that their babies did not sleep well and cried a lot when they used DECT monitors but were ok when no baby monitor was used. When they then tried a cheaper analogue monitor, the infant then slept as well as they did with no monitor.

A DECT monitor placed in your baby's bedroom will expose them to more pulsing microwave radiation that living near to a mobile phone base station mast would do. As a result, whilst there have been no studies done into baby monitors specifically, studies that cover mobile phone masts provide a good background to the effects that would be expected in your baby.”

Dr. von Klitzing reported that otherwise perfectly healthy infants had erratic heart beat when exposed to a DECT cordless phone. When the DECT phone was removed from the bedroom or neighboring apartment, the infant's heartbeat returned to normal (7).

ACUTE EXPOSURE TO RADIATION WHILE USING MOBILE PHONES

A secondary concern of mobile phones (cordless and cell, analog and digital) is that people who use them are exposing their brain to microwave radiation. Studies show an increase in various types of tumors (gliomas, astrocytomas, acoustic neuromas, uveal melanomas) that range from a 30% increase to a 4.6-fold increase (8). Often the tumor is on the same side of the head that one uses the phone and becomes a statistically significant risk after 10 years of use, which is a relative short latency period for a brain tumor. See also Appendix C.

Once again children are likely to be more sensitive and authorities in the UK have warned that children should minimize their use of this technology (9).

INADEQUACY OF HEALTH CANADA'S SAFETY CODE 6 GUIDELINES

In 1999, an Expert Panel of the Royal Society of Canada (10) was convened to review the potential health risks of radio frequency radiation from wireless devices. In their report they state the following:

- A growing body of scientific evidence suggests that exposure to RF fields at intensities far less than levels required to produce measurable heating can cause effects in cells and tissues.
- These biological effects include alterations in the activity of the enzyme ornithine decarboxylase (ODC), which is associated with cancer growth; regulation of calcium; and permeability of the blood-brain barrier
- Some of these biological effects brought about by non-thermal exposure levels of RF could potentially be associated with adverse health effects.

Canada's guideline for DECT phone frequencies (2.4 and 5.8 GHz) is 1000 microW/cm² (11). In Russia the guideline is 10 microW/cm² for the same frequency range, and in Salzburg, Austria the recommended level is 0.1 microW/cm² (12). The Canadian Safety Code 6 Guideline is based on thermal effects, whereas the other guidelines are based on biological effects. It is Health Canada's position that stricter guidelines are not required because if this radiation does not heat body tissue it will have no effect and the current guidelines protect us from such heating. Scientific evidence points to the contrary (2,12) as has been recognized by other governments (3,4,5) and has been recently documented in the Bioinitiative Report that calls for biological guidelines for microwave radiation (13).

The Canadian public needs to be protected against microwave radiation and it is Health Canada's responsibility to do so. It seems that in this case, Health Canada is failing to protect the public and is not acting expeditiously to inform Industry Canada of the potential treat of microwave radiation presented by DECT phone technology. This situation needs to be changed. Under no circumstances should these early warning signals of adverse health effects be dismissed or disregarded. At the *very least* Health Canada should invoke the Precautionary Principle if they consider the scientific evidence inconclusive.

PETITIONS REQUESTS/QUESTIONS:

1. Based on the fact that:
 - a. DECT phones radiate 24/7 at maximum power, and that
 - b. Levels of radiation within 3 meters of a DECT phone base station, while not in use, have been associated in various scientific studies with ill health, memory loss, sleep disturbances, cancers, etc. and that
 - c. Newer versions of DECT phones are available in Germany that have lower emissions,

Will Health Canada recommend to Industry Canada that these phones be banned in Canada? Could they also provide their rationale for their decision?

2. Will Industry Canada consider banning DECT phones in Canada? If not, what kind of information is necessary to warrant a ban of this technology?

3. What is Health Canada doing to warn Canadians about DECT phones?
4. What is Health Canada doing to minimize the exposure of children to DECT phones and other types of wireless technology in schools and in the home?
5. Since studies are documenting adverse health effects at levels well below Safety Code 6 why has Health Canada not revised this safety code so that it protects the Health of Canadians?
6. What combination of scientific research results is required for Health Canada to revise Safety Code 6? In other words, what does Health Canada recognize as "conclusive scientific evidence" of harmful effects? Please provide specifics of the types of scientific studies required, the number of studies required, and the types of results needed to provide what Health Canada would consider "conclusive evidence".
7. What research is Health Canada conducting or funding to determine the safety of DECT phones and other types of wireless technology including cell phones, cell phone antennas, WiFi, WiMax, smart meters, radio frequency identification tags, and broadband over power lines (BPL)?
8. Does Health Canada or Industry Canada know if DECT baby monitors are sold in Canada and, if they are, would they consider warning the public not to use them?
9. In light of scientific uncertainty, will Health Canada recommend prudent avoidance and/or the Precautionary Principle to the Canadian public? If not, why not?
10. Is any of the research conducted by Health Canada (including reviews of the literature as well as primary research) directly or indirectly funded by the wireless telecommunications industry and/or the electric utility? Could Health Canada provide a list of financial contributions made to them by these organizations during the past 10 years?
11. Is any of the research conducted by Industry Canada (including reviews of the literature as well as primary research) directly or indirectly funded by the wireless telecommunications industry and/or the electric utility? Could Industry Canada provide a list of financial contributions made to them by these organizations during the past 10 years?

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Appendix A. Study by Dr. Cornelia Waldmann Selsam

Source: http://www.powerwatch.org.uk/news/20050722_bamberg.asp

The following is a foreword to an Open Letter written by Dr. Cornelia Waldmann Selsam to Edmund Stoiber, Prime Minister of Bavaria in Germany.

"These reports show that the people for years have been ill due to pulsed high frequency electromagnetic fields, without the treating doctors recognising the cause. For that reason, people who are receiving the high frequency at home or at work have suffered and are suffering and they receive no therapy. The deciding [effective] therapy is to end the exposure.

"The continually repeated assertion in the media by the Radiological Protection Commission (Strahlenschutzkommission), that there is no proof for health risks under the present valid limits, has had the consequence that most doctors, (including myself until a year ago) have not drawn a relationship between the many unexplained illness patterns and high frequency radiation. The doctors do not know that at not one single mobile phone base station have investigations into the health-state of the people been carried out. Thus, the evaluation of the Strahlenschutzkommission in 2001 has no scientific basis.

"In Oberfranken, we have just evaluated the medical complaints of 356 people who have had long-term [radiation] exposure in their homes.

- The pulsed high frequency electro magnetic fields (from mobile phone base stations, from cableless DECT telephones, amongst others), led to a new, previously unknown pattern of illnesses with a characteristic symptom complex.
- People suffer from one, several or many of the following symptoms: Sleep disturbances, tiredness, disturbance in concentration, forgetfulness, problem with finding words, depressive mood, ear noises, sudden loss of hearing, hearing loss, giddiness, nose bleeds, visual disturbances, frequent infections, sinusitis, joint and limb pains, nerve and soft tissue pains, feeling of numbness, heart rhythm disturbances, increased blood pressure episodes, hormonal disturbances, night-time sweats, nausea.
- Even at $10 \mu\text{W}/\text{m}^2$ ($0.001 \mu\text{W}/\text{cm}^2$ only $0.06 \text{ V}/\text{m}$ average) many people are becoming ill.
- The symptoms occur in temporal and spatial relationship to exposure. It is no way only a subjective sensitivity disturbance. Disturbances of rhythm, hearing problems, sudden deafness, hearing loss, loss of vision, increased blood pressure, hormonal disturbances, concentration impairments, and others can be proved using scientific objective measures.
- Some of the health disturbance disappears immediately the exposure ceases (removal of DECT telephone, temporary moving away from home, permanently moving away, using shielding).

Therefore, the expansion must be stopped immediately. Mobile phone base stations, in whose fields people are exposed to more than $10 \mu\text{W}/\text{m}^2$ [$0.001 \mu\text{W}/\text{cm}^2$] must be turned off . . . DECT telephones must be changed . . . Affected people, relatives and doctors must jointly commit themselves and work together with all their energy [to this end].

Evaluation of symptoms of 356 people under long time home exposure to high frequency pulsed electromagnetic fields (DECT telephones, mobile phone base stations) versus the level of the power flux density in microwatts per square metre.

Foreword - Documented Health Damage under the Influence of High Frequency Electromagnetic Fields, Dr. Cornelia Waldmann Selsam, Karl-May-Str.48, 96049 Bamberg.

The values convert approximately as follows:

- * $10 \mu\text{W}/\text{m}^2 = 0.001 \mu\text{W}/\text{cm}^2 = 0.06 \text{ V/m average}$
- * $100 \mu\text{W}/\text{m}^2 = 0.01 \mu\text{W}/\text{cm}^2 = 0.2 \text{ V/m average}$
- * $1000 \mu\text{W}/\text{m}^2 = 0.1 \mu\text{W}/\text{cm}^2 = 0.6 \text{ V/m average}$

The *symptom groups* are defined as follows:

- Group 1: No symptoms
- Group 2: Sleep disturbance, tiredness, depressive mood
- Group 3: Headaches, restlessness, dazed state, irritability, disturbance of concentration, forgetfulness, learning difficulties, difficulty finding words.
- Group 4: Frequent infections, sinusitis, lymph node swellings, joint and limb pains, nerve and soft tissue pains, numbness or tingling, allergies
- Group 5: Tinnitus, hearing loss, sudden hearing loss, giddiness, impaired balance, visual disturbances, eye inflammation, dry eyes
- Group 6: Tachycardia, episodic hypertension, collapse
- Group 7: Other symptoms (hormonal disturbances, thyroid disease, night sweats, frequent urge to urinate, weight increase, nausea, loss of appetite, nose bleeds, skin complaints, tumours, diabetes)

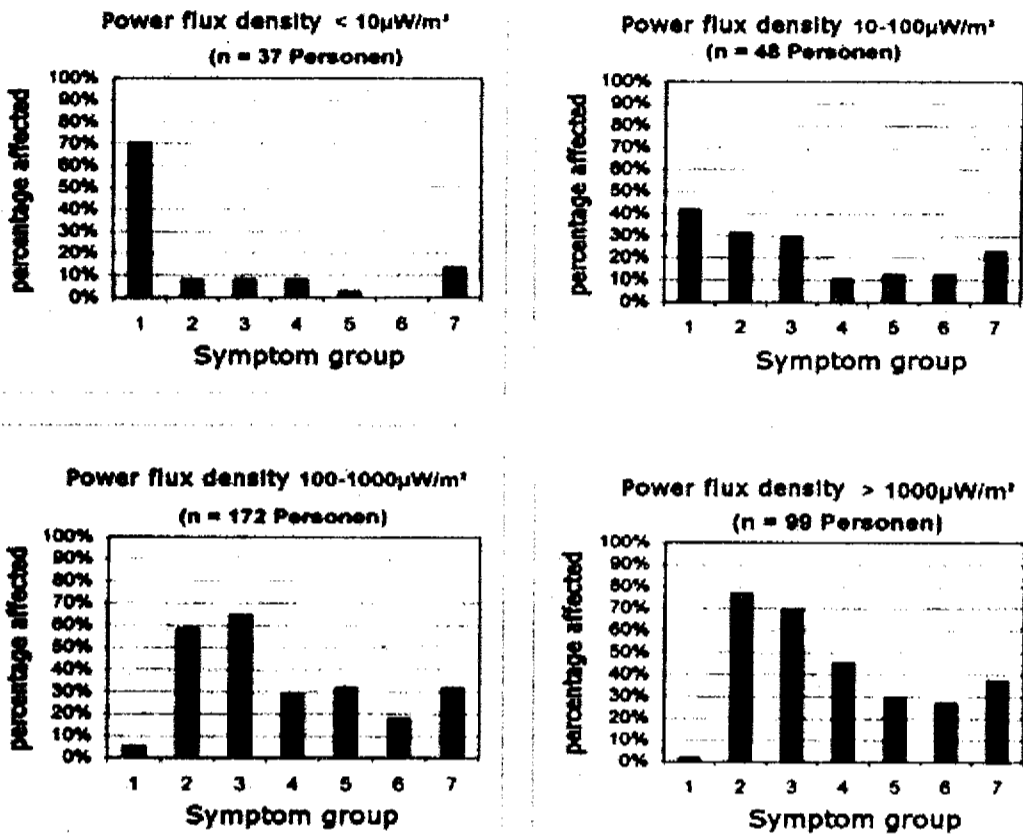


Figure 1. Symptoms grouped by power flux density. Note conversion as follows:
 $10 \mu\text{W}/\text{m}^2 = 0.001 \mu\text{W}/\text{cm}^2$; $100 \mu\text{W}/\text{m}^2 = 0.01 \mu\text{W}/\text{cm}^2$; $1000 \mu\text{W}/\text{m}^2 = 0.1 \mu\text{W}/\text{cm}^2$

If true, this is a very clear trend. For those where it is under $10 \mu\text{W}/\text{m}^2$ [$0.001 \mu\text{W}/\text{cm}^2$] 70% of the sample (37 people) suffered no adverse health effects. For those where the power flux density is over $100 \mu\text{W}/\text{m}^2$ [$0.01 \mu\text{W}/\text{cm}^2$] only 5-6% of the sample (172 people) did not experience adverse health effects. Please look at this graph to see how these levels translate to exposure from a typical mast. Microwave signals are often above $0.6 \text{ V}/\text{m}$ [$0.1 \mu\text{W}/\text{cm}^2$] within 400 metres! There are no confounding factors listed in the data, but the strength of the trend is extremely pronounced.

This is further evidence to support the potential adverse health effects that may be synonymous with the pulsed Microwave technology that surround us in everyday life. Those in the medical profession are beginning to voice their concerns, and it is worth bearing in mind that they have first hand experience of real people with real problems. It is important not to discard this evidence due to lack of experimental control, as it seems that a number of qualified professionals have independently found the same trends. At the very least this should call for more organised research into these findings.

Appendix B: *Mobile phones stop teenagers getting a good night's sleep*

By Kate Devlin Medical Correspondent, Telegraph (UK)

Last updated: 1:23 AM BST 10/06/2008

TEENAGERS WHO send more than five text messages or make more than five calls a day on their mobile phones are ruining their chances of getting a good night's sleep, a new study shows.

Young people who often used their phone to text or call their friends were more likely to have trouble sleeping than those who used their mobile moderately.

As a consequence "excessive texters" felt more tired during the day and drank more caffeine to help them stay awake.

Many young people also felt a "pressure" to be at the end of their phones "around the clock", the stress of which led them to take up smoking or drinking, the team behind the research warned.

The study, presented at SLEEP 2008, the 22nd Annual Meeting of the Associated Professional Sleep Societies (APSS), in Baltimore, found that teenagers who used their mobiles often were more prone to disrupted sleep, restlessness, stress and fatigue than other young people.

Researchers at Sahlgren's Academy in Gothenburg, Sweden, looked at 21 otherwise healthy teenagers, between 14 and 20 years of age, who had regular school or work hours and who did not suffer from serious sleep problems.

The volunteers were split into two groups, the first who made less than five calls or sent less than five texts a day and a second group who used their phones at least 15 times daily.

The scientists found that those who used their mobile phones the most were most susceptible to stress and fatigue.

Not only did they find it more difficult to fall asleep than the other group but they also suffered from more disruptive sleep patterns once they finally nodded off.

The study also found that those who often used their phones were more likely to take drinks designed to make them feel more alert during the day.

They were also more likely to feel more awake at night than in the morning, suggesting a delayed biological clock.

Dr Gaby Badre, who led the study, said that those who used their phones the most appeared to have a different, more frantic lifestyle than other teenagers.

Dr Badre said: "Addiction to cell phone is becoming common. Youngsters feel a group pressure to remain inter-connected and reachable round the clock.

Children start to use mobile phones at an early stage of their life. There seem to be a connection between intensive use of cell phones and health compromising behaviour such as smoking, snuffing and use of alcohol."

Getting a good night's sleep was extremely important for young people, she added, and they should be made more aware that excessive mobile phone use can bring with it "serious health risks" as well as attention problems and trouble sleeping.

Jessica Alexander, from the Sleep Council, which promotes healthy sleeping habits, said: "Too many teenagers are stimulating their brains with mobile phones or computers late at night, when they should be settling down in preparation for sleep."

Although adults are advised to get between seven and eight hours sleep a night, doctors recommend that adolescents get nine hours.

However, another paper presented at the SLEEP 2008 conference shows that teenagers often get into a pattern of getting less sleep on school nights and having to "make up" the difference at weekends.

Appendix C: Sunday Times: Headline: Cellphone link to tumours.

The Sunday Times. Publication: SST Date: 23 Mar 2003 Page: A16
http://www.rfsafe.com/its_time_to_be_rf_safe.htm

SCIENTISTS HAVE found the first evidence of a link between regular use of digital mobile phones and brain tumours. Researchers in Sweden discovered a 30% increased risk of brain tumours among regular users, typically those spending more than an hour a day on the phones. Such tumours occurred most frequently on the side of the head to which the person held their phone. The biggest increase was seen in acoustic neuromas, which form behind the ear and can mostly be treated.

Mobile phones have been found to alter the workings of brain cells, affect memory and cause cancer in laboratory rats. Until now, however, there has been no proven link to human disease.

The new study, published in the International Journal of Oncology, was based on the analysis of 1600 tumour victims who had been using mobile phones for up to 10 years.

Professor Kjell Mild, the Swedish biophysicist who led the study, said: "*The evidence for a connection between phone use and cancer is clear and convincing. The more you use phones and the greater the number of years you have them, the greater the risk of brain tumours.*"

An earlier study by Mild and Lennart Hardell, a cancer specialist, linked brain tumours to the use of analogue mobile phones. The new research repeated this and also looked at digital mobiles and "DECT" cordless phones. It showed that all three types were linked with increased tumour rates.

Acoustic neuromas are usually slow growing and can be detected because they cause tingling and hearing loss. However, it takes doctors an average of two years to make a diagnosis, and surgery, the usual treatment, can leave damaged nerves that lead to involuntary facial spasms. Since 1980, the number of acoustic neuromas diagnosed in Britain has risen from one in every 100,000 of the population to one in 80,000 a year.

The mobile phone industry has long resisted any suggestion of a link to cancer, though it accepts that mobile phone radiation does affect the electrical activity in the brain.

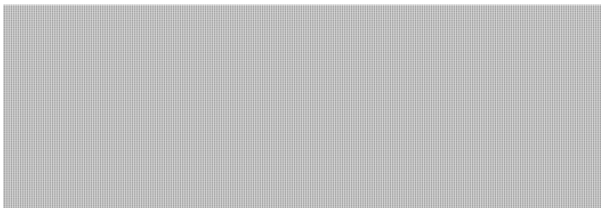
Minister of Health and the Minister
for the Federal Economic Development
Initiative for Northern Ontario



Ministre de la Santé et Ministre de
l'initiative fédérale du développement
économique dans le Nord de l'Ontario

Ottawa, Canada K1A 0K9

OCT 22 2008



Dear 

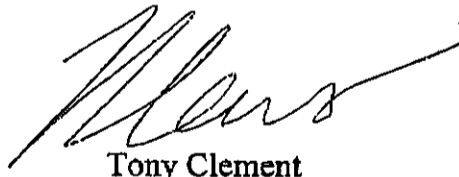
This is in response to your environmental petition no. 253 which was forwarded to Health Canada by Mr. Scott Vaughan, Commissioner of the Environment and Sustainable Development (CESD), on July 4, 2008.

In your petition you raised concerns about digitally enhanced cordless technology (DECT) phones.

I am pleased to provide you with the enclosed Health Canada response to your petition. I understand that the Minister of Industry will be responding separately to the questions that fall within the purview of his department.

I appreciate your interest in this important matter, and I hope that you will find this information useful.

Yours sincerely,



Tony Clement

Enclosure

c.c. Mr. Scott Vaughan, CESD
The Honourable Jim Prentice, P.C., M.P.

Canada

**Health Canada Response to
Environmental Petition No. 253 filed by [REDACTED]
under Section 22 of the *Auditor General Act*
Received July 4, 2008**

Request that first generation DECT phones be banned in Canada

November 1, 2008

**Minister of Health and the Minister for the Federal Economic
Development Initiative for Northern Ontario**

1. *Based on the fact that:*

a. DECT phones radiate 24/7 at maximum power, and that

b. Levels of radiation within 3 meters of a DECT phone base station, while not in use, have been associated in various scientific studies with ill health, memory loss, sleep disturbances, cancers, etc. and that

c. Newer versions of DECT phones are available in Germany that have lower emissions

Will Health Canada recommend to Industry Canada that these phones be banned in Canada? Could they also provide their rationale for their decision?

3. *What is Health Canada doing to warn Canadians about DECT phones?*

Answer to Questions 1 & 3:

Canadian and international scientists have looked long and hard at the possible health effects of radiofrequency (RF) fields. The results overwhelmingly indicate that there are no adverse effects observed when exposures remain below the safety limits recommended by science-based RF exposure standards, such as Health Canada's Safety Code 6.

Safety Code 6 sets out safety requirements for the installation and use of radiofrequency (RF) and microwave devices that operate in the frequency range from 3 kHz to 300 GHz (such as DECT phones). It can be found online at <http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/99ehd-dhm237/index-eng.php>. Since all DECT phones sold in Canada must meet the standards of Safety Code 6 as specified by Industry Canada, Health Canada does not anticipate any adverse health effects from DECT phones.

4. *What is Health Canada doing to minimize the exposure of children to DECT phones and other types of wireless technology in schools and in the home?*

The exposure limits for the general public, as specified in Health Canada's Safety Code 6, were designed to take into account individuals of all ages of varying health status (which include susceptible groups or individuals such as children, pregnant women and the elderly). Again, when exposures remain below the safety limits recommended by science-based RF exposure standards, including Health Canada's Safety Code 6, no adverse effects are anticipated.

5. *Since studies are documenting adverse health effects at levels well below Safety Code 6 why has Health Canada not revised this safety code so that it protects the Health of Canadians?*

Health Canada scientists continue to carry out internally funded studies on RF fields and to review the scientific literature on an ongoing basis either as participants in standard-setting bodies and international scientific meetings, as academic or peer reviewers for publications, or as part of a continuous program of literature surveillance. Based on information to date and the weight-of-evidence from this ongoing scientific review, the exposure limits specified in Safety Code 6 remain current and valid.

6. *What combination of scientific research results is required for Health Canada to revise Safety Code 6? In other words, what does Health Canada recognize as "conclusive scientific evidence" of harmful effects? Please provide specifics of the types of scientific studies required, the number of studies required, and the types of results needed to provide what Health Canada would consider "conclusive evidence".*

A weight-of-evidence approach is employed when considering peer-reviewed scientific publications and assessing the possible health risks of RF fields. This method takes into account both the quantity of studies on a particular endpoint (whether adverse or no effect), and also the quality of those studies. Poorly conducted studies (e.g. incomplete dosimetry or inadequate control samples) receive relatively little weight while properly conducted studies (e.g. all controls included, appropriate statistics, complete dosimetry, and reproducibility) will receive more weight. There are numerous concerns with the studies referenced by the petitioner; therefore, these studies have lower weight in the risk assessment process.

7. *What research is Health Canada conducting or funding to determine the safety of DECT phones and other types of wireless technology including cell phones, cell phone antennas, WiFi, WiMax, smart meters, radio frequency identification tags, and broadband over power lines (BPL)?*

Health effect studies on RF fields have been conducted for over 50 years. During this time, a great deal of scientific information has been obtained regarding the health impacts of these exposures. There are literally thousands of research studies and many of them have evaluated long-term exposures in experimental animals, while others have investigated the possibility of non-thermal effects. Based upon this large volume of information, it is Health Canada's position that there is no convincing scientific evidence that human exposure to RF fields below the limits outlined in Safety Code 6 produce any adverse human health effects. Similar conclusions have been reached in a variety of reviews (see below for some examples) and by other international organizations. It is important to point out that all international science-based exposure standards are based on the same scientific literature.

Krewski D, Glickman BW, Habash RW, Habbick B, Lotz WG, Mandeville R, Prato FS, Salem T, Weaver DF. Recent advances in research on radiofrequency fields and health: 2001-2003. *J Toxicol Environ Health B Crit Rev.* 10:287-318 (2007).

Valberg PA, van Deventer TE, Repacholi MH. Workgroup report: base stations and wireless networks-radiofrequency (RF) exposures and health consequences. *Environ Health Perspect.* 115:416-424 (2007).

Moulder JE, Foster KR, Erdreich LS, McNamee JP. Mobile phones, mobile phone base stations and cancer: a review. *Int J Radiat Biol.* 81:189-203 (2005).

Vijayalaxmi, Obe G. Controversial cytogenetic observations in mammalian somatic cells exposed to radiofrequency radiation. *Radiat Res.* 162:481-496 (2004).

Ahlbom A, Green A, Kheifets L, Savitz D, Swerdlow A; ICNIRP (International Commission for Non-Ionizing Radiation Protection) Standing Committee on Epidemiology. Epidemiology of health effects of radiofrequency exposure. Environ Health Perspect. 112:1741-1754 (2004).

Health Canada has been an active international partner in the global effort to understand and elucidate the potential health risks of Electromagnetic Radiation (EMR). Health Canada and its scientists have participated in the World Health Organization (WHO) International EMF project, through attendance and organization of international fora and meetings and through the generation of new knowledge through scientific research of topics highlighted by the WHO EMF project as "high priority". A list of relevant studies is included at the end of this document.

9. *In light of scientific uncertainty, will Health Canada recommend prudent avoidance and/or the Precautionary Principle to the Canadian public? If not, why not?*

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.

10. *Is any of the research conducted by Health Canada (including reviews of the literature as well as primary research) directly or indirectly funded by the wireless telecommunications industry and/or the electric utility? Could Health Canada provide a list of financial contributions made to them by these organizations during the past 10 years?*

All Health Canada activities in this area have been funded entirely by the Government of Canada.

Studies Described in Question 7

Extremely Low Frequency (ELF) Studies done at Health Canada

McNamee JP, Bellier PV, Chauhan V, Gajda GB, Lemay E, Thansandote A. Evaluating DNA damage in rodent brain after acute 60 Hz magnetic-field exposure. *Radiat Res.* 2005 Dec;164(6):791-7.

Vijayalaxmi, McNamee JP, Scarfi MR. Comments on: "DNA strand breaks" by Diem et al. [*Mutat. Res.* 583 (2005) 178-183] and Ivancsits et al. [*Mutat. Res.* 583 (2005) 184-188]. *Mutat Res.* 2006 Jan 31;603(1):104-6.

McLean JR, Thansandote A, McNamee JP, Tryphonas L, Lecuyer D, Gajda G. A 60 Hz magnetic field does not affect the incidence of squamous cell carcinomas in SENCAR mice. *Bioelectromagnetics.* 2003 Feb;24(2):75-81.

McNamee JP, Bellier PV, McLean JR, Marro L, Gajda GB, Thansandote A. DNA damage and apoptosis in the immature mouse cerebellum after acute exposure to a 1 mT, 60 Hz magnetic field. *Mutat Res.* 2002 Jan 15;513(1-2):121-33.

McLean JR, Thansandote A, Lecuyer D, Goddard M. The effect of 60-Hz magnetic fields on co-promotion of chemically induced skin tumors on SENCAR mice: a discussion of three studies. *Environ Health Perspect.* 1997 Jan;105(1):94-6.

McLean J, Thansandote A, Lecuyer D, Goddard M, Tryphonas L, Scaiano JC, Johnson F. A 60-Hz magnetic field increases the incidence of squamous cell carcinomas in mice previously exposed to chemical carcinogens. *Cancer Lett.* 1995 Jun 8;92(2):121-5.

Scaiano JC, Mohtat N, Cozens FL, McLean J, Thansandote A. Application of the radical pair mechanism to free radicals in organized systems: can the effects of 60 Hz be predicted from studies under static fields? *Bioelectromagnetics.* 1994;15(6):549-54.

Stuchly MA, Lecuyer DW, McLean J. Cancer promotion in a mouse-skin model by a 60-Hz magnetic field: I. Experimental design and exposure system. *Bioelectromagnetics.* 1991;12(5):261-71.

McLean JR, Stuchly MA, Mitchel RE, Wilkinson D, Yang H, Goddard M, Lecuyer DW, Schunk M, Callary E, Morrison D. Cancer promotion in a mouse-skin model by a 60-Hz magnetic field: II. Tumor development and immune response. *Bioelectromagnetics.* 1991;12(5):273-87.

Stuchly MA, McLean JR, Burnett R, Goddard M, Lecuyer DW, Mitchel RE. Modification of tumor promotion in the mouse skin by exposure to an alternating magnetic field. *Cancer Lett.* 1992 Jul 31;65(1):1-7.

Stuchly MA, Lecuyer DW. Exposure to electromagnetic fields in arc welding. *Health Phys.* 1989 Mar;56(3):297-302.

Stuchly MA, Ruddick J, Villeneuve D, Robinson K, Reed B, Lecuyer DW, Tan K, Wong J. Teratological assessment of exposure to time-varying magnetic field. *Teratology*. 1988 Nov;38(5):461-6.

Stuchly MA, Lecuyer DW. Survey of static magnetic fields around magnetic resonance imaging devices. *Health Phys*. 1987 Sep;53(3):321-4.

Stuchly MA, Lecuyer DW. Induction heating and operator exposure to electromagnetic fields. *Health Phys*. 1985 Nov;49(5):693-700.

RF Studies done at Health Canada

Chauhan V, Mariampillai A, Kutzner BC, Wilkins RC, Ferrarotto C, Bellier PV, Marro L, Gajda GB, Lemay E, Thansandote A, McNamee JP. Evaluating the biological effects of intermittent 1.9 GHz pulse-modulated radiofrequency fields in a series of human-derived cell lines. *Radiat Res*. 2007 167(1):87-93.

Qutob SS, Chauhan V, Bellier P, Yauk C, Douglas G, Williams A, Berndt L, Gajda G, Thansandote A and McNamee JP. Microarray gene expression profiling of a human glioblastoma cell line exposed *in vitro* to 1.9 GHz pulse modulated radiofrequency fields. *Radiation Research* (2006, In Press).

Chauhan V, Mariampillai A, Bellier PV, Qutob SS, Gajda GB, Lemay E, Thansandote A and McNamee JP. Gene expression analysis of a human lymphoblastoma cell line exposed *in vitro* to an intermittent 1.9 GHz pulse-modulated radiofrequency field. *Radiation Research* (2006, In Press).

Moulder JE, Foster KR, Erdreich LS, McNamee JP. Mobile phones, mobile phone base stations and cancer: a review. *Int J Radiat Biol*. 2005 Mar;81(3):189-203.

McNamee JP, Bellier PV, Gajda GB, Lavallee BF, Marro L, Lemay E, Thansandote A. No evidence for genotoxic effects from 24 h exposure of human leukocytes to 1.9 GHz radiofrequency fields. *Radiat Res*. 2003 May;159(5):693-7.

Gajda GB, McNamee JP, Thansandote A, Boonpanyarak S, Lemay E, Bellier PV. Cylindrical waveguide applicator for *in vitro* exposure of cell culture samples to 1.9-GHz radiofrequency fields. *Bioelectromagnetics*. 2002 Dec;23(8):592-8.

McNamee JP, Bellier PV, Gajda GB, Lavallee BF, Lemay EP, Marro L, Thansandote A. DNA damage in human leukocytes after acute *in vitro* exposure to a 1.9 GHz pulse-modulated radiofrequency field. *Radiat Res*. 2002 Oct;158(4):534-7.

McNamee JP, Bellier PV, Gajda GB, Miller SM, Lemay EP, Lavallee BF, Marro L, Thansandote A. DNA damage and micronucleus induction in human leukocytes after acute *in vitro* exposure to a 1.9 GHz continuous-wave radiofrequency field. *Radiat Res*. 2002 Oct;158(4):523-33.

Thansandote A, Gajda GB, Lecuyer DW. Radiofrequency radiation in five Vancouver schools: exposure standards not exceeded. CMAJ. 1999 May 4;160(9):1311-2.

Stuchly MA, Kozlowski JA, Symons S, Lecuyer DW. Measurements of contact currents in radiofrequency fields. Health Phys. 1991 Apr;60(4):547-57.

Stuchly MA, Repacholi MH, Lecuyer DW, Mann RD. Radiofrequency emissions from video display terminals. Health Phys. 1983 Sep;45(3):772-5.

Stuchly MA, Lecuyer DW, Mann RD. Extremely low frequency electromagnetic emissions from video display terminals and other devices. Health Phys. 1983 Sep;45(3):713-22.

Stuchly MA, Repacholi MH, Lecuyer DW. Operator exposure to radiofrequency fields near a hyperthermia device. Health Phys. 1983 Jul;45(1):101-7.

Minister of Industry



Ministre de l'Industrie

Ottawa, Canada K1A 0H5

15712158



Dear

I am writing to provide you with Industry Canada's response to Environmental Petition No. 253, dated June 19, 2008, regarding Digital Enhanced Cordless (DECT) phones. This petition was forwarded to the Minister of Health and the Minister of Industry by the Commissioner of the Environment and Sustainable Development. I am pleased to respond to your questions that fall within Industry Canada's area of responsibility.

Question 2: Will Industry Canada consider banning DECT phones in Canada? If not, what kind of information is necessary to warrant a ban of this technology?

All DECT phones that are to be sold on the Canadian market must be certified under Industry Canada's Radio Standards Specification (RSS)-213, which provides technical regulatory requirements. In addition, DECT phones must comply with the requirements of RSS-102, entitled *Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)*, which incorporates the limits for such devices from Health Canada's Safety Code 6 guidelines, entitled *Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz*.

Industry Canada requires that all radiocommunication apparatus comply with Health Canada's Safety Code 6 guidelines for the protection of the general public. These guidelines are written for pregnant

.../2

Canada

women, seniors, children, the chronically ill and persons with disabilities, as well as certain members of the general public who may be more susceptible than others. Safety Code 6 incorporates a safety factor to provide for all possible conditions under which the exposure might occur, and is based on the rationale that the exposure to the public is potentially 24 hours a day, seven days a week. Therefore, a ban on DECT phones is not necessary.

Question 8: Does Health Canada or Industry Canada know if DECT baby monitors are sold in Canada, and, if they are, would they consider warning the public not to use them?

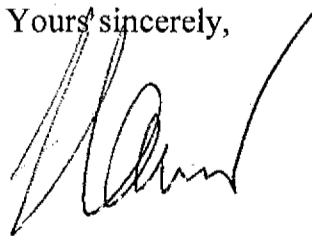
Industry Canada is aware that DECT baby monitors are sold in Canada. DECT baby monitors containing Industry Canada's certification label have met all technical requirements, including radio frequency exposure compliance, and may be sold on the Canadian market.

Question 11: Is any of the research conducted by Industry Canada (including reviews of the literature as well as primary research) directly funded by the wireless telecommunications industry and/or electric utility? Could Industry Canada provide a list of financial contributions made to them by these organizations during the past 10 years?

Industry Canada has not received funding, either directly or indirectly, from the wireless telecommunications industry and/or any electric utility for the purpose of carrying out research.

I appreciate this opportunity to respond to your petition, and trust that this information is of assistance.

Yours sincerely,



Tony Clement

c.c. ~~Mr. Scott Vaughan~~
Commissioner of the Environment
and Sustainable Development

**Environmental Petition to the Auditor General
Submitted June 22, 2008**

Petitioners:



The Auditor General of Canada
 Commissioner of the Environment and Sustainable Development
 240 Sparks St.
 Ottawa, ON
 K1A 0G6

Attn. Petitions

Auditor General,

Health Canada's Safety Code 6 was established as a protection against thermal radiation and, therefore, is set at a dangerously high level for all who live close to transmission towers. It provides no protection whatsoever from the real danger to residents: non-thermal electromagnetic radiation. And Health Canada appears only too willing to ignore the health concerns of the residents in order to protect the interests of the telecommunication industry.

We live on the top of Triangle Mountain, in a cul-de-sac with 28 other homes, most of which were built in 1992-1994. At that time there was one small radio tower, which had been there for decades. In addition there was an amateur radio antenna about 300 meters away on Walfred Road.

Suddenly, in 2000 this was removed and 2 new, tall towers were built and 3 FM transmitters with 2 Studio Link Transmitters (STLs) were installed, location address Fulton Road. These towers are as close as 30 meters from our homes. (Please see attached photos)

Company	Frequency	Avg. power	Peak power
CIOC-FM ROGERS	98.5 Mhz	47,000 Watts	100,000 Watts
CHTT-FM ROGERS	103.1	9,400	20,000
CFEX-FM CTV	107.3	9,700	20,000
CTV STL	955.525		
ROGERS STL	957.6875		

From the very beginning, the residents experienced harmful interference with their electronic equipment. Despite numerous complaints that continue even to this day and with an emission level in the year 2001 that is more than 11.00 times higher than is allowed under the new CPC-2-0-03 guidelines, Industry

Canada is quoted as saying: "To date...the Broadcasters have successfully remedied the issues." (letter of May 26, 2008 from Mr. Neil Allwood, A/Director, Industry Canada, Coastal District Office. To Mayor Jody Twa, Colwood)

But, as harmful as this interference is, and as irritating as Industry Canada's failure to live up to its obligation is, they are nothing, nothing, in comparison to the real harm the transmitters are causing us.

In 2000, the residents on Bexhill Place expressed concern about the possible health implications and were repeatedly assured that Safety Code 6 provides protection. In 2001, with the help of the City of Colwood, the residents were able to get Industry Canada to perform a test of emission levels, which we later learned was not done with the proper equipment or following the correct protocol. (please refer to page 23 of petition) After a few hours of testing over 2 consecutive days in August, everyone was told the emissions were under Safety Code 6 and therefore there was nothing to worry about.

Before building our home, we asked various authorities about the FM towers and any potential health implications and received repeated assurances that Industry Canada has strict guidelines which ensure that there is no danger from RF emissions. We believed them.

Neighbours soon began to complain about health problems and at a gathering in 2005 many discussed sleeping problems including insomnia and nightsweats, skin rashes, and headaches. We decided to investigate to see if proximity to the transmitters might be the cause.

We've since learned that within 1 city block of the towers we have several people with various cancers, neurological problems, multiple miscarriages, and dermatological problems. This was discovered through casual conversations; no survey of the neighbourhood has been done.

We approached Dr. Richard Stanwick, Vancouver Island Health Officer and he told us any problems were Health Canada's responsibility and he could not get involved. In numerous discussions with people at the BC Cancer and Radiation Centre, specifically Dr. Randy Ross, we have received assurance that Safety Code 6 is safe and any health problems are due to other causes. In telephone calls and letters to people at Industry Canada both in Vancouver (Mr. Bruce Drake) and Victoria (Mr. Jim Laursen) I've received the same response -- so long as the emissions are within the limits set by Safety Code 6, there is nothing that can be done. Through emails, Dr. McNamee of Health Canada assured us that Safety Code 6 is consistent with the rest of the world's guidelines and EMR at the non-thermal level is not dangerous.

Over the last year, we've learned that the scope of the problem has changed, with Industry Canada's requirement that broadcasters use existing towers

wherever possible. Now there is a cell transmitter (869.00 MHz) on the FM towers (no notice was given, so I have no information on the installation date). The tower on Walfred has been removed and new towers were installed, with no notice or consultation. There are now many transmitters of various sorts and we were told by Mr. Laursen that 2 additional cell transmitters will be installed shortly. As of today, there are 44 transmitters within 1 kilometer of our home (please see the list from Industry Canada's website).

	NO. ON WALFRED	NO. ON FULTON
1999	1	1
2000	1	5
2008	29	6

According to one of many influential studies : "During the first 3-5 years of exposure, people suffer sleep disorders, melatonin reduction which leads to immune deficiencies. From 5-7 years, neurological problems begin to become noticeable with headaches, confusion, and memory loss. After 10 years, serious disorders such as cancer occur and health damage become irreversible." (I.S.F. Institute for Stress Research, Berlin, Biological effects of electromagnetic fields on humans in the frequency range of 1 to 3 Ghz)

Most of the people in our neighbourhood have been exposed to these FM towers for 8 years.

We all are on borrowed time and we ask for Health Canada to reduce the allowable exposure level by studying independent, non-industry funded research and heeding the recommendations of the preponderance of credible peer-reviewed international scientists.

We respectfully petition the Auditor General, on behalf of all Canadians:

to have Health Canada and Industry Canada explain their reliance on and association with the telecommunication industry, to the detriment of the health of the citizens by whom they are employed;

to have Health Canada explain why Canadians are not granted the same level of protection that citizens of many other countries are granted;

to instruct Health Canada to revisit its decision regarding Safety Code 6 and to implement a biologically (health)-based standard for non-thermal electromagnetic radiation, patterned after those recommended by the

BioInitiative Report, August 2007;

to ensure that all FM and cell phone transmitters presently in use be adjusted to meet this new standard;

to remind Health Canada that its mandate is to enhance and protect the health of Canadians;

to instruct that Health Canada use only scientific studies that are credible, peer-reviewed, non-industry funded that have no industry connections;

to ensure that Health Canada personnel no longer be allowed to have connections with bodies that tend to cast doubt on the impartiality of their work;

to ensure that Industry Canada carryout its mandates as published on their webpage. But while doing so that it respect the concerns of those not in industry but with an interest in decisions that may impact upon them to be properly considered, informed and respected;

to ensure that all dealings with the public be fair, objective, and aboveboard.

We earnestly petition the Auditor General to ask for honest answers that are not mere repetitions of replies that have been given to us and to many others already but which do not respond to the questions.

Petitioners:

I. INDEPENDENCE OF ADVISORY BODIES

In the New York Times, June 10, 2008, "Three prominent psychiatrists at the Harvard Medical School and its affiliated Massachusetts General Hospital have been caught vastly underreporting their income from drug companies whose fortunes could be affected by their studies and their promotional efforts on behalf of aggressive drug treatments. Their failure to divulge their conflicts is striking proof that today's requirements for reporting payments from industry — essentially an honor system in which researchers are supposed to reveal their outside income to their institutions — needs to be strengthened."

Health Canada and Industry Canada receives great sums of money from the telecommunication industry each through various licensing fees, siting fees, spectrum auctions, etc. For example, according to CanWest News Source, May 28, 2008, more than \$560 million was committed by 24 of the 60 participants on the first day of the recent auction of spectrum licenses. It was reported in The Times Colonist of June 18, 2008, page 5B, that "Canada's auction of the airwaves for wireless services ... has raised about \$3.77 billion in revenue" and that the auction is not yet over.

From this arises the perception of a conflict of interest in Health Canada's and Industry Canada's responsibility of protecting the citizens of Canada from the potential dangers of electromagnetic radiation emitted by telecommunication transmitters and devices. We undertook to see if perception conflicts with reality:

A. Health Canada Independence

1. In his letter to me of Dec. 17, 2007, Dr. James McNamee, Research Scientist, Consumer and Clinical Radiation Protection Bureau (CCRPB) of Health Canada, stated that "Myself and my colleagues maintain a vigilant surveillance of the health effects literature related to this issue and conduct our own research to evaluate potential bioeffects (such as DNA damage). It is Health Canada's position, and one which I personally agree with, that exposure to radiofrequency fields below the limits outlined in Safety Code 6 do not pose a health risk."

In reply to my request for examples of what Health Canada considers credible studies showing that there are no adverse health effects from non-thermal RF radiation, on March 17, 2008, Dr. McNamee sent me the following list:

a) Krewski D, Glickman BW, Habas RW, Habbick B, Lotz WG, Mandeville R, Prato FS, Salem T, Weaver DF. Recent advances in research on radiofrequency fields and health: 2001-2003. *J Toxicol Environ Health B Crit Rev.* 10:287-318 (2007)

b) Valberg PA, van Deventer TE, Repacholi MH. Workgroup report: base stations and wireless networks-radiofrequency (RF) exposures and health

consequences. EnvironHealth Perspect. 115:416-424 (2007)

c) Moulder JE, Foster KR, Erdreich LS, McNamee JP. Mobile phones, mobile phone base stations and cancer: a review. Int J Radiat Biol. 81:189-203 (2005)

d) Vijayalaxmi, Obe G. Controversial cytogenic observations in mammalian somatic cells exposed to radiofrequency exposure. Radiat Res. 162:481-496 (2004)

e) Ahlbom A, Green A, Kheifets L., Savitz D, Swerdlow A; ICNIRP. Epidemiology of health effects of radiofrequency exposure. Environ Health Perspect. 112:1741-1754 (2004)

2. I decided to apply Dr. McNamee's "vigilant surveillance" to the quality and integrity of some of his sources:

a) D. Krewski is Director of the R. Samuel McLaughlin Centre for Population Risk Assessment, University of Ottawa.. According to CBC's Marketplace, Nov. 25, 2003, the Canadian Wireless and Telecommunication Association (CWTA), a cell phone industry lobby group along with its members invested \$1 million to help establish the R. Samuel McLaughlin Centre for Population Health Risk Assessment at the University of Ottawa, where Dr. Krewski is doing his cellphone research. The head of the CWTA, Peter Barnes, told CBC that the million dollars his lobby group gave to Krewski's centre has no strings attached.

Dr. Krewski also holds the position of Chair of the scientific advisory group of the Wireless Information Research Centre (WIRC). According to CBC News, Nov. 25, 2003, the WIRC is funded by the Canadian Wireless and Telecommunication Association.

Another of his positions is that of Director of IARC, the Canadian Interphone Study. Canada is the only country of the 13 participants that accepts funding from the telecommunications industry. "Krewski has about \$1million to fund his part of the IARC research, most of it came from the Canadian Wireless and Telecommunications Association, the cellphone industry lobby group." (CBC News, Nov. 25, 2003)

According to the University of Ottawa Gazette, May 10, 2001, "The Canadian project has received a grant from the Canadian Wireless Telecommunications Association (CWTA), which is being administered through the university-industry partnership program of the Canadian Institutes for Health Research (CIHR). CIHR is expected to fund half, with the CWTA funding the remainder. "Industry has a responsibility to contribute to health research on their products, to address questions about potential health risks associated with wireless telecommunications," he says. "The university-industry partnership program that CIHR has set up is exactly designed for this purpose." In addition, "Roger Poirier, the man who negotiated the million dollar deal, is a consultant on the big cellphone study for IARC," as reported by CBC News, Nov. 25, 2003.

The World Health Organization (WHO), according to many observers, is closely associated with the industries they are supposed to be researching. According to the WHO 2005 Annual Report, Krewski acted as the Principal Investigator in the epidemiological study of cellular telephones and head and neck cancer which was funded by CIHR and CWTA, with the databases created and coordinated by the McLaughlin Centre.

In the same WHO Report is documentation that Dr. Krewski, along with R. Habash and M. Repacholi, was the principal investigator for the study on Electromagnetic Fields and Health which was funded by the CWTA and CIHR (\$850,000).

b) John Moulder is an industry consultant, and, according to *Microwave News*, July 31, 2006, "has a lucrative consulting practice on EMFs and health. Over the years, Moulder has earned hundreds of thousands of dollars disputing the existence of adverse EMF health effects, even those accepted by most other members of the EMF community."

He has worked for *Radiation Research* since the early 1990s and is now senior editor of it. "Over the last 16 years, only one positive paper on microwave genotoxicity has appeared in *Radiation Research*.... 80% of the negative papers (17 out of 21) published in *Radiation Research* were paid for by either industry or the U.S. Air Force."

Microwave News is "meticulously researched and thoroughly documented." **Time Magazine, July 30, 1990**

"the most authoritative journal on ELF fields and health." **Fortune Magazine, Dec. 31, 1990**

"the world's most authoritative source on EMF health risks." **Washington Journalism Review, Jan/Feb 1991**

c) Obe G. Vijayalaxmi, together with Moulder and some colleagues from Washington University and the U.S. Air Force had published a review paper that dismissed any possible connection between cell phones and cancer. This was published in *Radiation Research*. After Moulder had moved up to senior editor in 2001, he recruited Vijayalaxmi of the University of Texas in San Antonio to join the *Radiation Research* editorial board. Vijayalaxmi is the lead author on seven of the negative microwave-genotox papers. All were funded by the U.S. Air Force, Motorola or a combination of the two. (*Microwave News*, July 31, 2006)

Dr. Vijayalaxmi is treasurer for the Bioelectromagnetics Society, and will be until 2010.

d) James McNamee, research scientist, Consumer & Clinical Radiation Protection Bureau, Health Canada, is the new EMR specialist on the editorial board of *Radiation Research*. He has published three negative papers on microwave genotoxicity in *Radiation Research*. McNamee also has written a review paper with Moulder on cell phones and cancer. Vijayalaxmi, McNamee and Maria Scarfi, an Italian researcher, are authors on 14 of the 42 negative genotox papers. Ten of their 14 negative papers were published in *Radiation*

Research. (Microwave News, July 31, 2006)

Dr. McNamee is on the Board of Directors for the Bioelectromagnetics Society, with his term ending 2008. (www.bioelectromagnetics.org) This Society's newsletter is funded by Motorola, and its editor is Dr. Mays Swicord, director of EMR research for Motorola. (Microwave News, July 2004)

e) MH Repacholi headed the Project into ElectroMagneticFields (EMFs) by the World Health Organisation (WHO) until July 2007 and has been tied to the telecommunication industry contributions as reported in Microwave News, Nov. 17, 2006.

f) R. Mandeville -- President and CSO of Biophage, Inc, a biopharmaceutical company. **Company Partners:**The Company's partners include the REGA Institute of the University of Leuven in Belgium, Nymox Inc., the Defence Research Establishment Suffield (DRES) and Biopolymer Engineering of Eagan, MN.

Dr. Mandeville is on the Board of Directors of Montec Holdings, which is directly associated with telecommunication companies. (www.Montecholdings.com/boardofdirectors.htm)

QUESTION:

- 1) How can Health Canada rationalize using research that is influenced to such a degree by people who rely upon industry for funding?
- 2) Who in Health Canada is responsible for vetting researchers and the peer-reviewed research used to confirm that Safety Code 6 is safe?
- 3) Are Health Canada and Industry Canada employees required to sign conflict of interest statements that declare they have no affiliation with any organization that may bring into question the impartiality of their work?
- 4) Are scientists conducting research for Health Canada and Industry Canada required to sign conflict of interest statements that declare they have no affiliation with any organization, nor do they accept, directly or indirectly, funding from any source that could be perceived in anyway to cast doubt on the objectivity of their work?
- 5) Do Industry Canada and Health Canada adhere to the rule that the authors, whatever their affiliation, of all studies that Industry Canada or Health Canada depend on to support their position on EMR, must clearly be seen to be independent, and must be willing to declare that they have no financial interests in the outcome of their studies and that they receive no industry funding, whether directly or indirectly, in carrying out their studies?

B. Royal Society

1. According to Artnarong Thansandote, Chief, Electromagnetics Division, CCRPB, Health Canada, in a letter of June 2, 2006, to Pim Vanderveen, Industry Canada, copied to Robert Bradley, Director CCRPB, "...at the request of Health Canada, the Royal Society of Canada assembled an expert panel on radiofrequency (RF) fields to conduct an independent review of the guidelines for safe exposure limits set out in the Code."

Yet even the Expert Panel convened by the Royal Society of Canada to review new scientific studies and to make recommendations about the adequacy of SC6, has persons with close ties to the telecommunications industries. In support of this statement I provide the following:

1. Dr. D. Krewski (please refer to #2a above)
2. R.W.Y. Habash has connections with the R. Samuel McLaughlin Centre, which is largely industry-funded. (See WHO 2005 Annual Report) (please refer to #2a)
3. B. Habbick also works for the R. Samuel McLaughlin Centre. (please refer to #2a)
4. T. Salem also works for the R. McLaughlin Centre.(please refer to #2a)
5. Mary McBride, worked on the WHO "Epidemiological Study of Cellular Telephones and Head and Neck Cancer" with D. Krewski and J. Siemiatycki, which was funded by CIHR, CWTA (Canadian Wireless and Telecommunications Association. The Collaborating Centre was the R. Samuel McLaughlin Centre for Population Health Risk Assessment. Source: WHO Annual Report, 2005.
6. R. Mandeville, President and CSO of Biophage, Inc a biopharmaceutical company. (refer to #2f for information)

QUESTION:

6) When at least half the members of the "expert panel" have direct or indirect associations with the telecommunication industry, why should the public believe that the recommendations of these people are not influenced by the industry?

7) How does Health Canada refute the perception that it is unduly supportive of telecommunication companies because of its dependence upon researchers who have ties to that industry?

C. WHO

1.

a) **MH Repacholi** headed the Project into ElectroMagneticFields (EMFs) by the World Health Organisation (WHO) until July 2007. For years, the WHO have declared Mobile Telephone Masts and the microwave radiation (the EMFs) emitted by them and other such devices not to be dangerous. **Repacholi has now admitted that a large proportion of the WHO-EMF Project funding was sourced via donations sent to the Royal Adelaide Hospital from where Repacholi was seconded**, and according to Microwave News, Nov. 17, 2006, reported that the funds were then transferred to the WHO. "Norm Sandler, a Motorola spokesman, told us that, 'This is the process for all the supporters of the WHO program.' At the time, Motorola was sending Repacholi \$50,000 each year. That money is now bundled with other industry contributions and sent to Australia by the Mobile Manufacturers Forum (MMF), which gives the project \$150,000 a year. " (WHO Progress Report, July 2007 as reported by Mast Sanity.org)

b) **D. Krewski**: The World Health Organization (WHO), according to many observers, is closely associated with the industries they are supposed to be researching. According the WHO 2005 Annual Report, Krewski acted as the Principal Investigator in the epidemiological study of cellular telephones and head and neck cancer which was funded by CIHR and CWTA, with the databases created and coordinated by the McLaughlin Centre.

c) **R. Habash**: In the same WHO Report is documentation that Dr. Krewski, along with R. Habash and M. Repacholi, was the principal investigator for the study on Electromagnetic Fields and Health which was funded by the CWTA and CIHR (\$850,000).

d) **Mary McBride**, worked on the WHO Epidemiological Study of Cellular Telephones and Head and Neck Cancer with D. Krewski and J. Siemiatycki, which was funded by CIHR, CWTA (Canadian Wireless and Telecommunications Association). The Collaborating Centre was the R. Samuel McLaughlin Centre for Population Health Risk Assessment. Source: WHO Annual Report, 2005.

QUESTION:

8. **Since WHO accepts funding from the wireless industry, why should any credence be given to studies that WHO sponsors?**

9. **Since the researchers appear to be so closely associated with the industry that has a direct interest in the results of their research, why should we not assume that those results are biased in its favour?**

II. SCIENTIFIC EVIDENCE

A. Credible Studies?

1. In his letter to me of Dec. 17, 2007, Dr. McNamee said, "I must point out that while there are some studies reporting evidence of adverse effects from radiofrequency field exposure, there are a much larger (sic) of other studies which do not find similar findings..."

In response to our request for more examples of credible, scientific, peer-reviewed studies that showed the absence of harm from non-thermal radiation, Dr. McNamee provided 20. Of these 20 studies, 18 were published in 3 journals funded by the telecommunication industry:

Radiation Research, funded by Industry and US Air Force (Microwave News, July 31, 2006.

Bioelectromagnetics Society Journal, funded by Motorola. Editor is Dr. Mays Swicord, director of EMR research at Motorola. (Microwave News, July 2004)

International Journal of Radiation Biology published by Informa Healthcare which, along with its partner, Informa Media and Telecom, are part of the Informa Group Plc

In explanation of this reliance on industry-funded journals, Microwave News, July 31, 2006, pointed out; "Wireless companies like Motorola have fostered the spurious view that negative studies cancel out positive ones. Their strategy is this: First, seed the journals with no-effect papers that run counter to previously published work which does show biological changes. Then argue: 'If we couldn't replicate the effect, it cannot be real.' The assumption here is that industry science is superior to everyone else's. They make no effort to resolve inconsistent results."

Studies have confirmed that this could apply to industry-funded researchers and research projects regarding radiofrequency dangers.

A comparison of 85 Genotox Studies done from 1990-2006. 45 reported negative effects and 42 reported none. Of the 45 positive report, 3 were industry funded. Of the 42 negative all but 5 were industry funded, and one of these 5 was by Dr. James McNamee of Health Canada who has ties to industry but would not commit whether he was industry funded or not. ***Microwave News, July 2006 (vol. XXIV No.4)***

"Two of the world's leading radiation experts told The Express that multinational companies tried to influence the results of their research. Professor Ross Adey, a biologist, had his funding withdrawn by Motorola before completing research which showed that mobiles affected the number of brain tumours in animals. Dr. Henry Lai, who has been studying the biological effects of electromagnetic fields for 20 years, was asked three times to change findings on how they caused DNA breaks in

rats." *Express Newspapers*, 24 May, 1999

Dr. Henry Lai, compared 326 Cell Phone Biological Studies in an internal 2006 study for the Univ. of Washington and found the following:

Of the studies showing no biological effects, 72% were industry-funded.
Of the studies showing biological effects, 33% were industry-funded.

Egger, Nat. Inst. Of Environ. Health Science (NIEHS), Vol. 115 #1 Jan 2007: "Health effects of radiofrequency radiation should take sponsorship into account."

QUESTION:

10) How does Health Canada refute the perception that it discounts credible peer-reviewed scientific studies that are not industry-funded and favors studies that are industry-funded?

11) How does H.C. refute the perception that just as the multibillion dollar asbestos and tobacco industries were able to persuade government overseers to ignore credible evidence harmful to the bottom line of those industries, the multibillion dollar telecommunications industry is not persuading Health Canada to ignore credible evidence that is harmful to the bottom line of that industry?

B. Credible Studies

1. In his letter to me of Dec. 17, 2007, Dr. McNamee said, "When evaluating the scientific evidence for a potential health risk, one must consider all data (not just a selected subset of the literature) to make scientifically sound health risk assessment."

Yet, it is maintained by both HC and the 'expert panel', the Royal Society of Canada, that there has been no new evidence to justify revision of SC 6 since its 1999 review.

Please find below just a few of quite credible studies from around the world that were reported since 1999, showing health effects from non-thermal radiation and, apparently, have been overlooked by the Royal Society of Canada and Health Canada.

REFLEX Report, (December 2004) *Risk Evaluation of Potential Environmental Hazards From Low Frequency Electromagnetic Field Exposure Using Sensitive in vitro Methods*, A project funded by the European Union under the programme "Quality of Life and Management of Living Resources".

"Twelve institutes in seven countries have found genotoxic effects and modified expressions on numerous genes and proteins after Radio frequency and extremely low frequency EMF exposure at low levels, below current international safety guidance, to living cells in-vitro. These results confirm the likelihood of long-term genetic damage in the blood and brains of users of mobile phones and other sources of electromagnetic fields. The idea behind the REFLEX study was to attempt replicate damage already reported to see if the effects were real and whether, or not, more money should be spent of research into the possible adverse health effects of EMF exposure. They concluded that in-vitro damage is real and that it is important to carry out much more research, especially monitoring the long-term health of people."

Eger H et al, (November 2004) *The Influence of Being Physically Near to a Cell Phone Transmission Mast on the Incidence of Cancer*, Umwelt Medizin Gesellschaft 17,4 2004

"Newly diagnosed cancers were significantly higher among those who had lived for 10 years within 400 metres of the mast, in operation since 1993, compared with those living further away, and the patients had fallen ill on average 8 years earlier. People living within 400 metres of the mast in Naila had three times the risk of developing cancer than those living further away. This seems to be an undeniable clustering of cancer cases."

Oberfeld G et al, (October 2004) *The Microwave Syndrome - Further Aspects of a Spanish Study*, Conference Proceedings

"The adjusted (sex, age, distance) logistic regression model showed statistically significant positive exposure-response associations between the E-field and the following variables: fatigue, irritability, headaches, nausea, loss of appetite, sleeping disorder, depressive tendency, feeling of discomfort, difficulty in concentration, loss of memory, visual disorder, dizziness and cardiovascular problems. The inclusion of the distance, which might be a proxy for the sometimes raised "concerns explanation", did not alter the model substantially."

Hallberg O, Johansson O, (July 2004) *Malignant melanoma of the skin - not a sunshine story!*, Med Sci Monit. 2004 Jul;10(7):CR336-40

"A good correlation in time was found for the rollout of FM/TV broadcasting networks while the increased amount of "sun travel" by air (charter) did not start until 7 years after the melanoma trend break in 1955. Counties that did not roll out their FM-broadcasting network until several years after 1955 continued to have a stable melanoma mortality during the intervening years. The increased incidence and mortality of melanoma of skin cannot solely be explained by increased exposure to

UV-radiation from the sun. We conclude that continuous disturbance of cell repair mechanisms by body-resonant electromagnetic fields seems to amplify the carcinogenic effects resulting from cell damage caused e.g. by UV-radiation

Boscol et al. reported that RFR from radio transmission stations affected immunological system in women [Effects of electromagnetic fields produced by radiotelevision broadcasting stations on the immune system of women. *Sci. Total Environ* 273:1-10, 2001].

Salford et al. (2003) have shown that extremely low doses of GSM radiation can cause brain damage in rats. The authors reported nerve damage following a single two-hour exposure at a SAR of 2 mW/kg. They showed that RF energy can impair the BBB, but they added that the chemicals that leak through the BBB probably damage neurons in the cortex, the hippocampus and the basal ganglia of the brain. The cortex is close to the surface of the skull, while the basal ganglia are much deeper...

BioInitiative Report, August 2007. An international working group of scientists, researchers and public health policy professionals (The BioInitiative Working Group) has released its peer-reviewed report on electromagnetic fields (EMF) and health. By reviewing more than **2000** peer-reviewed studies, they document serious scientific concerns about current limits regulating how much EMF is allowable from power lines, cell phones, and many other sources of EMF exposure in daily life. The report concludes that the existing standards for public safety are inadequate to protect public health.

Clark, M.L. et al, "Biomonitoring of Estrogen and melatonin metabolites among women residing near radio and television radio broadcasting transmitters" concluded that RF and temporally stable 60 Hz exposures were associated with increased E1G excretion among post-menopausal women. *J. Occup. Environ. Med.* 2007;49: 1149-1156.

QUESTION:

12) How does Health Canada explain why each of these non-industry funded studies is not considered relevant or credible by the experts at HC and the Royal Society?

13) How much has the telecommunications industry spent for research annually over the last 5 years?

14) How much has Health Canada spent for independent, non-industry funded research annually during the last 5 years?

III. OUR PROTECTION?

A. Safety Code 6

1. Health Canada and Industry Canada continue to assure the public that Safety Code 6 is adequate to protect the general public. In his letter to me of Dec. 17, 2007, Dr. McNamee said, "... we would not support Safety Code 6 unless we personally felt it was adequately protective."

The public has been told that we should be comforted by knowing that Canada's Safety Code 6 is one of the most stringent in the world and is consistent with most other western countries.

In reality, "an increasing number of countries have implemented stricter public exposure limits in response to concerns about and studies demonstrating health problems from RF exposure at levels lower than those allowed by SC 6. Many western European countries have done so following the precautionary principle attempting to keep RF exposure as low as possible:

In eastern European and Asian countries, lower standards are being established to protect the public from effects observed in their studies among people chronically exposed to RFs through their work, such as changes in the central nervous, endocrine and immune system functions. (Toronto Prudent Avoidance Policy on Siting Telecommunication Towers and Antennas, Nov. 20, 2007)

As reported by the Medical Officer of Health of the Toronto Board of Health in the Siting Policy, "there are already several jurisdictions that have adopted lower exposure limits for the public. Some, such as Bulgaria, China, the Czech Republic, Hungary, Italy, Poland, Russia, and Switzerland have established legally enforceable national levels. Several other local governments have made exposure limits more protective, primarily through cooperative arrangements with industry: Auckland, Brussels, Paris, Salzburg (Austria), and several municipalities in Australia." In 1999, the Toronto Board of Health recommended exposure limits of .1W/meter squared (.1W/m²).

Following are a number of countries and their national standards for 450MHz frequency.

Austria's "precautionary limit	0.001 W/m ²
Russia's exposure limit	0.02 W/m ²
ECOLOG recommendation 1998	0.023 W/m ²
Poland's exposure limit	0.1 W/m ²
Italy's exposure limit	0.16 W/m ²

CSSR's exposure limit	0.24	W/m ²
New Zealand's exposure limit	2.0	W/m ²
Canada's exposure limit	3.0	W/m²

Following are the national standards in many countries for 1800MHz frequency.

Toronto Board of Health precautionary	0.10	W/m ²
Italy regulatory, precautionary	0.10	W/m ²
Switzerland, regulatory, precautionary	0.10	W/m ²
China, regulatory	0.10	W/m ²
Russia, regulatory	0.10	W/m ²
Paris precautionary, cooperative	0.10	W/m ²
Salzburg, precautionary, cooperative	0.001	W/m ²
ICNIRP Guideline*	10.0	W/m ²
Canada	10.0	W/m²

Canada has the same guideline as ICNIRP which says it is only intended to protect the public against short term gross heating effects and NOT against 'biological' effects such as cancer and genetic damage from long term low level microwave exposure from mobile phones, their masts and many other wireless devices. This statement is made at: <http://www.icnirp.de/documents/emfgdl.pdf>

QUESTION:

15) Will Health Canada justify the current exposure standards of SC 6, which are at levels to protect the public only against short term gross heating effects, as per ICNIRP?

16) Will Health Canada and Industry Canada amend its public documents to reflect the fact that Canada's standard is not consistent with most other developed countries and to instruct its researchers to stop telling the public that Canada's standards are among the most stringent in the world?

17) Health Canada and Industry Canada do not follow the stricter safety codes of most of Europe but rather the much more lax safety codes of the U.S. To what degree is this because Health Canada and Industry Canada have been unduly influenced by the powerful North American telecommunication industry?

IV. POLICY APPROACHES

The **International Commission for Electromagnetic Safety (ICEMS)** is a non-profit organization that promotes research to protect public health from electromagnetic fields and develops the scientific basis and strategies for assessment, prevention, management and communication of risk, based on the

precautionary principle

In Dec. 2007 and June 2008 ICEMS and the 47 scientists who were signatories to the Benevento Resolution stated in the follow-up Venice Resolution:

"...we are compelled to confirm the existence of non-thermal effects of electromagnetic fields on living matter, which seem to occur at every level of investigation from molecular to epidemiological..." and urged the immediate adoption of precautionary measures to protect the public. (www.icems.eu)

A. The Precautionary Principle

1. The Precautionary Principle adopted in 1998 at the Wingspread Conference:

"We believe existing environmental regulations and other decisions, particularly those based on risk assessment, have failed to adequately protect human health and the environment, as well as the larger system of which humans are but a part.

We believe there is compelling evidence that damage to humans and the worldwide environment, is of such magnitude and seriousness that new principles for conducting human activities are necessary.

While we realize that human activities may involve hazards, people must proceed more carefully than has been the case in recent history.

Corporations, government entities, organizations, communities, scientists and other individuals must adopt a precautionary approach to all human endeavors.

Therefore it is necessary to implement the Precautionary Principle: Where an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.

In this context the proponent of an activity, rather than the public bears the burden of proof." (the emphasis is mine)

(www.sehn.org/wing.html)

2. In several of his letters to me, and in response to a question asking him for studies that prove that living in the midst of FM and cell transmitters, as we do, is safe, Dr. McNamee responded in his letter of April 3, 2008, "It is technically impossible to ever 'prove' that any activity, product, or item is absolutely safe..." In the same letter he admits, "There are some studies claiming that biological effects may occur at RF energy levels below SC 6 limits."

3. According to an Environment Canada pamphlet:

"Canada applies the precautionary approach in situations when a decision must be made about a risk of serious or irreversible harm and where there is scientific uncertainty. These factors should not be used as a reason to postpone decisions. The precautionary approach/principle is a distinctive

approach to managing threats of serious or irreversible harm where there is scientific uncertainty. The precautionary approach recognizes that the absence of full scientific certainty shall not be used as a reason to postpone decisions where there is a risk of serious or irreversible harm. Even though scientific information may be inconclusive, decisions have to be made to meet society's expectations that risks be addressed and living standards maintained." (www.ec.gc.ca/econom/pamphlet_e.htm)

B. Risk Assessment

1. Health Canada has publicly subscribed to the Risk Assessment/Management approach that balances harm against cost.

2. But Health Canada and Industry Canada are attempting to redefine the Wingspread precautionary principle, as per their FAQ on Radiofrequency Fields (www.ic.gc.ca/epic/site/smt-gst/nsf/print-en/sf08792e.html#3):

“(21) What is the precautionary principle and when should it be used?”

The precautionary principle (PP) is a public policy approach for **risk management** of possible, but unproven, adverse effects....If you are concerned about RF exposure, you may apply PP by limiting the length of your calls on cell phones and using a “hands-free” device that keeps the cell phone away from your head and body.”

5. Obviously Health Canada and Industry Canada do not understand the precautionary principle to mean the same thing as the Wingspread Conference intended. It is not an approach to **manage risk**, but to **avoid risks where there is a possible threat of serious or irreversible harm**.

Health Canada and Industry Canada also confuse precautionary principle with precautionary avoidance, eg. recommending limiting the length of cell phone calls is PA, not PP.

Perhaps Health Canada's and Industry Canada's redefining its risk management approach can best be explained by a report presented by Wirthlin, a public relations firm, and Nichols Dezenhall Communications Management, specialists in crisis management. In the report, entitled Industry's Response to the Precautionary Principle, industry is encouraged to “Conduct research and (<http://209.204.197.52/publicns/report/PPFINAL.PDF>)

As Mr. Vecchia, chairman of ICNIRP advised: “Be realistic about the EMR issue and consider the economical impact of precautionary measures.”

QUESTION:

18) Why do Health Canada and Industry Canada require that the risk be established before the precautionary principle is applied when the essential point of the Precautionary Principle is to provide protection in the absence of full scientific certainty?

19) Given the risk involved and the growing body of credible scientific evidence indicating serious harm from non-thermal levels of RF, will Health Canada follow the lead of other Federal Departments (eg. Environment Canada), and implement the original Wingspread Statement on the Precautionary Principle in place of the current risk assessment method of determining the exposure level for the general public?

20) Until and unless the precautionary principle is implemented as intended, would Health Canada and Industry Canada amend their public statements so as to eliminate the possibility of confusing the public about the fact that they are employing risk management, not the precautionary principle?

21) Have Industry Canada and Health Canada changed the label of their risk assessment approach (which emphasizes cost) to the "Precautionary Principle" (which emphasizes safety) in an attempt to co-opt the positive public opinion of the Precautionary Principle without having to change the focus of their approach?

22) Why does Health Canada hold, as stated by Dr. McNamee, that the danger associated with RF must be proven before action is taken, rather than taking the stance, recommended by the Wingspread Conference and Environment Canada, of making the proponent of the product (eg. the telecommunication industry) prove that RF exposure is safe? If it is not possible to prove its safety, as Dr. McNamee states, then how does Health Canada justify imposing a potentially unsafe product on the Canadian public?

23) How does Health Canada recommend utilizing its avoidance approach by those living next to or under transmission towers 24 hours a day for years on end?

24) Why is it Health Canada's policy that, contrary to the industry standard whereby a new product must be shown to be safe before it is introduced to the public, in the case of cell phones and FM transmitters, they are first introduced to the public and then it becomes the public's obligation to prove them to be unsafe?

25) If Health Canada applied the Precautionary Principle as Environment Canada defines it, new technology would be withheld from public use until it is demonstrated to be safe.

Since to Health Canada the Precautionary Principle is really a synonym for industry's Risk Assessment, are there any tests that new technology must undergo before it is approved for public use?

V. HEALTH IMPLICATIONS

A. Electromagnetic Sensitivity

1. Recent studies in many countries have indicated that more and more people are suffering from electromagnetic sensitivity. The symptoms are varied and severity ranges from mild to debilitating. Sweden now recognizes this as a disability and more people are going on disability pensions each year.

Sweden, Austria, Germany, United States, Switzerland, England and Ireland participated in studies which indicate an increase in the number of people affected which corresponds to the increase in exposure, through more technological development and wider use of transmitters, such as cell phone towers.

As reported in the journal "Electromagnetic Biology and Medicine", 25:189-191, 2006: 190 **Hallberg and Oberfeld** Table 1 Estimated prevalence of electrosensitive people in different years and countries Measured % EI year sensitive Country, reported year Ref. No.:

1985 0.06 Sweden 1991 (0.025–0.125%) National Encyclopedia Sw., 1991
 1994 0.63 Sweden 1995 Anonymous est., 1994
 1995 1.50 Austria 1995 Leitgeb N. et al., 1995, 2005
 1996 1.50 Sweden 1998 SNBHW, Env. report, 1998
 1997 2.00 Austria 1998 Leitgeb N. et al., 1998, 2005
 1997 1.50 Sweden 1999 Hillert L. et al., 2002
 1998 3.20 California 2002 Levallois P., 2002
 1999 3.10 Sweden 2001 SValberg PANBHW, Env. report, 2001
 2000 3.20 Sweden 2003 Sw Labour Union Sif, 2003
 2001 6.00 Germany 2002 Schroeder E., 2002
 2002 13.30 Austria 2003 (7.6–19%) Spiß B., 2003
 2003 8.00 Germany 2003 Infas, 2003
 2003 9.00 Sweden 2004 Elöverkänsligas Riksförbund, 2005
 2003 5.00 Schweiz 2005 Bern, Medicine Social, 2005
 2003 5.00 Ireland 2005 This is London, 2005
 2004 11.00 England 2004 Fox E., 2004
 2004 9.00 Germany 2005 Infas, 2004
 2017 50.00 Extrapolated to 50%

3. EHS - which can be very debilitating - is thought to result from large changes in the immune system caused by continuing exposure to microwave radiation, leading to chronic inflammation and allergic responses. Estimates of EHS vary from 3% to 10% of the population in the UK and other European countries. (The London Resolution, Dec. 3, 2007)

Canada did not have the technology and number of cell phones as Europe for some time, but it is logical to assume that Canada's exposure is growing at the same rate, and the health complaints are, too.

QUESTION:

Without acknowledging that there is evidence of health effects in humans exposed to non-thermal RF, and with the awareness that Health Canada has publicly subscribed to the risk assessment/management approach that balances harm against cost:

26) What research has Health Canada done to determine the current and future costs to our health system from the effects of EMR?

27) What level of harm will prompt Health Canada to revise its Safety Code 6 guideline to a lower biologically based but, perhaps, more costly level? Please give examples.

B. Consequences of Long-term exposure to FM and cell transmitters

1. Dr. Louis Slevin, editor of the authoritative Microwave News, upon learning that we lived within 100 meters of 3 FM transmitters, warned us that "cell phone transmitters are very dangerous, but FM transmitters can kill you." (in a telephone conversation on June 18, 2008).

2. There are, and were in 2000, many studies **specific to FM transmitters**, concluding that prolonged exposure to radiation from these powerful antennae lead to various types of cancer including childhood leukemia. Examples are:

Chiang et al. found that people who lived and worked near radio antennae and radar installations showed deficits in psychological and short-term memory tests [Health effects of environmental electromagnetic fields. *Journal of Bioelectricity* 8:127-131, 1989].

Dolk H, Shaddick G, Walls P, Grundy C, Thakrar B, Kleinschmidt I, Elliott P. Department of Public Health and Policy, London School of Hygiene and Tropical Medicine, England. PMID: 8982016 [PubMed - indexed for MEDLINE] *Am J Epidemiol.* 1997 Jan 1;145(1):1-9

Melanoma Incidence and Frequency Modulation (FM) Broadcasting

Ref 3. Hallberg Ö, Johansson O. Melanoma incidence and frequency modulation (FM) broadcasting. Arch Environ Health (2002); 57: 32-40

...**Magras & Xenos (1997)** have reported irreversible sterility in mice after 5 generations of exposure to 0.168 to 1.053 microwatts per square centimeter in an "antenna park." Note that the current, applicable US exposure standard would be 579 microwatts per square centimeter, -- 500 times higher! -- and that this very low exposure level would relate more to a person living near a Cellular Tower, than a phone user. (<http://www.wave-guide.org/library/cellphones.html>)

Dr Vini Gautam Khurana is a Mayo Clinic-trained neurosurgeon with an advanced neurosurgery Fellowship in cerebral vascular and tumour microsurgery. He has established that long term exposure and its effects on the body, particularly its electrical organ, the brain, are compounded by numerous other simultaneous long-term exposures including continuous waves from radio and TV transmitter towers, cordless phone base stations, power lines, and wireless/WiFi computing devices. (www.brain-surgery.net.au)

3. According to Report, University of Washington, by Henry Lai, Sept. 2004
 "when considering the health effect of radiation from wireless transmitters, one has to consider the effect of long-term exposure. People who live, attend school, or work close to transmitters are constantly being exposed to the radiation for months or years. Even though the level is low, it would matter if the effects of radiofrequency radiation turn out to be cumulative (eg. add up over time). Small doses cumulate over a long period of time will eventually lead to harmful effects. Therefore, exposure of the general public to radiofrequency radiation from wireless transmitters should be limited to a minimal level."
 (www.Salzburg.gv.at/henrylailletterspt132004.PDF)

QUESTION:

28) If Health Canada continuously monitors all relevant scientific information, as they profess, how can it justify having allowed the corporations to install these dangerous transmitters among my neighbours on Triangle Mountain?

C. Consequences of Proximity to FM and cell transmitters

1. Many studies demonstrate that living near (within 300 meters of a base station) is dangerous:

a) A German study found a threefold higher frequency of cancer among people living in the vicinity (400 m) of a GSM base station compared to people living further away from the antenna. The risk for mammary cancer was 3,4 times greater and the average age of contracting this disease was considerably lower,

50,8 years than in the control group (69,9 years). The frequency increased also the longer people had been exposed to the radiation. The study covered a ten year long period (1994-2004), starting the year after the installation of the base station. Before the installation of the base station, there was no difference in cancer incidence between people living in the vicinity of the (future) base station and the control area.

Excerpt:

"The result is a quite concrete epidemiological proof of a connexion between exposition to radiation from GSM Base stations and Cancer. This result is, considering the available documentation about the effect of high frequency electromagnetic radiation not only plausible but probable."

Source (in German): Horst Eger, Klaus Uwe Hagen, Birgitt Lucas, Peter Vogel, Helmut Voit, Einfluss der räumlichen Nähe von Mobilfunksendeanlagen auf die Krebsinzidenz. *Umwelt-Medizin-Gesellschaft* | 17 | 4/2004

b) New Austrian research confirms health effects of base station radiation. Despite exposure to radiation far below recommended levels (max. 4.1 mW/m²), effects on wellbeing and performance on cognitive tests was observed in a study of 365 subjects living within 20-600 metres from Mobile Phone Base stations.

Source: Hutter HP, Moshhammer H, Wallner P, Kundi M. Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations. *Occup Environ Med.* 2006 May;63(5):307-13.

c) Studies "on symptoms experienced by people living in vicinity of base stations shows that, in view of radioprotection, **minimal distance of people from cellular phone base stations should not be < 300 m.**" Physicians and Scientists for Responsible Application of Science and Technology, June 15,2008

d) Clark, M.L. et al, "Biomonitoring of Estrogen and melatonin metabolites among women residing near radio and television radio broadcasting transmitters" concluded that RF and temporally stable 60 Hz exposures were associated with increased E1G excretion among post-menopausal women. *J. Occup. Environ. Med.* 2007;49: 1149-1156.

QUESTION:

29) Given than many people living in proximity to these are suffering serious diseases which are consistent with those attributable to chronic exposure to radiation from FM transmitters, what will Health Canada do to enforce removal of these transmitters to non-residential areas?

30) Given that these FM transmitters are in close proximity to and directed toward schools, and given that children are more susceptible to radiation danger, how will Health Canada and Industry Canada respond to concern from parents about their children's health?

C. Antenna Farms

1 "In releasing Professor Dobell's review, Minister Rock acknowledged the Mayor, City Council and citizens of Colwood as having helped inspire the National Antenna Consultation, announced in October 2002. The National Antenna Tower Policy Review will give all Canadians the opportunity to shape the Department's tower siting procedures to ensure they keep pace with an evolving technological and consumer environment to best meet citizens' concerns." (Industry Canada's Minister Releases Third Party Review of Triangle Mountain Antenna Towers Siting Process, Feb. 6, 2003.)

2. In its circular CPC-2-0-03 effective Jan. 1, 2008, Industry Canada in section 3 states:

"Before building a new antenna-supporting structure, Industry Canada requires that proponents first explore the following options:
1) consider sharing an existing antenna system, modifying or replacing a structure if necessary;
2) locate, analyze and attempt to use any feasible existing infrastructure such as rooftops, water towers, etc."

3. In layman's term, such arrangements are called 'antennae farms', where multiple transmitters are grouped on one towers. When I asked why this was being encouraged, I was told by Jim Laursen, a local IC official, that people didn't object to transmitters but they do object to towers.

Industry itself admits, as stated in the Canadian Association of Broadcasters' submission, Oct. 17, 2003, "electromagnetic field levels in excess of HC's limits may be produced on the site if additional facilities are added."

Even the industry-weighted World Health Organization (WHO) states, "Situations where simultaneous exposure can occur to multiply frequency fields must be accounted for in the standard." source

4. Narda, the leading manufacturer of equipment to measure all aspects of EMR, used by Industry Canada in its field surveys, states that today's multi-emitter transmission sites present difficulties for

"accurate RF emissions measurements. Multiple emitters dramatically complicate the measurement process, and it is quite easy to make measurements that appear accurate but are, in fact, quite the opposite...The fact that data gathering must be conducted in the field at sites where there are other transmitting systems besides the one to be measured compounds measurement difficulties. The emitters may also operate at different frequencies, invoking more than one level of

acceptable exposure as defined by today's frequency-dependent standards....

The antennas for these systems are usually located within a stone's throw of each other. Without the ability to discriminate among signals, it is almost impossible to determine the radiation level of a specific emitter. In addition, diode detectors that have often been used for electric and magnetic field measurements in the broadcast industry have characteristics that make their accuracy questionable in these applications." (*Narda East Product Brochure*)

(Please note: Even with improper equipment and giving no consideration for compounding effects of multiple transmitters, the measurements taken by Industry Canada in my neighbourhood in 2001 were as high as 115 microwatts per square centimeter, or up to 685 times higher than those used in the Magras & Xenos study (see page. 17). And since 2001, many more antennae have been added within 300 meters, with plans for more. Canada's Safety Code 6 allows 200 microwatts per square centimeter for the general public.)

5. In the Canadian Association of Broadcasters submission to Industry Canada as part of the Antenna Policy Review, Oct. 17, 2003, the broadcasters state one of the key licensing conditions imposed by IC is that all RF installations must meet the requirements of HC with respect to non-ionizing RF fields, as set out in SC 6. Engineering submissions supporting applications for new or modified facilities (eg. antenna farms) must include a technical analysis demonstrating that the facilities will not exceed the levels of SC 6. This is done by making "theoretical signal-level calculations."

In the same submission, the broadcasters state that "although the effective radiated power from FM/TV/DAB broadcasting installations can often be quite high, tall antenna towers are generally used. This automatically ensures that high-energy zones are located well above the ground.

In all of my research I have been unable to find even one long-term study of the effects of these antenna farms on nearby residents.

QUESTION:

It is uncontested that when wireless electronic equipment is added in an already existing EMR zone that the result is a compounding of emissions.

In light of the recent study BY Dr. Khurana regarding the impact of the compounding effects of multi-product use, without acknowledging that the evidence of documented health effects in animals or humans exposed to non-thermal levels of radiation is conclusive, and in the interest of protecting Health Canada from a future charge of falling in its fiduciary responsibility to protect the health of its citizens, and in mitigating somewhat the possibility of the

telecommunications industry from being held liable for injuries caused by EMR:

31) Will Health Canada advocate/support the placing of warning signs within 200 meters of the transmitter sites with the wording?

WARNING! YOU ARE ENTERING AN AREA OF HIGH ELECTROMAGNETIC RADIATION EMISSIONS. USE OF WIRELESS EQUIPMENT, INCLUDING CELL PHONES, WITHIN A RADIUS OF 200 METERS OF THESE TRANSMITTERS IS TO BE AVOIDED.

32) Who is responsible for establishing the parameters for technical analyses associated with multiple transmitters?

33) Do these "theoretical calculations" take into consideration the fundamental properties of EM fields, namely reflection and compounding?

34) How does Ind. Can. ensure that the allowable limits for maximum values are never exceeded?

35) With the knowledge that "the effective radiated power from FM/TV/DAB broadcasting installations can often be quite high", why has Health Canada allowed, and continues to allow, installations of these transmitters near homes and schools which are at or near the same elevation of the transmitters? Please justify this practice.

36) Why is Industry Canada taking the approach of requiring the placement of multiple transmitters on towers? Is it, as I have been told by Mr. Jim Laursen of Industry Canada, because people see the towers and complain; they don't see the transmitters and don't complain?

37) Upon what scientific evidence does Health Canada base its decision to force proliferation of these antenna farms near residences and schools?

38) Under the new siting policy, CPC-2-0-03, no consultation is required for placement of new transmitters, only for new towers. Why was this presented to the public as an effort for more consultation between Ind. Can. and the public when it really was intended to allow the creation of antenna farms with no consultation with or input by the public?

D. OUR SITUATION

1. In the study entitled "Biomonitoring of Estrogen and melatonin metabolites among women residing near radio and television radio broadcasting transmitters" M.L. Clark, et al, concluded that RF and temporally stable 60 Hz exposures were

associated with increased E1G excretion among post-menopausal women. *J. Occup. Environ. Med.* 2007;49: 1149-1156.

The study took place at Lookout Mountain, Colorado, where people live with multiple FM and TV antennae. Results of the long-term study showed that long-term exposure to RF results in increases in estrogen in post-menopausal women and reduction in melatonin production, both of which have been shown to be related to cancer.

It should be pointed out that the closest house to the transmitters was 900 meters away and the scientists conducting the study considered, for their purposes, a high exposure level to be anything greater than 4 microwatts per centimeter squared.

2. However, I and my neighbours who live on top of Triangle Mountain live at nearly the same elevation as the FM and cell transmitters, and some live as close as 30 meters from them. Even with inadequate testing methods, which I will detail in the following section, the exposure level in the Triangle Mountain study was as high as 114 microwatts per centimeter squared. And today there are 10 times the number of transmitters here than there were in 2001. There are 44 transmitters of varying frequencies within 1 kilometer of my home, 55 within 2 kilometers.

And within approximately one kilometer there are two schools, an elementary school and a middle school, in direct line with the transmissions.

3. The Triangle Mountain study:

In August 2001, at the request of the City of Colwood and the residents of Triangle Mountain, two experts from Industry Canada spent 2 days at 10 different locations, measuring emission levels, in an effort to provide reassurance that health was not endangered by 3 FM transmitters and 2 Studio Link Transmitters (STLs) that were installed in 2000.

According to Safety Code 6,6.1: "the objective of a survey is to determine whether the device or installation complies with recommended standards of performance and personnel exposure...."

a) SC 6, 6.1f says that equipment shall match the source and the exposure levels in the near- and far-field.

According to the report written by Angela Choi, the spectrum analyzer was used merely to find the FM emissions, not to measure them. Instead, an electronic survey meter and a Narda field probe were used. According to an independent expert with whom I consulted, this means that not all RF emissions

were measured from the STLs or other nearby transmitters.

In addition, according to Narda specifications, the Narda field probe that was used is "very suitable for Occupational Exposure levels and partially suitable for General Public Levels."

Conclusion:

The correct equipment for the situation was not used.

b) SC 6, 6.2a says that records shall be kept for all RF survey measurements, including calibration date, and, SC 6, 6.1f says that survey instruments shall be fully calibrated at least every 3 years.

No calibration data was provided with the report and when, in Oct. 2007, Ms. Choi of Industry Canada, who performed the tests, was asked for the data, she said it had not been kept. But she replied that some of equipment had last been calibrated on March 19, 1998, or 3 ½ years before the test.

Inconsistencies in the results were noted in the report and readings could not be duplicated, a clear indication that the equipment was not performing properly.

Conclusion:

Industry Canada's protocol regarding equipment and record keeping was not followed.

c) SC 6.2.2.1a requires that testing be done using a time averaging over a period of .1 hour (6 minutes).

Industry Canada reported that a 30 second averaging method was used.

Conclusion:

Industry Canada's protocol regarding time averaging was not followed.

d) Narda, the equipment manufacturer, states that the antenna should be at head level (1.5-1.75 meters) and should be placed on a non-conducting tripod connected to a basic unit via cable. This ensures that the field being measured is not influenced by the unit or the tester.

The Industry Canada report describes how the probe was moved slowly up and down as the surveyor held it and walked back and forth. "The probe was held high over his head, pointing the probe away from the body." Variable readings were explained by the movement of nearby people.

Conclusion:

Neither manufacturer nor Industry Canada's instructions for testing were followed.

e) SC 6.2.4.3 states that if measured strengths are as high as 20% of limits, induced and contact current measurements should be taken.

No such measurements were taken even though readings were reported to be as high as 54.5% .

Conclusion:

Industry Canada's protocol was not followed.

Even using improper equipment and incorrect protocol, the highest reported reading was 20.3 V/m or 109 uW/cm². (When the calculations were checked for accuracy, the highest reading actually was 20.7 W/m or 114 uW/cm² outdoors and 75 uW/cm² indoors.)

To put this into perspective, the precautionary maximum set by the BioInitiative Report is .1 uW/cm² outdoors and .01uW/cm² indoors, 7500 times lower than the results from the measurements done in 2001 inside a home where people live, exposed, for 24 hours a day.

4. It should come as no surprise, then, that there are many people on my street suffering severe diseases: sleep disorders, memory reduction, loss of concentration, multiple miscarriages, skin rashes, multiple cataracts, prostate cancers, breast cancers -- all within one city block of the FM transmitters.

Whenever I have written to Health Canada or to Industry Canada informing them about our problems, I've been told the emissions are within Safety Code 6 levels for the general public. Therefore 1) there is nothing I can do; 2) there is no proof of a connection between the illnesses and electromagnetic radiation from the transmitters.

5. 21:08 06.08.2006 "microwave radiation can...functionally interfere with the natural processes involved in DNA replication and repair, by subtly altering molecular conformation (architecture), for example; this could well account, respectively, for the reports of chromosome aberrations / micronuclei formation and for the increased amount of DNA fragmentation observed under irradiation." Source: How Exposure to GSM & TETRA Base-station Radiation can Adversely Affect Humans. By Dr Gerard Hyland.

QUESTION:

39) Please define "general public" as the term is used in Safety Code 6.

40) If, as according to ICNIRP, levels allowed by Safety Code 6 apply to short-term acute exposure, why are there no biologically (health)-based standards which apply to chronic, long-term exposures for people who are living with the transmitters 24 hours a day, 365 days a year?

41) Would Industry Canada provide the power level of each of the 55 transmitters within 2 kilometers of my home?

42) Does Industry Canada have a limit to the number of transmitters that will be added within this radius?

43) Would Health Canada commit to having an independent epidemiological study done to determine the health status of people on Triangle Mountain?

44) Would Health Canada commit to an immediate and independent investigation into the dangers posed by antenna farms and, should these show harm, would it commit to establishing biologically (health)-based exposure standards?

45) Considering the improper procedures and equipment used in the 2001 testing for EMR on Triangle Mountain, why should the residents of Colwood have any confidence in Health Canada's and Industry Canada's assurances that they are safe since the actions of their employees left them in no position to offer an opinion?

46) Given the lack of concern for the public demonstrated by their employees at every level, why should the citizens of Canada have confidence in anything Health Canada or Industry Canada says or does?

Closing Statement

It is strikingly clear to us that Canada is in desperate need of a Corporate Manslaughter Act. The UK enacted one in 2007. It came into force in April, 2008. It made public and private corporations, as well as agents of these corporation, criminally responsible for actions that result in a person's death. The Act, and offence, also applies to Crown bodies.

With such an act in place here in Canada, there would be no need to have written this petition.

It is particularly offensive to us that the telecommunications industry appears to have such an influence over governmental departments that it can deleteriously impact the public weal. It has led to the bizarre situation in which the citizens of Canada are forced to act as guinea pigs testing potentially harmful telecommunications technology.

But this was to be expected when Canada allowed the telecommunications industry to introduce its products before any testing was done to prove them safe. Now it is up to the Public, by epidemiological studies showing their tumours, lesions, heart problems, sleep disorders, childhood leukemia, and cancers, to prove them unsafe.

Easy enough, you might think, if the evidence is that clear. Ah, but what matter clarity when it is industry, abetted by their Faustian enablers within Health Canada and Industry Canada, that has the final say. Not for nothing comes the proverb: "He who pays the piper, calls the tune."

And to prove the faith that industry has placed in them has not been misapplied, Health Canada and Industry Canada have now gone so far as to improvise on a theme made infamous in Orwell's classic, 1984. Every schoolboy remembers "War is Peace" and "Slavery is Freedom". But they'll never place: "Cost is Harm" "Risk Management is the Precautionary Principle" and "Precautionary Avoidance is Living Under Transmission Towers."

Ah, yes, indeed, it is a brave new world today. But will we be around to enjoy tomorrow?

Minister of Industry



Ministre de l'Industrie

Ottawa, Canada K1A 0H5

29/1/09



Dear

I am writing to provide you with Industry Canada's response to two Environmental Petitions, No. 255, received June 25, 2008, regarding the effects of non-thermal electromagnetic radiation at Triangle Mountain, Colwood, British Columbia, and Environmental Petition No. 255-B, received July 21, 2008, requesting that transmission towers be removed from there. These petitions were forwarded to the Minister of Health and the Minister of Industry by the Commissioner of the Environment and Sustainable Development. I am pleased to respond to your questions that fall within Industry Canada's area of responsibility.

Environmental Petition No. 255

Question 3: Are Health Canada and Industry Canada employees required to sign conflict of interest statements that declare they have no affiliation with any organization that may bring into question the impartiality of their work?

Question 4: Are scientists conducting research for Health Canada and Industry Canada required to sign conflict of interest statements that declare they have no affiliation with any organization, nor do they accept, directly or indirectly, funding from any source that could be perceived in any way to cast doubt on the objectivity of their work?

Question 5: Do Industry Canada and Health Canada adhere to the rule that the authors, whatever their affiliation, of all studies that Industry Canada or Health Canada depend on to support their

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position on EMR, must clearly be seen to be independent, and must be willing to declare that they have no financial interests in the outcome of their studies and that they receive no industry funding, whether directly or indirectly, in carrying out their studies?

Question 13: How much has the telecommunications industry spent for research annually over the last 5 years?

Regarding the quantity of money spent by the telecommunications industry on research, Industry Canada does not maintain records of this nature.

Question 16: Will Health Canada and Industry Canada amend its public documents to reflect the fact that Canada's standard is not consistent with most other developed countries and to instruct its researchers to stop telling the public that Canada's standards are among the most stringent in the world?

Question 17: Health Canada and Industry Canada do not follow the stricter safety codes of most of Europe but rather the much more lax safety codes of the U.S. To what degree is this due to Health Canada and Industry Canada having been unduly influenced by the powerful North American telecommunication industry?

Question 18: Why do Health Canada and Industry Canada require that the risk be established before the precautionary principle is applied when the essential point of the Precautionary Principle is to provide protection in the absence of full scientific certainty?

Question 20: Until and unless the precautionary principle is implemented as intended, would Health Canada and Industry Canada amend their public statements so as to eliminate the possibility of confusing the public about the fact that they are employing risk management, not the precautionary principle?

Question 21: Have Industry Canada and Health Canada changed the label of their risk assessment approach (which emphasizes cost) to the

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“Precautionary Principle” (which emphasizes safety) in an attempt to co-opt the positive public opinion of the Precautionary Principle without having to change the focus of their approach?

Question 30: Given that these FM transmitters are in close proximity to and directed toward schools, and given that children are more susceptible to radiation danger, how will Health Canada and Industry Canada respond to concerns from parents about their children’s health?

Health Canada has established safety guidelines for exposure to radiofrequency fields in its Safety Code 6 publication entitled *Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz*. To Industry Canada’s knowledge, Health Canada endorses the precautionary principle and its approach to decision making can be found on their website at <http://www.hc-sc.gc.ca/sr-sr/advice-avis/decision/index-eng.php>.

While the responsibility for developing Safety Code 6 rests with Health Canada, Industry Canada has adopted this guideline for the purpose of protecting the general public, which includes pregnant women, seniors, children, the chronically ill, and persons with disabilities. Industry Canada requires that all proponents and operators ensure that their radiocommunication and broadcasting installations comply with Safety Code 6 at all times. Proponents and operators must also consider the combined effects of nearby installations within the local radio environment.

Industry Canada independently chose to adopt Safety Code 6 for the protection of the general public. This decision was not taken due to influence by the telecommunication industry.

To Industry Canada’s knowledge, Health Canada’s Safety Code 6 takes into account all possible biological and/or health effects of radiofrequency fields, including short-term heating, non-thermal and/or long-term effects. Furthermore, it has been determined that there is no convincing scientific evidence that exposure to radiofrequency fields at levels below the limits outlined in Safety Code 6 cause any adverse health effects.

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Question 32: Who is responsible for establishing the parameters for technical analyses associated with multiples transmitters?

Question 34: How does Industry Canada ensure that the allowable limits for maximum values are never exceeded?

The technical aspects of radiocommunication, including the technical aspects of broadcasting, is under the responsibility of Industry Canada. It is the responsibility of proponents and operators of installations to ensure that all radiocommunication and broadcasting installations comply with Health Canada's Safety Code 6 at all times, including consideration of combined effects of nearby installations within the local radio environment.

Compliance with Safety Code 6 is an ongoing obligation. Antenna system operators may be required, as directed by Industry Canada at any time, to demonstrate compliance with Safety Code 6 by (i) providing detailed calculations, and/or (ii) conducting site surveys and, where necessary, by implementing corrective measures.

Question 33: Do these "theoretical calculations" take into consideration the fundamental properties of EM fields, namely reflection and compounding?

Industry Canada's internal tools that are used for assessing Safety Code 6 compliance take into account the fundamental properties of EM fields. Ground wave reflection of the electromagnetic waves, as well as the compounding of field strengths produced by all antenna systems, are taken into account when theoretical calculations are made to determine radio frequency (RF) exposure compliance. Numerous other electromagnetic properties of antennas, such as frequency, effective radiated power (ERP), antenna gain, antenna pattern, size of the antenna and antenna tilt, need to be accounted for during theoretical calculations, where appropriate and as required.

Question 36: Why is Industry Canada taking the approach of requiring the placement of multiple transmitters on towers?

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Is it, as I have been told by Mr. Jim Laursen of Industry Canada, because people see the towers and complain; they don't see the transmitters and don't complain?

Question 38: Under the new siting policy, CPC-2-0-03, no consultation is required for placement of new transmitters, only for new towers. Why was this presented to the public as an effort for more consultation between Industry Canada and the public when it really was intended to allow the creation of antenna farms with no consultation with or input by the public?

Procedures for the installation of new towers are set out in Industry Canada's Client Procedures Circular (CPC) 2-0-03, entitled *Installing Radiocommunication and Broadcasting Antenna Systems*, Issue 4, which replaces the former CPC-2-0-03, entitled *Environmental Process, Radiofrequency Fields and Land-Use Consultation*, Issue 3, June 24, 1995. In preparing its update to the procedures, the department studied the recommendations of both the Telecommunications Policy Review and the National Antenna Tower Policy Review. These reviews indicate that there are compelling social and economic reasons to support antenna tower and site sharing.

Industry Canada has incorporated many of the key recommendations of these two independent public reviews into the updated procedures, notably those relating to sharing and the exclusion from consultation for certain types of installations, while recognizing the requirement to balance the need for local input with the orderly development of radiocommunication in Canada. Local consultation regarding the installation of a new tower gives the public an opportunity to provide their input.

Question 41: Would Industry Canada provide the power level of each of the 55 transmitters within 2 kilometers of my home?

Publicly available licence information, including power levels, is available on Industry Canada's Spectrum Direct website at <https://sd.ic.gc.ca>, which is updated regularly and therefore provides the

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most current information. One of the features of the website is a geographic search feature that permits search radii that can encompass all of Canada.

Question 42: Does Industry Canada have a limit to the number of transmitters that will be added within this radius?

No, Industry Canada does not have a preset limit on the number of transmitters for a given geographic area. However, there are a number of technical issues that may limit the number of transmitters in a given location. For example, Industry Canada applies Health Canada's Safety Code 6 for the protection of the general public related to radiofrequency exposure. The field strength limits described in Safety Code 6, are not to be exceeded at any location accessible to the public.

Question 45: Considering the improper procedures and equipment used in the 2001 testing for EMR on Triangle Mountain, why should the residents of Colwood have any confidence in Health Canada's and Industry Canada's assurances that they are safe since the actions of their employees left them in no position to offer an opinion?

The department can assure the residents of Colwood that the employees who took measurements have proper training to work in the radio frequency discipline, have knowledge of electromagnetic field theory and followed proper engineering methods and practices. In 2001, the power density levels at Triangle Mountain were tested and Industry Canada staff found the levels to be in compliance with Safety Code 6 at all locations examined. The department has full confidence in the testing procedures and measurement equipment that were used to verify public Safety Code 6 compliance on Triangle Mountain in 2001 and, again, in 2008.

Question 46: Given the lack of concern for the public demonstrated by their employees at every level, why should the citizens of Canada have confidence in anything Health Canada or Industry Canada says or does?

Industry Canada employs competent and professional staff. Our employees are often called upon to find solutions for complex situations and, in doing so, may need to weigh competing interests with consideration of Industry Canada's official mandate.

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As can be expected in these types of complex situations, it may be necessary to make decisions that are not supported by the competing interests. Industry Canada employees would never knowingly place the health of the Canadian public at risk.

Environmental Petition No. 255-B

Question 1: Do Industry Canada and Health Canada not consider it appropriate that they pay the \$3-million fee that the broadcasters are demanding to move their transmission towers from Triangle Mountain to a non-residential site that their engineers have already deemed acceptable and, in some ways, superior to the current site since it was Industry Canada and Health Canada that allowed the broadcasters to place their tower and transmitters in the midst of a residential area? If not, then why not?

The Triangle Mountain radio site was originally developed for broadcasting service in 1964. At that time, the area was rural in nature. Since then, residential development has moved closer and closer to the site.

In 2000, the existing tower was rebuilt to meet current standards and an additional 48-metre tower was added to the site. Due to allegations of error in procedure, Industry Canada reviewed the process, followed by the proponent, and found no significant issues. Then, due to concerns raised by the City of Colwood, Industry Canada commissioned a third party review which found that the department did not depart in any material way from its established antenna siting procedures. The third party review can be found at <http://www.ic.gc.ca/antenna>. It also confirms that the use of this site for radiocommunication purposes preceded residential development.

Subsequent to this independent review, the City of Colwood was advised that it may identify alternate locations for the towers. However, the decision to relocate rests with the broadcasters. To date, the broadcasters have not agreed that there is an alternative site that is equal to their existing one at Triangle Mountain. While Industry Canada has committed to facilitate discussions between these parties, there is no

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justifiable reason for the department to provide funding to relocate facilities, given established process was followed.

Question 2: How many sites in Canada have more than two transmitter sites on them?

Publicly available licence information is available on Industry Canada's Spectrum Direct website at <https://sd.ic.gc.ca>. This website is updated daily to provide the most current information. One of the features of the website is a geographic search feature that permits search radii that can encompass all of Canada.

You may be able to obtain the answer to the question being asked via this database by defining what you consider to be a site, using the available data elements.

Question 3: How many letters, e-mails, phone calls, and other communications has Industry Canada and Health Canada received each year during the last 5 years from the public concerning electromagnetic radiation, transmission towers of all sorts, and transmitters of all sorts?

Industry Canada complies with pertinent legislation and policies regarding archiving of public records. However, this does not require Industry Canada to maintain records of all letters, e-mails, phone calls and other communications.

Question 4: How often have the field strengths of the transmitters been monitored over the last 5 years?

Question 5: How many reports of breaches of emission guidelines have been reported over the last 5 years?

Question 6: How many random tests (tests that have been conducted without warning the broadcasters in advance) have been carried out over the last 5 years?

Question 7: How many non-random tests have been carried out over the last 5 years?

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Question 8: Given that the “modelling” approach Industry Canada allows the broadcasters to use has proven to be inaccurate on Triangle Mountain, how is Industry Canada ensuring that emission levels at other sites, especially where there are antenna farms, are within Safety Code 6 guidelines?

Question 9: Are there consequences to broadcasters found guilty of excessive field strength? If so, what are they? If not, then why not?

Industry Canada's Spectrum Management monitors and inspects various technical aspects of transmitters on an ongoing basis as part of the regulatory function it performs. Where non-compliance is identified, Industry Canada ensures mitigation measures are taken, commensurate with the risk associated with the discrepancy, and immediate action is taken on discrepancies that pose a high risk.

There are approximately 2,500 regular power and another 2,500 low power AM, FM and TV broadcasting transmitters in Canada. In addition to the above monitoring and inspection, Industry Canada carries out an ongoing program that ensures compliance with Health Canada's Safety Code 6 guidelines for the protection of the general public. Industry Canada sets priorities through the use of software to predict emitted levels, coupled with field knowledge of departmental spectrum management officers, in order to anticipate which sites have the potential to exceed the exposure limits set in Safety Code 6.

Then, where warranted, measurements are carried out to confirm that the public is protected. Over the past several years, Industry Canada has required that remedial action be taken on approximately 20 sites. This included actions such as requiring the installation of fences, warning signs and making antenna tower modifications in order to ensure ongoing public protection.

Question 10: Will Industry Canada immediately undertake random (e.g., with no advance notice to the broadcasters) testing of the field strength of the transmitters on Triangle Mountain?

Question 11: Will Industry Canada immediately, during that random test, determine total exposure levels from all transmitters in the area?

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Monitoring of the signal levels from the stations on Triangle Mountain were conducted before and after the July 30, 2008 scheduled field strength measurements for Safety Code 6 compliance. Additionally, unannounced field strength measurements were conducted on August 13, 2008, to verify ongoing Safety Code 6 compliance. The results were similar to the July 30 measurements.

Industry Canada uses a Safety Code 6 measurement compliance instrument that automatically combines all the emissions within the device's operating bandwidth, from 100 kHz to 3 GHz, in order to determine total exposure levels. For all the testing undertaken during 2008 at Triangle Mountain, Industry Canada considered total exposure levels.

Question 12: If these random tests indicate excessive exposure levels at any location, will Industry Canada force the immediate removal of offending transmitters from this residential neighbourhood?

If at any time Industry Canada were to determine that Safety Code 6 was not being respected, then the department would take immediate action commensurate with public risk, including administrative or legal action, in order to remedy the situation. As there are many options available in order to bring an installation into compliance, complete removal of transmitters is unlikely to be required.

Question 13: On July 19, an article appeared in *The Times Columnist*, our Greater Victoria newspaper, which featured Mayor Twa of Colwood castigating Industry Canada and Health Canada for the high transmission levels we are subject to. The very same day my wife and I monitored the transmission levels on Triangle Mountain and found them to be 400 percent lower than they had been for the previous two weeks. If Industry Canada should monitor the FM transmitters, how will it ensure that the broadcasters do not immediately lower their broadcasting levels for the period of the testing?

Question 14: Industry Canada has stated (Gary Paugh, July 8, 2008) that it would have no reason to warn the broadcasters on Triangle Mountain that Industry Canada was about to monitor them (thus allow them to temporarily lower their transmitting power). But since it is

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Industry Canada's policy to random monitor only if there is a demonstrated need to do so and the need to do so, of course, can only been shown by random monitoring, a high reading would prove that Industry Canada was quite remiss in fulfilling its responsibility and, therefore, would have good reason to warn the broadcasters. How can Industry Canada assure the public that any monitoring it does it without prior notification of the broadcasters?

Industry Canada's past measurements to confirm Safety Code 6 compliance at Triangle Mountain, both announced and unannounced, have confirmed compliance with the Safety Code 6 limits in publicly accessible areas.

Operators are required by Industry Canada to ensure that all radiocommunication and broadcasting installations comply with Safety Code 6 at all times, including the consideration of combined effects of nearby installations within the local radio environment. An apparent reduction of transmission levels by 400 percent would not compromise the requirement to meet the levels set out in Safety Code 6.

Industry Canada monitors radio frequency emissions in order to ensure compliance with the radio frequency spectrum management program, including reasons other than Safety Code 6 compliance.

There are many purposes for monitoring a frequency or frequency band, one of which is to check the reliability of information provided to a Spectrum Management officer. Signal level monitoring conducted on the FM transmitter frequencies at Triangle Mountain fell into this category. Some of the results are noted in the 2008 report containing the Safety Code 6 measurements.

Industry Canada's Spectrum Management representatives are public officers who take their duties regarding compliance seriously, and carry out their duties in a competent and professional manner. Advising the operator of a facility in the instance described would not serve any compliance purpose except where arrangements were required for access to the facility.

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Question 19: On what basis does Industry Canada contend, as it does in its policy documents, that it is not responsible for, nor will it discuss, loss of property value or impairment of health due to transmitters?

Question 20: On what basis is Industry Canada not responsible, as it contends in its policy documents, for loss of property value or impairment of health when it is the failure of Industry Canada to adequately monitor the emission levels that contribute to that loss and impairment?

In March 2003, the department selected Professor David A. Townsend of the University of New Brunswick to lead the National Antenna Tower Policy Review with the support and assistance of the National Antenna Tower Review Committee. This committee included industry, academic and health experts, as well as municipal officials. With consideration of many of the recommendations of the National Antenna Tower Policy Review, Industry Canada's updated antenna siting procedures came into effect as of January 1, 2008.

Professor Townsend's report provided answers and recommendations on the question of "What evidence exists that property values are impacted by the installation of an antenna tower?" Professor Townsend's recommendation was that the impact—positive or negative—that a proposed antenna installation may have upon the property values of particular parcels of land should not be the subject of an antenna consultation.

Health Canada has established safety guidelines for exposure to radio frequency fields in its Safety Code 6 publication entitled *Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz*.

Health Canada has broad responsibilities for protecting the health of Canadians, and acts as the principal health advisor to Industry Canada on protecting the public from potential health effects from exposure to radiofrequency fields. While the responsibility for developing Safety Code 6 rests with Health Canada, Industry Canada has adopted this guideline for the purpose of protecting the general public. Through its

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procedures, Industry Canada makes compliance with Safety Code 6 an ongoing obligation. At any time, antenna system operators may be required, as directed by Industry Canada, to demonstrate compliance with Safety Code 6 by (i) providing detailed calculations, and/or (ii) conducting site surveys and, where necessary, by implementing corrective measures.

Question 21: Will Industry Canada make available its test equipment to its citizens, at no cost, provided they have a qualified expert to use it? If the answer is no, then please provide the rationale behind it.

Question 22: If the answer to #21 is yes, will Industry Canada allow an independent source to determine whether the expert the citizens have chosen is, indeed, qualified? If the answer is no, then please provide the rationale behind it.

Industry Canada has, on occasion, made its staff and equipment available to carry out measurements to ensure that the limits set in Safety Code 6 are being respected. For example, in 2001, Industry Canada's radiocommunication engineering and technical staff took measurements to ensure that the Safety Code 6 public exposure limits were being respected at Triangle Mountain. Measurements were taken in local residents' backyards, front yards, and within homes. Industry Canada's experts were accompanied by a representative of the Colwood Triangle Mountain Citizens' Committee, who provided input on where measurements should be taken. Using calibrated professional equipment, the same type used by other regulatory agencies, and employing standard measurement methods consistent with good engineering practice, Industry Canada's measurements consistently concluded that the Safety Code 6 limit for general public exposure was being respected at the measurement locations.

As warranted, Industry Canada will work with local citizens and make departmental technical staff and test equipment available to ensure the limits set in Safety Code 6 are being respected. However, Industry Canada is not prepared to make its equipment available to the public as its care and safekeeping are the responsibility of Industry Canada.

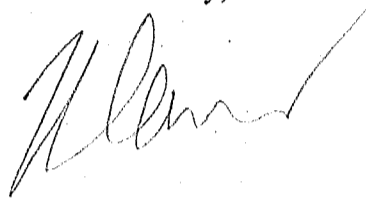
Question 23: If it is Industry Canada's responsibility to police the broadcasting industry, who is it that polices the "Police"?

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Industry Canada is a department established by the Government of Canada under the *Department of Industry Act*. Accordingly, it reports to the Parliament of Canada through the Minister of Industry.

I appreciated this opportunity to respond to your petition, and trust this information is of assistance.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Tony Clement', written in a cursive style.

Tony Clement

c.c. Mr. Scott Vaughan
Commissioner of the Environment
and Sustainable Development

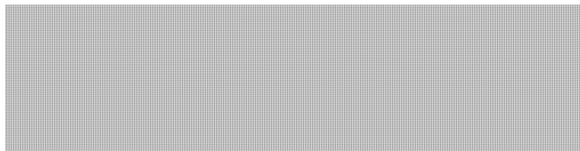
Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

NOV 05 2008



Dear 

This is in response to your environmental petition no. 255 of June 22, 2008, addressed to Mr. Scott Vaughan, the Commissioner of the Environment and Sustainable Development (CESD).

In your petition you raised concerns about the effects of electromagnetic radiation.

I am pleased to provide you with the enclosed joint Health Canada and Public Health Agency of Canada response to your petition. I understand that the Minister of Industry will be responding separately to the questions that fall within the purview of his department.

I appreciate your interest in this important matter, and I hope that you will find this information useful.

Yours sincerely,

Leona Aglukkaq

Enclosure

c.c. Mr. Scott Vaughan, CESD
The Honourable Tony Clement, P.C., M.P.

Canada

Response to Environmental Petition No. 255
filed by [REDACTED]
under Section 22 of the *Auditor General Act*
Received July 9, 2008

Effects of Electromagnetic Radiation (EMR)

November 6, 2008

**Minister of Health and the Minister for the Federal Economic
Development Initiative for Northern Ontario**

1. *How can Health Canada rationalize using research that is influenced to such a degree by people who rely upon industry funding?*
5. *Do Industry Canada and Health Canada adhere to the rule that the authors, whatever their affiliation, of all studies that Industry Canada or Health Canada depend on to support their position on EMR, must clearly be seen to be independent, and must be willing to declare that they have no financial interests in the outcome of their studies and that they receive no industry funding, whether directly or indirectly, in carrying out their studies?*
7. *How does Health Canada refute the perception that it is unduly supportive of telecommunication companies because of its dependence upon researchers that have ties to that industry?*
9. *Since the researchers appear to be so closely associated with industry that has a direct interest in the results of their research, why should we not assume that those results are biased in its favour?*
10. *How does Health Canada refute the perception that it discounts credible peer-reviewed scientific studies that are not industry funded and favours studies that are industry funded?*
11. *How does HC refute the perception that just as the multibillion dollar asbestos and tobacco industries were able to persuade government overseers to ignore credible evidence harmful to the bottom line of those industries, the multibillion dollar telecommunications industry is not persuading Health Canada to ignore credible evidence that is harmful to the bottom line of that industry?*
12. *How does Health Canada explain why each of these non-industry funded studies is not considered relevant or credible by experts at HC or the Royal Society?*

Answer to Questions 1, 5, 7, 9, 10, 11 & 12:

Health Canada's Safety Code 6 sets out safety requirements for the installation and use of radiofrequency (RF) and microwave devices that operate in the frequency range from 3 kHz to 300 GHz. It is based on internal scientific reviews of original relevant scientific studies that are published in internationally recognized peer-reviewed journals. For further information, please refer to <http://www.hc-sc.gc.ca/ewh-smmt/pubs/radiation/99ehd-dhm237/index-eng.php>.

All credible peer-reviewed scientific studies are included in Health Canada's weight-of-evidence approach. Each study is evaluated individually for its scientific quality, the important factors being proper scientific design and analysis. The fact that some studies are either directly or indirectly funded, in whole or in part, from the wireless industry or any other sources does not constitute a valid reason to dismiss these research findings outright. The only scientifically justifiable approach is to evaluate the science in each study based upon its merits and deficiencies and then roll up the analysis using a weight-of-evidence approach.

Health Canada conducts its own analysis of the scientific literature in a completely independent fashion. All research, review and surveillance activities in the area of bioelectromagnetics health risk assessment by Health Canada have been solely funded by the Government of Canada. Health Canada is not dependent on any external parties for its risk assessment of the safety of RF fields.

Health Canada cannot control such perceptions about the adequacy of the scientific process used to evaluate scientific studies. We endeavour to maintain an open and fair environment for scientific discourse and respond to any questions regarding the evaluation process.

2. *Who in Health Canada is responsible for vetting researchers and the peer-reviewed research used to confirm that Safety Code 6 is safe?*

Safety Code 6 was written by a team of scientists at Health Canada as stated in the document. The proposed guidelines were reviewed by a number of internal and external referees, including the Royal Society of Canada's (RSC) Expert Panel on Radiofrequency Fields. It is important to point out that the health effects literature reviewed by Health Canada staff is the same as that reviewed by all other national and international standards organizations. The safety limits outlined in Safety Code 6 are consistent with other international science-based exposure limits.

3. *Are Health Canada and Industry Canada employees required to sign conflict of interest statements that declare they have no affiliation with any organization that may bring into question the impartiality of their work?*
4. *Are scientists conducting research for Health Canada and Industry Canada required to sign conflict of interest statements that declare they have no affiliation with any organization, nor do they accept, directly or indirectly, funding from any source that could be perceived in any way to cast doubt on the objectivity of their work?*

Answer to Questions 3 & 4:

Health Canada staff adhere to the *Values and Ethics Code for the Public Service* and make declarations of conflict of interest as required. All work performed by Health Canada staff in this area has been entirely funded by the Government of Canada.

6. *When at least half of the members of the "expert panel" have direct or indirect associations with the telecommunication industry, why should the public believe that the recommendations of these people are not influenced by industry?*

The RSC is a highly reputable organization which is composed of esteemed scientists. Health Canada contracted with the RSC to independently select an expert panel to review Safety Code 6 and the scientific basis for its exposure limits for the protection of the public from RF fields. While Health Canada wrote the terms of reference for the tasks of the Expert Panel, the selection of Panel members was done entirely by the RSC and Health Canada had no part in the research, review and development of the conclusions and recommendations presented by the panel.

8. *Since WHO accepts funding from the wireless industry, why should credence be given to studies that WHO sponsors?*

The World Health Organization (WHO) is a highly reputable international science-based organization which is composed of a diverse set of esteemed scientists from around the world in a variety of disciplines.

The fundamental purpose of the WHO EMF project is to advise and assist national health authorities to develop protection measures for their populations from exposure to electromagnetic fields. This is especially valuable for smaller countries lacking the scientific infrastructure to undertake their own reviews and develop guidelines. Countries are not obligated to accept the recommendations of the WHO and are free to formulate their own protective measures. This is the case in Canada, where Safety Code 6 was one of the first national exposure guidelines developed and continues to be supported by the scientific community.

The WHO EMF project receives funding from many national health authorities and private industry. However, the WHO EMF project does not fund research studies, but rather reviews the literature and identifies knowledge gaps which require further research.

14. *How much has Health Canada spent for independent, non-industry funded research annually during the last 5 years?*

Research in the field of bioelectromagnetics conducted by Health Canada scientists is solely funded by the Government of Canada. Since 2003, Health Canada has spent a total of approximately \$500,000 plus approximately 15 person-years of staff time on EMF research, evaluation, survey and surveillance activities.

15. *Will Health Canada justify the current exposure standards of SC6, which are at levels to protect the public only against short term gross heating effects, as per ICNIRP?*

Health Canada's Safety Code 6 takes into account all possible biological and/or health effects of RF fields, including short-term heating effects, non-thermal effects and/or long-term effects. It should also be pointed out that the exposure standards of Safety Code 6 are applicable for continuous, uninterrupted exposure (24 hours per day, 7 days per week) and not only for short-term or intermittent exposure.

16. *Will Health Canada and Industry Canada amend its public documents to reflect the fact that Canada's standard is not consistent with most other developed countries and to instruct its researchers to stop telling the public that Canada's standards are among the most stringent in the world?*

17. *Health Canada and Industry Canada do not follow the stricter safety codes of most of Europe but rather the much more lax safety codes of the U.S.. To what degree is this because Health Canada and Industry Canada have been unduly influenced by the powerful North American telecommunication industry?*

Answer to Questions 16 & 17:

The basic restrictions outlined in Health Canada's Safety Code 6 guideline are similar to both the Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz (IEEE C95.1) and International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines, adopted by most Western European nations and the United States. The Guidelines can be found at the following links:

<http://www.icnirp.net/documents/emfgdl.pdf>, and

http://standards.ieee.org/reading/ieee/std_public/description/emc/C95.1-1991_desc.html.

Health Canada's Safety Code 6, however, is more restrictive in terms of compliance. It requires Specific Absorption Rates (SAR) evaluations to be conducted using an averaging volume of 1 g of tissue, whereas a 10 g volume is used for both IEEE C95.1 and ICNIRP guidelines. This means greater accuracy with Safety Code 6.

As described above, Health Canada's recommendations regarding safety of exposure to RF fields have not been influenced by the telecommunications industry in any way.

18. *Why do Health Canada and Industry Canada require that the risk be established before the precautionary principle is applied when the essential point of the Precautionary Principle is to provide protection in the absence of full scientific certainty?*
19. *Given the risk involved and the growing body of credible scientific evidence indicating serious harm from non-thermal levels of RF, will Health Canada follow the lead of other Federal Departments (eg. Environment Canada), and implement the original Wingspread Statement of the Precautionary Principle in place of the current risk assessment method of determining the exposure level for the general public?*
20. *Until and unless the precautionary principle is implemented as intended, would Health Canada and Industry Canada amend their public statements so as to eliminate the possibility of confusing the public about the fact that they are employing risk management, not the precautionary principle?*
21. *Have Industry Canada and Health Canada changed the label of their risk assessment approach (which emphasizes cost) to the "Precautionary Principle" (which emphasizes safety) in an attempt to co-opt the positive public opinion of the Precautionary Principle without having to change the focus of their approach?*
25. *If Health Canada applied the Precautionary Principle as Environment Canada defines it, new technology would be withheld from public use until it is demonstrated to be safe. Since to Health Canada the Precautionary Principle is really a synonym for industry's Risk Assessment, are there any tests that new technology must undergo before it is approved for public use?*

Answer to Questions 18, 19, 20, 21, & 25:

Health Canada endorses the precautionary principle and its approach to decision making can be found online at <http://www.hc-sc.gc.ca/sr-sr/advice-avis/decision/index-eng.php>.

Health Canada's position and public statements are consistent with the Precautionary Principle. If the guidelines in Safety Code 6 are respected, then there is no convincing scientific evidence to expect any adverse human health effects.

22. *Why does Health Canada hold, as stated by Dr. McNamee, that the danger associated with RF must be proven before action is taken, rather than taking the stance, recommended by the Wingspread Conference and Environment Canada, of making the proponent of the product (eg. the telecommunication industry) prove that RF exposure is safe? If it is not possible to prove its safety, as Dr. McNamee states, then how does Health Canada justify imposing a potentially unsafe product on the Canadian public?*

Health Canada staff do not advocate that the dangers associated with RF must be proven before action is taken. If the guidelines in Safety Code 6 are respected, Health Canada's position is that there is no convincing scientific evidence to expect any adverse human health effects. Health Canada does not impose, regulate, license or monitor the compliance of wireless technologies in Canada. These activities are responsibilities of the Department of Industry.

23. *How does Health Canada recommend utilizing its avoidance approach by those living next to or under transmission towers 24 hours a day for years on end?*
28. *If Health Canada continuously monitors all relevant scientific information, as they profess, how can it justify having allowed the corporations to install these dangerous transmitters among my neighbours on Triangle Mountain?*
29. *Given that many people living in close proximity to these are suffering serious diseases which are consistent with those attributable to chronic exposure to radiation from FM transmitters, what will Health Canada do to enforce the removal of these transmitters to non-residential areas?*
30. *Given that these FM transmitters are in close proximity to and directed toward schools, and given that children are more susceptible to radiation danger, how will Health Canada and Industry Canada respond to concern from parents about their children's health?*
31. *Will Health Canada advocate/support the placing of warning signs within 200 meters of the transmitter sites with the wording?*

WARNING! YOU ARE ENTERING AN AREA OF HIGH ELECTROMAGNETIC RADIATION EMISSIONS. USE OF WIRELESS EQUIPMENT, INCLUDING CELL PHONES, WITHIN A RADIUS OF 200 METERS OF THESE TRANSMITTERS IS TO BE AVOIDED.

35. *With the knowledge that "the effective radiated power from FM/TV/DAB broadcasting installations can often be quite high", why has Health Canada allowed, and continues to allow, installations of these transmitters near homes and schools which are at or near the same elevation of the transmitters? Please justify this practice.*

37. *Upon what scientific evidence does Health Canada base its decision to force proliferation of these antenna farms near residences and schools?*

Answer to Questions 23, 28, 29, 30, 31, 35, & 37:

Health Canada is not responsible for siting, licensing or compliance of wireless transmitters. Those activities are the responsibility of Industry Canada.

It is Health Canada's scientific position that there are no anticipated adverse health effects associated with short-term or long-term exposure of the general public to RF fields, provided that exposure levels are below the limits outlined in Safety Code 6.

It is Health Canada's opinion that there is no scientific justification for such a warning. However, it is the responsibility of Industry Canada to determine whether warning signs are warranted.

24. *Why is it Health Canada's policy that, contrary to the industry standard whereby a new product must be shown to be safe before it is introduced to the public, in the case of cell phones and FM transmitters, they are first introduced to the public and then it becomes the public's obligation to prove them to be unsafe?*

In the case of cellular technology, exposure guidelines existed (1979 in Canada) well before the introduction of the technology (about the late 1980's in Canada). A large body of scientific research also existed before the introduction of the technology, much of which looked at the possibility of non-thermal effects. Health Canada does not promote, regulate, license or monitor the compliance of wireless and broadcast technologies in Canada. These activities are the responsibilities of the Department of Industry. There is no convincing scientific evidence that exposure to RF fields at levels below the limits outlined in Safety Code 6 cause any adverse health effects.

26. *What research has Health Canada done to determine the current and future costs to our health care system of EMR?*

Health Canada has not assessed the possible costs to the health care system from exposure to electromagnetic radiations (EMR) since there is no convincing scientific evidence of adverse health effects as long as the exposure limits outlined in Safety code 6 are respected.

27. *What level of harm will prompt Health Canada to revise its Safety Code 6 guideline to a lower biologically-based but, perhaps, more costly level? Please give examples.*

Any credible, independently replicated and consistent adverse health effect that is demonstrated to arise from RF field exposures below the limits outlined in Safety Code 6 would prompt Health Canada to revise its exposure limits.

39. *Please define "general public" as the term is used in Safety Code 6.*

The term "general public" is defined in Safety Code 6 (Appendix VIII, Definitions, page 67) as follows: "All persons not employed as RF and microwave exposed workers or those not working in controlled environments (areas). They include pregnant women, the aged, children, the chronically ill and disabled". For more information, please refer to the following link: <http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/99ehd-dhm237/index-eng.php>.

40. *If, as according to ICNIRP, levels allowed by Safety Code 6 apply to short-term acute exposure, why are there no biologically (health)-based standards which apply to chronic, long-term exposures for people who are living with the transmitters 24 hours a day, 365 days a year?*

Health Canada's Safety Code 6 takes into account all possible biological and/or health effects of RF fields, including short-term heating effects, non-thermal effects and/or long-term effects.

43. *Would Health Canada commit to an independent epidemiological study done to determine the health status of people on Triangle Mountain?*

Conclusions from a WHO expert workshop, published in 2007, state that public exposures to permissible RF levels from mobile telephone and base stations are not likely to adversely affect human health. Based on current evidence of health effects, the Public Health Agency of Canada has no plans to carry out an independent epidemiological study in Triangle Mountain.

44. *Would Health Canada commit to an immediate and independent investigation into the dangers posed by antenna farms and, should these show harm, would it commit to establishing biologically (health)-based exposure standards?*

It is Health Canada's scientific position that no adverse health effects associated with exposure of the general public to RF fields are anticipated, provided that exposure levels are below the limits outlined in Safety Code 6. Nevertheless, should any credible, independently replicated and consistent adverse health effect be demonstrated at RF field exposures below the limits outlined in Safety Code 6, Health Canada would initiate a revision of its exposure limits. Ensuring that human exposures do not exceed the human exposure limits outlined in Health Canada's Safety Code 6 near antennas and/or antenna farms is the responsibility of Industry Canada.

45. *Considering the improper procedures and equipment used in the 2001 testing for EMR on Triangle Mountain, why should the residents of Colwood have any confidence in Health Canada's and Industry Canada's assurances that they are safe since the actions of their employees left them in no position to offer an opinion?*

Health Canada had no involvement in the testing of EMR on Triangle Mountain. Compliance of wireless transmitters is the responsibility of Industry Canada.

46. *Given the lack of concern for the public demonstrated by their employees at every level, why should the citizens of Canada have confidence in anything Health Canada or Industry Canada says or does?*

Health Canada is the federal department responsible for helping Canadians maintain and improve their health. This is a responsibility that all staff at Health Canada, including those involved in the health risk assessment of EMF, take seriously.

Health Canada conducts its own analysis of the scientific literature on EMF in a completely independent fashion. All research, review and surveillance activities in the area of bioelectromagnetics health risk assessment by Health Canada have been solely funded by the Government of Canada. Health Canada is not dependent on any external parties for its risk assessment of the safety of RF fields.

It is Health Canada's scientific position that no adverse health effects associated with exposure of the general public to RF fields are anticipated, provided that exposure levels are below the limits outlined in Safety Code 6.

***Environmental Petition submitted to the
Auditor General of Canada July 21, 2008***

***Request to remove transmission towers from
Triangle Mountain, Colwood, British Columbia***

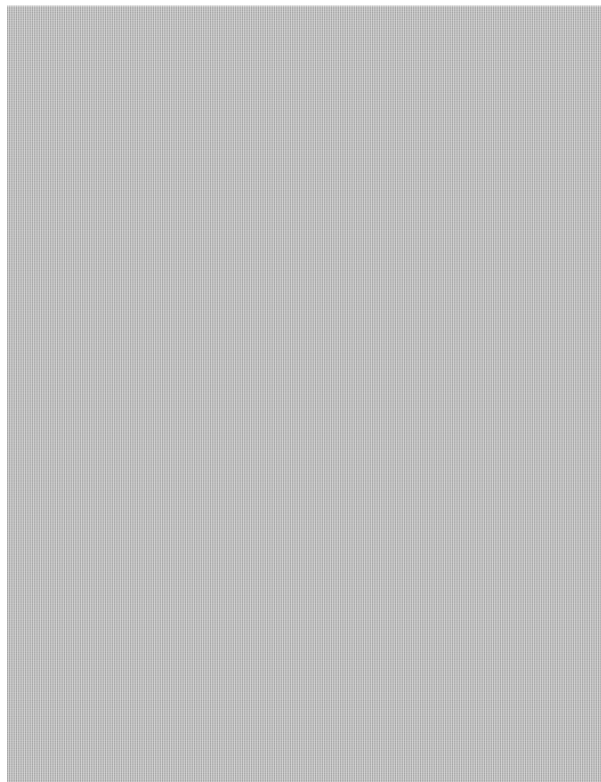
Names of Petitioners

Address of Petitioners

Telephone Number

Email Address

Signatures



Date

July 21, 2008



Environmental Petition to the Auditor General

Request that transmission towers be removed from Triangle Mountain, Colwood, British Columbia.

July 21, 2008

On June 25, 2008, Dr. Magda Havas, a respected scientist from Trent University, conducted a survey of our neighbourhood. She discovered that the electromagnetic radiation coming from the FM towers on Triangle Mountain reached an extremely high level. How long they had been at this level we can only guess because no monitoring has been done by Industry Canada.

It is not enough to be aghast at the loose EMR standards that Canada has in relation to much of the civilized world, at the inept and, quite possibly, collusive testing that was done here in 2001 by Industry Canada that yielded a suspicious 114 microwatts per square centimeter (114uW/cm²). But when Dr. Havas's test at our home yielded an astounding 455 uW/cm², it appears to us that Health Canada and Industry Canada are out of control. The cavalier attitude at these two departments about the danger they put us in as well as the rest of the residents of Triangle Mountain is positively incomprehensible.

Let me put this in perspective. The BioInitiative Report, a collection of 2000 peer-reviewed, non-wireless industry funded, world class scientific studies, recommends a precautionary limit of .01 uW/cm². That means, right at this moment while sitting in our home, we are being exposed to EMR at levels 45,500 times higher than the Report recommends.

Are we worried? Of, course.

Do we think that the people who allowed this, who supported this, who engineered this, deserve to have their fingers rapped? It has crossed our minds. Termination of employment should be the least of their problems.

Do we think that the residents of Triangle Mountain should pay the \$3,000,000 fee that the broadcasters are demanding from us in return for moving their towers to a non-residential site that their engineers have already deemed acceptable and, in some ways, superior to the current site (in letters between David Emerson, former Minister of Industry, Jody Twa, Mayor of Colwood, and Gary Paugh, Industry Canada, 2005)? If we had the money, we'd pay them off.

Gladly. Any suggestions as to where we might find the money would be greatly appreciated.

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QUESTIONS:

1. Do Industry Canada and Health Canada not consider it appropriate that they pay the \$3,000,000 fee that the broadcasters are demanding to move their transmission towers from Triangle Mountain to a non-residential site that their engineers have already deemed acceptable and, in some ways, superior to the current site since it was Industry Canada and Health Canada that allowed the broadcasters to place their towers and transmitters in the midst of a residential area? If not, why not?
2. How many sites in Canada have more than two transmitters on them?
3. How many letters, emails, phone calls, and other communications has Industry Canada and Health Canada received each year during the last 5 years from the public concerning electromagnetic radiation, transmission towers of all sorts, and transmitters of all sorts?
4. How often have the field strengths of the transmitters been monitored over the last 5 years?
5. How many reports of breaches of emission guidelines have been reported over the last 5 years?
6. How many random tests (tests that have been conducted without warning the broadcasters in advance) have been carried out over the last 5 years?
7. How many non-random tests have been carried out over the last 5 years?
8. Given that the "modeling" approach Industry Canada allows the broadcasters to use has proven to be inaccurate on Triangle Mountain, how is Industry Canada ensuring that emission levels at other sites, especially where there are antenna farms, are within Safety Code 6 guidelines?
9. Are there consequences to broadcasters found guilty of excessive field strength? If so, what are they? If not, why not?
10. Will Industry Canada immediately undertake random (eg. with no advance notice to the broadcasters) testing of the field strength of the transmitters on Triangle Mountain?
11. Will Industry Canada immediately, during that random test, determine total exposure levels from all of the many transmitters in the area?

12. If these random tests indicate excessive exposure levels at any location, will Industry Canada force immediate removal of the offending transmitters from this residential neighbourhood?

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13. On July 19, an article appeared in The Times Colonist, our Greater Victoria newspaper, which featured Mayor Twa of Colwood castigating Industry Canada and Health Canada for the high transmission levels we are subjected to. The very same day my wife and I monitored the transmission levels on Triangle Mountain and found them to be 400% lower than they had been for the previous 2 weeks. If Industry Canada should monitor the FM transmitters, how will it ensure that the broadcasters do not immediately lower their broadcasting levels for the period of the testing?

14. Industry Canada has stated (Gary Paugh, Victoria, July 8, 2008) that it would have no reason to warn the broadcasters on Triangle Mountain that Industry Canada was about to monitor them (thus allowing them to temporarily lower their transmitting power). But since it is Industry Canada's policy to random monitor only if there is a demonstrated need to do so and the need to do so, of course, can only be shown by random monitoring, a high reading would prove that Industry Canada was quite remiss in fulfilling its responsibility and, therefore, would have good reason to warn the broadcasters. How can Industry Canada assure the public that any monitoring it does is without prior notification of the broadcasters?

15. What studies can Health Canada cite that demonstrates that time-weighted averaging of EMR is a more accurate and effective indicator of possible radiation harm than a reading of the peaks?

16. If Health Canada cannot provide conclusive proof that the time-weighted average of EMR is a more accurate and effective indicator of possible radiation harm than a reading of the peaks, please justify advocating it instead of measuring the peaks.

17. What studies can Health Canada cite that demonstrate that living in the actual shadow of cell phone and FM transmission towers is safe?

18. If Health Canada cannot provide conclusive proof that living in the actual shadow of cell phone and FM transmission towers is safe, please justify allowing residents to be put in possible jeopardy.

19. On what basis does Industry Canada contend, as it does in its policy documents, that it is not responsible for, nor will it discuss, loss of property value or impairment of health due to transmitters?

20. On what basis is Industry Canada not responsible, as it contends in its policy documents, for loss of property value or impairment of health when it is the failure of Industry Canada to

adequately monitor the emission levels that contribute to that loss and impairment?

21. Will Industry Canada make available its test equipment to its citizens, at no cost, provided

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they have a qualified expert to use it? If the answer is no, please provide the rationale behind it.

22. If the answer to #21 is yes, will Industry Canada allow an independent source to determine whether the expert the citizens have chosen is, indeed, qualified? If the answer is no, please provide the rationale behind it.

23. If it is Industry Canada's responsibility to police the broadcasting industry, who is it that polices the "Police"?

24. The Standards Council of Canada has a mandate "to benefit the health, safety and welfare of workers and the public..." If Health Canada is failing in its responsibility to protect the health and well being of the citizenry, can the Standards Council establish a service to provide those benefits? If no, please provide the rationale in support of this response.

25. Would the Standards Council see in Health Canada's close ties to the industry as documented in our petition #255 an indication that its objectivity has been compromised? If not, please explain?

26. Does the Standards Council feel that because industry is so imbedded with Health Canada and only a complete change in personnel will resolve the problem, that a new oversight service would be in order? If not, please explain.

27. Would the Standards Council take into consideration standards of safety with regard to electromagnetic radiation that are in effect in other countries, and are recommended by many credible scientists, but which have been disparaged and ignored by Health Canada? If no, please provide the rationale.

28. Will the Standards Council establish a new service that eschews wireless industry influence and relies strictly on science-based, peer-reviewed studies published in accredited scientific journals which have no industry funding? If no, please provide the rationale.

29. Would the Standards Council establish a new service made up of distinguished scientists without ties, direct or indirect, to industry and who will not benefit, directly or indirectly, from the results of their decisions? If no, please explain why not.

30. Under what conditions would the Standards Council provide funding for public input to aid this new service in fulfilling its obligations?

31. How does the Standards Council provide for public participation?

32. How is the public able to access funding in order to participate in the process?

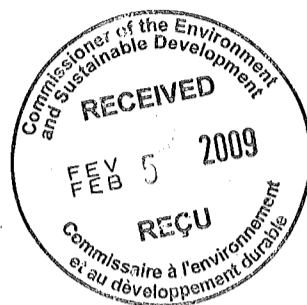
Minister of Industry



Ministre de l'Industrie

Ottawa, Canada K1A 0H5

29/1/09



Dear

I am writing to provide you with Industry Canada's response to two Environmental Petitions, No. 255, received June 25, 2008, regarding the effects of non-thermal electromagnetic radiation at Triangle Mountain, Colwood, British Columbia, and Environmental Petition No. 255-B, received July 21, 2008, requesting that transmission towers be removed from there. These petitions were forwarded to the Minister of Health and the Minister of Industry by the Commissioner of the Environment and Sustainable Development. I am pleased to respond to your questions that fall within Industry Canada's area of responsibility.

Environmental Petition No. 255

Question 3: Are Health Canada and Industry Canada employees required to sign conflict of interest statements that declare they have no affiliation with any organization that may bring into question the impartiality of their work?

Question 4: Are scientists conducting research for Health Canada and Industry Canada required to sign conflict of interest statements that declare they have no affiliation with any organization, nor do they accept, directly or indirectly, funding from any source that could be perceived in any way to cast doubt on the objectivity of their work?

Question 5: Do Industry Canada and Health Canada adhere to the rule that the authors, whatever their affiliation, of all studies that Industry Canada or Health Canada depend on to support their

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Canada

position on EMR, must clearly be seen to be independent, and must be willing to declare that they have no financial interests in the outcome of their studies and that they receive no industry funding, whether directly or indirectly, in carrying out their studies?

Question 13: How much has the telecommunications industry spent for research annually over the last 5 years?

Regarding the quantity of money spent by the telecommunications industry on research, Industry Canada does not maintain records of this nature.

Question 16: Will Health Canada and Industry Canada amend its public documents to reflect the fact that Canada's standard is not consistent with most other developed countries and to instruct its researchers to stop telling the public that Canada's standards are among the most stringent in the world?

Question 17: Health Canada and Industry Canada do not follow the stricter safety codes of most of Europe but rather the much more lax safety codes of the U.S. To what degree is this due to Health Canada and Industry Canada having been unduly influenced by the powerful North American telecommunication industry?

Question 18: Why do Health Canada and Industry Canada require that the risk be established before the precautionary principle is applied when the essential point of the Precautionary Principle is to provide protection in the absence of full scientific certainty?

Question 20: Until and unless the precautionary principle is implemented as intended, would Health Canada and Industry Canada amend their public statements so as to eliminate the possibility of confusing the public about the fact that they are employing risk management, not the precautionary principle?

Question 21: Have Industry Canada and Health Canada changed the label of their risk assessment approach (which emphasizes cost) to the

.../3

“Precautionary Principle” (which emphasizes safety) in an attempt to co-opt the positive public opinion of the Precautionary Principle without having to change the focus of their approach?

Question 30: Given that these FM transmitters are in close proximity to and directed toward schools, and given that children are more susceptible to radiation danger, how will Health Canada and Industry Canada respond to concerns from parents about their children’s health?

Health Canada has established safety guidelines for exposure to radiofrequency fields in its Safety Code 6 publication entitled *Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz*. To Industry Canada’s knowledge, Health Canada endorses the precautionary principle and its approach to decision making can be found on their website at <http://www.hc-sc.gc.ca/sr-sr/advice-avis/decision/index-eng.php>.

While the responsibility for developing Safety Code 6 rests with Health Canada, Industry Canada has adopted this guideline for the purpose of protecting the general public, which includes pregnant women, seniors, children, the chronically ill, and persons with disabilities. Industry Canada requires that all proponents and operators ensure that their radiocommunication and broadcasting installations comply with Safety Code 6 at all times. Proponents and operators must also consider the combined effects of nearby installations within the local radio environment.

Industry Canada independently chose to adopt Safety Code 6 for the protection of the general public. This decision was not taken due to influence by the telecommunication industry.

To Industry Canada’s knowledge, Health Canada’s Safety Code 6 takes into account all possible biological and/or health effects of radiofrequency fields, including short-term heating, non-thermal and/or long-term effects. Furthermore, it has been determined that there is no convincing scientific evidence that exposure to radiofrequency fields at levels below the limits outlined in Safety Code 6 cause any adverse health effects.

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Question 32: Who is responsible for establishing the parameters for technical analyses associated with multiples transmitters?

Question 34: How does Industry Canada ensure that the allowable limits for maximum values are never exceeded?

The technical aspects of radiocommunication, including the technical aspects of broadcasting, is under the responsibility of Industry Canada. It is the responsibility of proponents and operators of installations to ensure that all radiocommunication and broadcasting installations comply with Health Canada's Safety Code 6 at all times, including consideration of combined effects of nearby installations within the local radio environment.

Compliance with Safety Code 6 is an ongoing obligation. Antenna system operators may be required, as directed by Industry Canada at any time, to demonstrate compliance with Safety Code 6 by (i) providing detailed calculations, and/or (ii) conducting site surveys and, where necessary, by implementing corrective measures.

Question 33: Do these "theoretical calculations" take into consideration the fundamental properties of EM fields, namely reflection and compounding?

Industry Canada's internal tools that are used for assessing Safety Code 6 compliance take into account the fundamental properties of EM fields. Ground wave reflection of the electromagnetic waves, as well as the compounding of field strengths produced by all antenna systems, are taken into account when theoretical calculations are made to determine radio frequency (RF) exposure compliance. Numerous other electromagnetic properties of antennas, such as frequency, effective radiated power (ERP), antenna gain, antenna pattern, size of the antenna and antenna tilt, need to be accounted for during theoretical calculations, where appropriate and as required.

Question 36: Why is Industry Canada taking the approach of requiring the placement of multiple transmitters on towers?

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Is it, as I have been told by Mr. Jim Laursen of Industry Canada, because people see the towers and complain; they don't see the transmitters and don't complain?

Question 38: Under the new siting policy, CPC-2-0-03, no consultation is required for placement of new transmitters, only for new towers. Why was this presented to the public as an effort for more consultation between Industry Canada and the public when it really was intended to allow the creation of antenna farms with no consultation with or input by the public?

Procedures for the installation of new towers are set out in Industry Canada's Client Procedures Circular (CPC) 2-0-03, entitled *Installing Radiocommunication and Broadcasting Antenna Systems*, Issue 4, which replaces the former CPC-2-0-03, entitled *Environmental Process, Radiofrequency Fields and Land-Use Consultation*, Issue 3, June 24, 1995. In preparing its update to the procedures, the department studied the recommendations of both the Telecommunications Policy Review and the National Antenna Tower Policy Review. These reviews indicate that there are compelling social and economic reasons to support antenna tower and site sharing.

Industry Canada has incorporated many of the key recommendations of these two independent public reviews into the updated procedures, notably those relating to sharing and the exclusion from consultation for certain types of installations, while recognizing the requirement to balance the need for local input with the orderly development of radiocommunication in Canada. Local consultation regarding the installation of a new tower gives the public an opportunity to provide their input.

Question 41: Would Industry Canada provide the power level of each of the 55 transmitters within 2 kilometers of my home?

Publicly available licence information, including power levels, is available on Industry Canada's Spectrum Direct website at <https://sd.ic.gc.ca>, which is updated regularly and therefore provides the

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most current information. One of the features of the website is a geographic search feature that permits search radii that can encompass all of Canada.

Question 42: Does Industry Canada have a limit to the number of transmitters that will be added within this radius?

No, Industry Canada does not have a preset limit on the number of transmitters for a given geographic area. However, there are a number of technical issues that may limit the number of transmitters in a given location. For example, Industry Canada applies Health Canada's Safety Code 6 for the protection of the general public related to radiofrequency exposure. The field strength limits described in Safety Code 6, are not to be exceeded at any location accessible to the public.

Question 45: Considering the improper procedures and equipment used in the 2001 testing for EMR on Triangle Mountain, why should the residents of Colwood have any confidence in Health Canada's and Industry Canada's assurances that they are safe since the actions of their employees left them in no position to offer an opinion?

The department can assure the residents of Colwood that the employees who took measurements have proper training to work in the radio frequency discipline, have knowledge of electromagnetic field theory and followed proper engineering methods and practices. In 2001, the power density levels at Triangle Mountain were tested and Industry Canada staff found the levels to be in compliance with Safety Code 6 at all locations examined. The department has full confidence in the testing procedures and measurement equipment that were used to verify public Safety Code 6 compliance on Triangle Mountain in 2001 and, again, in 2008.

Question 46: Given the lack of concern for the public demonstrated by their employees at every level, why should the citizens of Canada have confidence in anything Health Canada or Industry Canada says or does?

Industry Canada employs competent and professional staff. Our employees are often called upon to find solutions for complex situations and, in doing so, may need to weigh competing interests with consideration of Industry Canada's official mandate.

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As can be expected in these types of complex situations, it may be necessary to make decisions that are not supported by the competing interests. Industry Canada employees would never knowingly place the health of the Canadian public at risk.

Environmental Petition No. 255-B

Question 1: Do Industry Canada and Health Canada not consider it appropriate that they pay the \$3-million fee that the broadcasters are demanding to move their transmission towers from Triangle Mountain to a non-residential site that their engineers have already deemed acceptable and, in some ways, superior to the current site since it was Industry Canada and Health Canada that allowed the broadcasters to place their tower and transmitters in the midst of a residential area? If not, then why not?

The Triangle Mountain radio site was originally developed for broadcasting service in 1964. At that time, the area was rural in nature. Since then, residential development has moved closer and closer to the site.

In 2000, the existing tower was rebuilt to meet current standards and an additional 48-metre tower was added to the site. Due to allegations of error in procedure, Industry Canada reviewed the process, followed by the proponent, and found no significant issues. Then, due to concerns raised by the City of Colwood, Industry Canada commissioned a third party review which found that the department did not depart in any material way from its established antenna siting procedures. The third party review can be found at <http://www.ic.gc.ca/antenna>. It also confirms that the use of this site for radiocommunication purposes preceded residential development.

Subsequent to this independent review, the City of Colwood was advised that it may identify alternate locations for the towers. However, the decision to relocate rests with the broadcasters. To date, the broadcasters have not agreed that there is an alternative site that is equal to their existing one at Triangle Mountain. While Industry Canada has committed to facilitate discussions between these parties, there is no

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justifiable reason for the department to provide funding to relocate facilities, given established process was followed.

Question 2: How many sites in Canada have more than two transmitter sites on them?

Publicly available licence information is available on Industry Canada's Spectrum Direct website at <https://sd.ic.gc.ca>. This website is updated daily to provide the most current information. One of the features of the website is a geographic search feature that permits search radii that can encompass all of Canada.

You may be able to obtain the answer to the question being asked via this database by defining what you consider to be a site, using the available data elements.

Question 3: How many letters, e-mails, phone calls, and other communications has Industry Canada and Health Canada received each year during the last 5 years from the public concerning electromagnetic radiation, transmission towers of all sorts, and transmitters of all sorts?

Industry Canada complies with pertinent legislation and policies regarding archiving of public records. However, this does not require Industry Canada to maintain records of all letters, e-mails, phone calls and other communications.

Question 4: How often have the field strengths of the transmitters been monitored over the last 5 years?

Question 5: How many reports of breaches of emission guidelines have been reported over the last 5 years?

Question 6: How many random tests (tests that have been conducted without warning the broadcasters in advance) have been carried out over the last 5 years?

Question 7: How many non-random tests have been carried out over the last 5 years?

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Question 8: Given that the “modelling” approach Industry Canada allows the broadcasters to use has proven to be inaccurate on Triangle Mountain, how is Industry Canada ensuring that emission levels at other sites, especially where there are antenna farms, are within Safety Code 6 guidelines?

Question 9: Are there consequences to broadcasters found guilty of excessive field strength? If so, what are they? If not, then why not?

Industry Canada's Spectrum Management monitors and inspects various technical aspects of transmitters on an ongoing basis as part of the regulatory function it performs. Where non-compliance is identified, Industry Canada ensures mitigation measures are taken, commensurate with the risk associated with the discrepancy, and immediate action is taken on discrepancies that pose a high risk.

There are approximately 2,500 regular power and another 2,500 low power AM, FM and TV broadcasting transmitters in Canada. In addition to the above monitoring and inspection, Industry Canada carries out an ongoing program that ensures compliance with Health Canada's Safety Code 6 guidelines for the protection of the general public. Industry Canada sets priorities through the use of software to predict emitted levels, coupled with field knowledge of departmental spectrum management officers, in order to anticipate which sites have the potential to exceed the exposure limits set in Safety Code 6.

Then, where warranted, measurements are carried out to confirm that the public is protected. Over the past several years, Industry Canada has required that remedial action be taken on approximately 20 sites. This included actions such as requiring the installation of fences, warning signs and making antenna tower modifications in order to ensure ongoing public protection.

Question 10: Will Industry Canada immediately undertake random (e.g., with no advance notice to the broadcasters) testing of the field strength of the transmitters on Triangle Mountain?

Question 11: Will Industry Canada immediately, during that random test, determine total exposure levels from all transmitters in the area?

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Monitoring of the signal levels from the stations on Triangle Mountain were conducted before and after the July 30, 2008 scheduled field strength measurements for Safety Code 6 compliance. Additionally, unannounced field strength measurements were conducted on August 13, 2008, to verify ongoing Safety Code 6 compliance. The results were similar to the July 30 measurements.

Industry Canada uses a Safety Code 6 measurement compliance instrument that automatically combines all the emissions within the device's operating bandwidth, from 100 kHz to 3 GHz, in order to determine total exposure levels. For all the testing undertaken during 2008 at Triangle Mountain, Industry Canada considered total exposure levels.

Question 12: If these random tests indicate excessive exposure levels at any location, will Industry Canada force the immediate removal of offending transmitters from this residential neighbourhood?

If at any time Industry Canada were to determine that Safety Code 6 was not being respected, then the department would take immediate action commensurate with public risk, including administrative or legal action, in order to remedy the situation. As there are many options available in order to bring an installation into compliance, complete removal of transmitters is unlikely to be required.

Question 13: On July 19, an article appeared in *The Times Columnist*, our Greater Victoria newspaper, which featured Mayor Twa of Colwood castigating Industry Canada and Health Canada for the high transmission levels we are subject to. The very same day my wife and I monitored the transmission levels on Triangle Mountain and found them to be 400 percent lower than they had been for the previous two weeks. If Industry Canada should monitor the FM transmitters, how will it ensure that the broadcasters do not immediately lower their broadcasting levels for the period of the testing?

Question 14: Industry Canada has stated (Gary Paugh, July 8, 2008) that it would have no reason to warn the broadcasters on Triangle Mountain that Industry Canada was about to monitor them (thus allow them to temporarily lower their transmitting power). But since it is

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Industry Canada's policy to random monitor only if there is a demonstrated need to do so and the need to do so, of course, can only be shown by random monitoring, a high reading would prove that Industry Canada was quite remiss in fulfilling its responsibility and, therefore, would have good reason to warn the broadcasters. How can Industry Canada assure the public that any monitoring it does it without prior notification of the broadcasters?

Industry Canada's past measurements to confirm Safety Code 6 compliance at Triangle Mountain, both announced and unannounced, have confirmed compliance with the Safety Code 6 limits in publicly accessible areas.

Operators are required by Industry Canada to ensure that all radiocommunication and broadcasting installations comply with Safety Code 6 at all times, including the consideration of combined effects of nearby installations within the local radio environment. An apparent reduction of transmission levels by 400 percent would not compromise the requirement to meet the levels set out in Safety Code 6.

Industry Canada monitors radio frequency emissions in order to ensure compliance with the radio frequency spectrum management program, including reasons other than Safety Code 6 compliance.

There are many purposes for monitoring a frequency or frequency band, one of which is to check the reliability of information provided to a Spectrum Management officer. Signal level monitoring conducted on the FM transmitter frequencies at Triangle Mountain fell into this category. Some of the results are noted in the 2008 report containing the Safety Code 6 measurements.

Industry Canada's Spectrum Management representatives are public officers who take their duties regarding compliance seriously, and carry out their duties in a competent and professional manner. Advising the operator of a facility in the instance described would not serve any compliance purpose except where arrangements were required for access to the facility.

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Question 19: On what basis does Industry Canada contend, as it does in its policy documents, that it is not responsible for, nor will it discuss, loss of property value or impairment of health due to transmitters?

Question 20: On what basis is Industry Canada not responsible, as it contends in its policy documents, for loss of property value or impairment of health when it is the failure of Industry Canada to adequately monitor the emission levels that contribute to that loss and impairment?

In March 2003, the department selected Professor David A. Townsend of the University of New Brunswick to lead the National Antenna Tower Policy Review with the support and assistance of the National Antenna Tower Review Committee. This committee included industry, academic and health experts, as well as municipal officials. With consideration of many of the recommendations of the National Antenna Tower Policy Review, Industry Canada's updated antenna siting procedures came into effect as of January 1, 2008.

Professor Townsend's report provided answers and recommendations on the question of "What evidence exists that property values are impacted by the installation of an antenna tower?" Professor Townsend's recommendation was that the impact—positive or negative—that a proposed antenna installation may have upon the property values of particular parcels of land should not be the subject of an antenna consultation.

Health Canada has established safety guidelines for exposure to radio frequency fields in its Safety Code 6 publication entitled *Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz*.

Health Canada has broad responsibilities for protecting the health of Canadians, and acts as the principal health advisor to Industry Canada on protecting the public from potential health effects from exposure to radiofrequency fields. While the responsibility for developing Safety Code 6 rests with Health Canada, Industry Canada has adopted this guideline for the purpose of protecting the general public. Through its

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procedures, Industry Canada makes compliance with Safety Code 6 an ongoing obligation. At any time, antenna system operators may be required, as directed by Industry Canada, to demonstrate compliance with Safety Code 6 by (i) providing detailed calculations, and/or (ii) conducting site surveys and, where necessary, by implementing corrective measures.

Question 21: Will Industry Canada make available its test equipment to its citizens, at no cost, provided they have a qualified expert to use it? If the answer is no, then please provide the rationale behind it.

Question 22: If the answer to #21 is yes, will Industry Canada allow an independent source to determine whether the expert the citizens have chosen is, indeed, qualified? If the answer is no, then please provide the rationale behind it.

Industry Canada has, on occasion, made its staff and equipment available to carry out measurements to ensure that the limits set in Safety Code 6 are being respected. For example, in 2001, Industry Canada's radiocommunication engineering and technical staff took measurements to ensure that the Safety Code 6 public exposure limits were being respected at Triangle Mountain. Measurements were taken in local residents' backyards, front yards, and within homes. Industry Canada's experts were accompanied by a representative of the Colwood Triangle Mountain Citizens' Committee, who provided input on where measurements should be taken. Using calibrated professional equipment, the same type used by other regulatory agencies, and employing standard measurement methods consistent with good engineering practice, Industry Canada's measurements consistently concluded that the Safety Code 6 limit for general public exposure was being respected at the measurement locations.

As warranted, Industry Canada will work with local citizens and make departmental technical staff and test equipment available to ensure the limits set in Safety Code 6 are being respected. However, Industry Canada is not prepared to make its equipment available to the public as its care and safekeeping are the responsibility of Industry Canada.

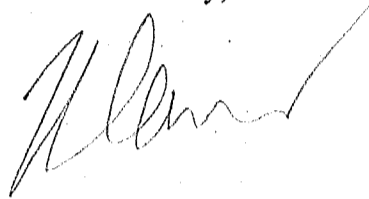
Question 23: If it is Industry Canada's responsibility to police the broadcasting industry, who is it that polices the "Police"?

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Industry Canada is a department established by the Government of Canada under the *Department of Industry Act*. Accordingly, it reports to the Parliament of Canada through the Minister of Industry.

I appreciated this opportunity to respond to your petition, and trust this information is of assistance.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Tony Clement', written in a cursive style.

Tony Clement

c.c. Mr. Scott Vaughan
Commissioner of the Environment
and Sustainable Development

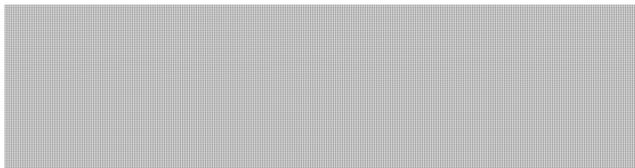
Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

NOV 28 2008



Dear

This is in response to your environmental petition no. 255-B of July 21, 2008, addressed to Mr. Scott Vaughan, the Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised concerns about the radiation emitted from the Triangle Mountain transmission towers.

I am pleased to provide you with the enclosed Health Canada response to your petition. I understand that the Minister of Industry will be responding separately to the questions that fall under the purview of his department.

I appreciate your interest in this important matter, and I hope that you will find this information useful.

Sincerely,

Leona Aglukkaq

Enclosure

c.c. Mr. Scott Vaughan, CESD
The Honourable Tony Clement, P.C., M.P.

Canada

**Health Canada Response to
Environmental Petition No. 255-B filed by
[REDACTED]
under Section 22 of the *Auditor General Act*
Received July 21, 2008**

**Petition to request to remove transmission towers from Triangle Mountain,
Colwood, British Columbia**

December 3, 2008

**Minister of Health and the Minister for the Federal Economic
Development Initiative for Northern Ontario**

1. *Do Industry Canada and Health Canada not consider it appropriate that they pay the \$3,000,000 fee that the broadcasters are demanding to move their transmission towers from Triangle Mountain to a non-residential site that their engineers have already deemed acceptable and, in some ways, superior to the current site since it was Industry Canada and Health Canada that allowed the broadcasters to place their towers and transmitters in the midst of a residential area? If not, why not?*
4. *How often have the field strengths of the transmitters been monitored over the last 5 years?*

Answers to Questions 1 and 4:

Industry Canada is responsible for siting, licensing and compliance of towers and transmitters, as well as for monitoring and conducting tests on field strengths of transmitters.

3. *How many letters, emails, phone calls, and other communications has Industry Canada and Health Canada received each year during the last 5 years from the public concerning electromagnetic radiation, transmission towers of all sorts, and transmitters of all sorts?*

Answer to Question 3:

Health Canada conducted a search of its records and identified approximately 5-50 pieces of correspondence received each year during the last 5 years related to these subjects. However, please note that Health Canada does not necessarily record and archive every e-mail and phone call received.

15. *What studies can Health Canada cite that demonstrates that time-weighted averaging of EMR is a more accurate and effective indicator of possible radiation harm than a reading of the peaks?*
16. *If Health Canada cannot provide conclusive proof that the time-weighted average of EMR is a more accurate and effective indicator of possible radiation harm than a reading of the peaks, please justify advocating it instead of measuring the peaks.*

Answers to Questions 15 and 16:

Safety Code 6 is intended as a safety document for the installation and use of radiofrequency (RF) and microwave devices that operate in the frequency range from 3 kHz to 300 GHz. The code can be found at <http://www.hc-sc.gc.ca/ewh-smmt/pubs/radiation/99ehd-dhm237/index-eng.php>.

The basic restrictions outlined in Health Canada's Safety Code 6 guideline are similar to both the Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz (IEEE C95.1), adopted by the American National Standards Institute, and International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines, adopted by most western European nations. The Guidelines can be found at the following link: <http://www.icnirp.net/documents/emfgdl.pdf> and

http://standards.ieee.org/reading/ieee/std_public/description/emc/C95.1-1991_desc.html. Health Canada's Safety Code 6 however, is more restrictive in terms of compliance; it has a lower localised Specific Absorption Rates (SAR) limit and requires evaluations to be conducted using an averaging volume of 1 g of tissue, whereas a 10 g volume is used for both IEEE C95.1 and ICNIRP guidelines. This means greater accuracy with Safety Code 6.

The exposure limits for the general public, as specified in Health Canada's Safety Code 6, were designed to take into account individuals of all ages of varying health status (which include susceptible groups or individuals such as children, pregnant women and the aged) who are unaware of potential risks. Again, when exposures remain below the safety limits recommended by science-based RF exposure standards, including Health Canada's Safety Code 6, no adverse effects are anticipated.

Six minute time averaging in Safety Code 6 was originally intended for application to industrial use of microwave or RF energy as in the case of heat sealers and plastic welding machines. In these situations, the RF energy is used intermittently and "ON" and "OFF" times can be accurately set by the operator. In telecommunications environments, emission levels from the source are relatively constant over the span of minutes. For a variety of reasons, actual exposure levels at a distance away from the source may fluctuate, so it is up to the skill and knowledge of the surveyor to choose an appropriate averaging time for compliance measurements. In some cases, averaging times may be as short as a few seconds or where longer term fluctuations occur, up to six minutes or even longer. However, when averaged over any six-minute interval, if an exposure level (when spatially averaged) is above the limits in the code, then it is not in compliance and should be brought to the attention of the regulator.

Peak electromagnetic field exposure quantities, on the other hand, are seldom used except in the case of high-powered pulsed field sources. Such fields are not encountered in broadcasting and telecommunications facilities.

The Safety Code 6 limits for frequency modulation (FM) broadcast and microwave frequencies are based on exposure thresholds derived from short term, reversible behavioural modification in animals arising from induced thermal loads. These are the only effects consistently demonstrated from a weight of evidence review of the scientific literature. Therefore, since the effects for which the code is intended to protect against are related to the rate of deposition of radiofrequency (RF) energy, which is subsequently manifested as thermal (temperature) increases in tissues, it is appropriate that measurement averaging times are used that reflect this thermal nature.

(Note: Every measurement instrument employs some kind of time averaging even if it is not apparent to the user. Even if no overt averaging mechanism is present, an instrument's response time constitutes a form of time averaging. For example, old-fashioned analog meters equipped with a moving needle had a response time partly determined by the mass of the needle.)

With respect to measurements of electromagnetic energy for compliance to safety standards such as Safety Code 6, usually long averaging times are specified. The reasons lie in the fact that temperatures in living endothermic (warm-blooded animal) tissues rise relatively slowly in response to an energy input. In this case the energy input in question is the absorption of

electromagnetic energy but it could also be from exercise or changes in ambient temperature. If an energy input is intermittent (ON for a period of time then OFF) the tissues can absorb a greater amount of energy during the "ON" times while still maintaining a relatively low temperature rise. The averaging time specified in Safety Code 6 that is deemed appropriate in this situation is six minutes*. This does not mean that the body can only tolerate an exposure of six minutes, but rather that in any six-minute period, tissue temperatures will not rise if the exposure, when averaged, is within the limits. This allows for exposures to be above the limits for one period of time and below the limits (or zero) for another period of time provided the two periods add to six minutes and the average of the two exposure levels is within the limits.

Six minute time averaging in Safety Code 6 was originally intended for application to industrial use of microwave or RF energy as in the case of heat sealers and plastic welding machines. In these situations, the RF energy is used intermittently and "ON" and "OFF" times can be accurately set by the operator. In telecommunications environments, emission levels from the source are relatively constant over the span of minutes. For a variety of reasons, actual exposure levels at a distance away from the source may fluctuate so it is up to the skill and knowledge of the surveyor to choose an appropriate averaging time for compliance measurements. In some cases, averaging times may be as short as a few seconds or where longer term fluctuations occur, up to six minutes or even longer. However, when averaged over any six-minute interval, if an exposure level (when spatially averaged) is above the limits in the code, then it is not in compliance and should be brought to the attention of the regulator.

In addition to thermally-based exposure guidelines, studies of non-thermal bio-effects almost universally report time-averaged exposure levels as the exposure metric. This is obvious for continuous wave (CW) experiments, but, for other types of pulsed waveforms used in telecommunications such as GSM and CDMA, the time average (usually referred to as the root-mean square or RMS field quantity) is the quantity most often reported. This allows direct comparison of results across different experimental approaches and assists in confirming whether exposures could be potentially thermal in nature.

In summary, peak electromagnetic field exposure quantities are seldom used except in the case of high-powered pulsed field sources, which, in this case, is to protect against air breakdown and spark discharges. Such fields are not encountered in broadcasting and telecommunications facilities. The parameter most often used in specifying the intensity of exposure is a time-weighted average. If fluctuations in the exposure intensity are of short duration, then short averaging times are adequate. If fluctuations are in the order of minutes, then averaging over the six minutes specified in the Safety Code 6 would be appropriate. If fluctuations span hours, then the appropriate measure of exposure is the worst-case six-minute average over the time span. Of course, spatial averaging must also be carried out to fully evaluate the true exposure levels with which to compare to the guideline limits. Finally, because of the complicated and highly technical nature of the task, compliance measurements of electromagnetic field exposures should be carried out by technically qualified persons using appropriate, calibrated instrumentation.

* In studies of temperature rises in endothermic tissues from electromagnetic (EM) absorption, it has been found that temperatures rise quickly at first and then slow down, reaching an equilibrium or steady state temperature rise despite continued EM absorption. Both early experimental studies and more recent analytical ones have shown that the time to reach

equilibrium is somewhere in the vicinity of 20 to 30 minutes (depending on the tissue type) and follows a well known mathematical relationship. That relationship states that the time required to reach 63% of the final steady state temperature rise is always fixed and is denoted by the term "thermal time constant". After a second thermal time constant, 63% of the remaining temperature rise is attained or 86% of the total. For each thermal time constant, 63% of the remaining temperature rise occurs and so on. Roughly speaking, five thermal time constants are needed to reach 99% of the steady state temperature rise. Thus, four to six minutes is the typical thermal time constant for human tissues. Safety Code 6 makes use of this when specifying six minutes for averaging intermittent exposures. For more details, the following papers can be consulted.

K. R. Foster and L.S. Erdreich, "Thermal Models for Microwave Hazards and Their Role in Standards Development", *Bioelectromagnetics Suppl* 4:52-63 (1999).

G.M.J. Van Leeuwen, J.J.W. Lagendijk, B.J.A.M. Van Leersum, A.P.M. Zwamborn, S.N. Hornsleth and A.N.T.J. Kotte, "Calculation of change in brain temperatures due to exposure to a mobile phone", *Phys. Med. Biol.* 44:2367-2379 (1999).

ANSI C95.3-1991. American National Standard. Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave. (Recent edition published in 2002).

17. *What studies can Health Canada cite that demonstrate that living in the actual shadow of cell phone and FM transmission towers is safe?*
18. *If Health Canada cannot provide conclusive proof that living in the actual shadow of cell phone and FM transmission towers is safe, please justify allowing residents to be put in possible jeopardy.*

Answers to Questions 17 and 18:

It is technically impossible to ever prove the absolute absence of risk/harm for any agent or activity. When doing risk assessment of agents and activities for which there is no evidence of adverse effects (as is the case with low level RF fields), scientists/regulators minimize any possible risks by looking long and hard for evidence of risk/harm. In the case of RF fields, health effects research on the subject has been ongoing for over 50 years and there are thousands of published studies. There is a great weight of evidence that RF field intensities below Safety Code 6 are not harmful. This conclusion is based upon the bulk of scientific evidence from animal, in-vitro and epidemiological studies that have been carried out worldwide, including at a Health Canada laboratory.

There are thousands of research studies on the possible bio-effects of RF fields. A searchable compendium of such studies is available at the WHO EMF project website: www.who.int/peh-emf/research/database/en/index.html.

Other sources include reviews (see below for some examples). It is important to point out that all international science-based exposure standards are based on the same scientific literature and other nations and international exposure guidelines have reached a similar consensus.

Krewski D, Glickman BW, Habash RW, Habbick B, Lotz WG, Mandeville R, Prato FS, Salem T, Weaver DF. Recent advances in research on radiofrequency fields and health: 2001-2003. *J Toxicol Environ Health B Crit Rev.* 10:287-318 (2007).

Valberg PA, van Deventer TE, Repacholi MH. Workgroup report: base stations and wireless networks-radiofrequency (RF) exposures and health consequences. *Environ Health Perspect.* 115:416-424 (2007).

Moulder JE, Foster KR, Erdreich LS, McNamee JP. Mobile phones, mobile phone base stations and cancer: a review. *Int J Radiat Biol.* 81:189-203 (2005).

Ahlbom A, Green A, Kheifets L, Savitz D, Swerdlow A; ICNIRP (International Commission for Non-Ionizing Radiation Protection) Standing Committee on Epidemiology. Epidemiology of health effects of radiofrequency exposure. *Environ Health Perspect.* 112:1741-1754 (2004).

24. *The Standards Council of Canada has a mandate "to benefit the health, safety and welfare of workers and the public..." If Health Canada is failing in its responsibility to protect the health and well being of the citizenry, can the Standards Council establish a service to provide those benefits? If no, please provide the rationale in support of this response.*

This question has been addressed to the Standards Council of Canada.

**The Auditor General of Canada
Commission of the Environment & Sustainable Development
Attention: Petitions
240 Sparks Street
Ottawa, ON
K1A 0G4**



Dear Auditor General,

This is my petition under the Auditor General Act

ELECTRO-MAGNETIC AND CHEMICAL SENSITIVITY

My name is _____ who was full of life, healthy habits, and very athletic all year round. I believed in the fresh outdoors and especially in Newfoundland, where our air is much cleaner than most other provinces. I have always respected our environment, reduced and recycled, along with re-using. I never owned a cell phone or used any wi-fi gadgets or even spent much time inside watching television.

Recently I was struck with Electro-Magnetic Chemical Sensitivity (EMS). I contracted this in November 2006. The changes of having one sensitivity going into the other is very high if the right conditions are present, which is what happened to me, first electrical and then chemical. I have been medically diagnosed in St Johns NL in September of 2007. It took me almost a year through my many doctor appointments, emergency visits, pain, discomfort, and almost death before I realized what I even had. I knew my reactions to computers, phones, ect, was NOT fabricated in my head. For the longest time, doctors were trying to prescribe me with anti-depressants, and relaxants used to for anxiety. Both of which I did NOT need and I thought was rather un-responsible for a doctor to just be handing these out for almost anything now a days. During this period, I could not even speak with my children over the telephone. On my own, I put the pieces together, to finally understand what was happening to me that was making me so ill. At times when I had some energy I read papers of research from Canada and further on different things such as metal fillings, Electro-Sensitivity and the fields that surround them that posed harm to humans.

I came across one tiny paragraph with a big message that saved my life. It stated that wire glasses acted like antennas, which could pick up all wi fi, Radio waves, cell phone waves, and other frequencies. This paragraph was a major piece of the puzzle that came together. I was underneath powerful electrical wires with big metal structures just on the side of the road in Corner Brook NL, Canada (where I lived at the time). These were only 22 ft above my head with about 230,000 volts running through them to a major Pulp and Paper Mill. I got a shock that night, and it changed my life forever.

After a year and a half pieces fit together. I moved into my parents home in October of 2006 to get ready to make a move to St Johns NL later on in the year. This home was only 25 ft from a transformer and a lot of stray voltage that built up in the home and just hanging around. On two occasions, while lying down because of illness, I raised my hand and I got two electrical current shocks that went down my arm and up my body, escaping through the top of my head. As I was informed from a Power Engineer Instructor, the build up of electricity in the home caused a lot of Electro Magnetic Fields known as stray voltage.

The people who feel this are Electro Magnetic, and Chemically Sensitive people. I started using a MP3 Player prior to getting sick when I walked to work. These small head phones had powerful magnets that also affected me by picking up all wi fi, Radio Waves and frequencies. It got so bad

that I had to stop working in March 07. After I done research on my symptoms, I had to do a lot of alterations to my lifestyle. I stopped wearing my wire glasses and used contact lenses and went deep in the woods away from Power and Cell Phone towers. I traveled to the Gorge where it has running water and is completely away from any electrical. Staying there for hours at a time, this helped a great deal. Within a week I was about 50% better. So this is also a key piece of information that when no electrical is around, I myself, find I feel a lot better and like myself again. I knew that my findings then of EMF's and EMR's was founded and there were causes and effects.

Auditor General, my life is far from normal anymore, I literally absorb microwave waves, all electrical, WI- fi's and ground currents. I had to give my job up, I can barely use a speaker phone because a hand line receiver is out of the question for me. I can only speak sparsely at times to my children and cannot visit them or even go to Doctors appointments without having to wait outside. I rush in and out of stores simply because I cannot tolerate electrical, cell phones or being around the florescent lights. Sometimes I feel like a prisoner in my home, even the transformers and towers of a distance is very hard on my body.

As being a law biding citizen, I have been through an ordeal with the medical system. The doctors here were trying to convince me that I was either going through menopause, depression, or anxiety. They even got me to see a psychiatrist. To think, they made me feel like I was making all of this up in my head. Why would a healthy athletic lady make these accusations unless they were real? Especially, when I was a citizen who always reached out to people in our community and loved to work. All of this was taken away when I was hit with this allergy.

Auditor General, I am no Engineer or Bio Chemist, nor do I have degrees in the Sciences. However I am intelligent enough to know that this is an extreme allergy and there is more than myself who suffer from it. There are numerous cases across Canada, and all over the world, believe me, this is only just the beginning. Radiation Syndrome is not a new disorder, and nor should this be. The allergy that I have breaks down the immune system and affects all of the bio electrical in our bodies. And I sincerely hope that no one close to you ever has to experience the pain, and humiliation that I have and had to endure over the past year and half.

If Canada Health officials do not attend or take this serious and lower the EMF's milligrams down, then there will be many, many more cases that will develop. And the not so good thing about this would be that none of the hospitals will be able to help because the lights and electrical equipment is just too much for a person like me to be around. The body cannot hold onto radiation for long before the damage internally starts breaking down their immune system. Then you are left with a disorder and extreme allergy that I have contracted. What is our Environmental World coming to? Why are people getting ill, and how come the list for allergies keeps increasing? Why don't our doctors have faith in us anymore? Rather, they shove us aside, and claim we are either depressed or have psychological problems instead of helping. (Which is the doctor's job; they take an oath for this sole purpose. It is to **help** people) And when they fail to provide the help we need, where are Canadians supposed to turn to for help and answers?

I have my doctor's note and at this point I am their teacher, because they have no knowledge on Environmental Illnesses like mine. However, there are some scientists from Canada that are up on this, and I thank them for their dedication. My body supplies enough proof to show the results of what EMF's cause to the human body. Our bodies are walking antennas that absorb everything. When driving a vehicle becomes unbearable, or even a walk in the sun, I think this is the point where someone needs to stand up and do something about it. People will start dropping like flies if something isn't done sooner to prevent us from harm.

The information that I shared in this petition is very real, and personal. This is a serious Allergy, EMF and Radiation problem. And sadly, I will continue to feel the pain of this disease. I have written articles and placed them in the Newfoundland newspapers, and at times I have also spoken out on radio programs, and I have been a loyal citizen to our people, in explaining to them the dangers of EMF's. I will continue to do so until my voice is heard. And I will continue my journey in getting support until all of our voices are heard. It will be known one day the dangers that EMF's, transformers, power lines, cell phone towers, and all of the emissions that each gives off, that **every** human body picks up.

It seems that our Government are leaving these concerns all up to Canadian citizens. There is little if no research being conducted now. And there is no evidence being collected to realize the harmful effects it has on our bodies. Please Mr. Auditor General, help us to uncover these major health concerns. Help shine some light on the people who need it most. This is not going to go away. The pressures being placed upon the Government will only increase as the days go by and more and more people like me speak up, and tell their story, until it maybe so catastrophic, there won't be enough hospitals to cope with this Allergy.

Questions

1. Is the department of Environment aware of the harm that is caused by Electro-Magnetic Fields? And if so, what has the department done to warn Canadians of the dangers or any awareness measures to help protect them?
2. In Canada it is not recognized as a disability, but there are people being diagnosed everyday. Findings in Sweden have passed over the amount of 300 000 people diagnosed medically with this disorder. What is Health Canada doing to acknowledge that this is a serious illness, or going to address it?
3. Does the Government who governs Health Canada realize that our Health care is going to be in the billions of dollars if nothing is done soon? The law of Sweden had to comply and reduce the milligrams of EMF's to 2mg. When will Canada impose laws similar to these?
4. I have experienced first hand what they call stray voltage, and this is a serious problem due to electrical pollution. Could the responsible party for this, please explain to me why this is so and what causes these stray voltages in the ground. What percentage of electricity in NL flows back to sub stations via ground instead of a distribution system? What can be done to stop this ground current that is too high in homes?
5. Should we as Canadians depend on Health Canada? Or do we need to depend on other countries to help make us well? Are the responsible authorities going to listen to the affected Canadians and help them get medical attention?
6. Have the ministers been fully briefed about the serious dangers posed by Electro Magnetic Radiation?
7. When is the Government or people responsible going to see the catastrophic illness and unusual allergies that are occurring in people? Where do Electro-magnetic and Chemically Sensitive people go to for help? Are we left to feel ignored on purpose?
8. The primary objective of the Canadian Health care is to protect, promote and restore the physical and mental well-being of Canadian citizens. They are

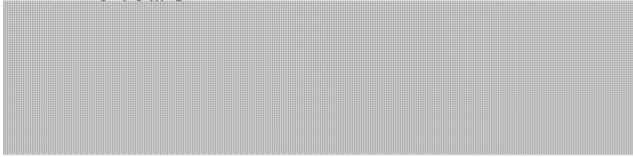
supposed to provide us with reasonable access to health services without financial or other barriers. With this allergy, there are few doctors who know how to treat us, or what direction to point us in. With EMS the cost alone is enormous. What Canadian Health Care system is helping these people when it states in the policy no financial or other barriers ?

9. As a Canadian citizen, I have been researching for 1.5 years for causes and effects of EMS. I am unable to return back to the workforce, sick to the point of human body exhaustion, and spent savings to prove that my life was a healthy one, and to not let doctors shove me aside as depressed. Why does the patient have to find, research, and spend their own savings, when our doctors are supposed to be doing this for us? How can they? When Health Canada does or will not reconize this as an illness.

I hope Health Canada and our Governments, Provincial and Federal are taking these Allergy and

Health concerns as another wake up call. We with these allergies to the Magnetic and Electrical Fields are suffering in pain and discomfort, and not to mention the Chemicals that are overpowering our Earth.

Sincerely Yours



Minister of Health and the Minister
for the Federal Economic Development
Initiative for Northern Ontario



Ministre de la Santé et Ministre de
l'Initiative fédérale du développement
économique dans le Nord de l'Ontario

Ottawa, Canada K1A 0K9

OCT 29 2008

Dear [REDACTED]

This is in response to your environmental petition no. 260 of June 28, 2008, addressed to Mr. Scott Vaughan, the Commissioner of the Environment and Sustainable Development (CESD).

In your petition you raised concerns about electromagnetic and chemical sensitivity.

I am pleased to provide you with the enclosed Health Canada response to your petition.

I appreciate your interest in this important matter, and I hope that you will find this information useful.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Tony Clement', written over a white background.

Tony Clement

Enclosure

c.c. Mr. Scott Vaughan, CESD

Canada

**Health Canada Response to
Environmental Petition No. 260 filed by [REDACTED]
under Section 22 of the *Auditor General Act*
Received July 14, 2008**

Concerns about Electromagnetic and Chemical Sensitivity

November 11, 2008

**Minister of Health and the Minister for the Federal Economic
Development Initiative for Northern Ontario**

1. *Is the department of Environment aware of the harm that is caused by Electro-Magnetic Fields? And if so, what has the department done to warn Canadians of the dangers or any awareness measures to help protect them?*
5. *Should we as Canadians depend on Health Canada? Or do we need to depend on other countries to help make us well? Are the responsible authorities going to listen to the affected Canadians and help them get medical attention?*
7. *When is the Government or people responsible going to see the catastrophic illness and unusual allergies that are occurring in people? Where do Electro-magnetic and Chemically Sensitive people go to for help? Are we left to feel ignored on purpose?*
8. *The primary objective of the Canadian Health care is to protect, promote and restore the physical and mental well-being of Canadian citizens. They are supposed to provide us with reasonable access to health services without financial or other barriers. With this allergy, there are few doctors who know how to treat us, or what direction to point us in. With EMS the cost alone is enormous. What Canadian Health Care system is helping these people when it states in the policy no financial or other barriers?*

Answer to Questions 1, 5, 7 and 8:

In terms of electromagnetic field (EMF) exposures in the frequency range of 3 kHz to 300 GHz, it is Health Canada's opinion that current scientific evidence does not suggest any harm to humans provided that exposures do not exceed the exposure limits outlined in Health Canada's Safety Code 6, which can be found online at <http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/99ehd-dhm237/index-eng.php>.

With respect to what is referred to as "electromagnetic hypersensitivity" (EHS), to date, numerous scientific studies have failed to demonstrate any association between claims of EHS and EMF exposure. In provocation studies where subjects were intentionally exposed, the bulk of the individuals were unable to detect whether EMFs were present or not, or showed symptoms which did not correlate with their exposure condition (<http://www.bmj.com/cgi/reprint/332/7546/886>).

At the present time, as it is still an unsubstantiated condition, there exist only a limited number of studies looking at treatments for EHS. A comprehensive review of EHS studies was recently published (Rubin et al. 2005) and is available at: <http://content.karger.com/produktedb/produkte.asp?typ=fulltext&file=PPS2006075001012>.

According to this review, there is no convincing scientific evidence to suggest EHS symptoms can be triggered or made worse as a result of exposure to EMFs. The review further indicates that cognitive behavioural therapy has had some success in alleviating concerns of patients towards exposure to low intensity EMFs, indicating it may be a psychosomatic condition. The current evidence indicates that other treatments for EHS symptoms such as shielding, supplementary oxidant (vitamin) therapy and acupuncture have yielded no significant success in treating EHS.

In view of the above information, it is the opinion of Health Canada that EHS is not caused by exposure to EMFs and, therefore, recognition of EHS along with its implied causality to EMFs runs counter to Health Canada's science-based approach for exposure limit setting. Nevertheless, Health Canada has informed the general public on EHS through a joint web publication with Industry Canada available online at <http://www.strategis.ic.gc.ca/epic/site/smt-gst.nsf/en/sf08792e.html>.

This information is readily accessible to physicians.

Health Canada encourages individuals who suffer any health complications to seek medical attention from a physician. However, there is no concrete scientific evidence to suggest that exposure to EMFs at levels normally encountered in our daily lives causes any health effects.

- 2. In Canada it is not recognized as a disability, but there are people being diagnosed everyday. Findings in Sweden have passed over the amount of 300 000 people diagnosed medically with this disorder. What is Health Canada doing to acknowledge that this is a serious illness, or going to address it?*

Please refer to the previous response which describes Health Canada's position on EHS. It is Health Canada's understanding that the Government of Sweden recognizes the symptoms attributed to EHS as a disability; however, it does not recognize that these symptoms are caused by exposure to EMFs.

- 3. Does the Government who governs Health Canada realize that our Health care is going to be in the billions of dollars if nothing is done soon? The law of Sweden had to comply and reduce the milligrams of EMF's to 2mg. When will Canada impose laws similar to these?*

To the best of our knowledge, there is currently no legally binding enforcement of exposure standards for low frequency EMFs in Sweden. Please refer to the following reference from the World Health Organization; the middle column of information is the one pertinent to your question: http://who.int/docstore/peh-emf/EMFStandards/who-0102/Europe/Sweden_files/table_sw.htm.

Health Canada acts on scientifically sound data and information for the purpose of establishing human exposure guidelines. At this time, there is no convincing scientific evidence that EMFs are related to the symptoms attributed to EHS. The measurement unit for magnetic field exposures at a frequency of 60 Hz is in milligauss (mG).

- 4. I have experienced first hand what they call stray voltage, and this is a serious problem due to electrical pollution. Could the responsible party for this, please explain to me why this is so and what causes these stray voltages in the ground. What percentage of electricity in NL flows back to sub stations via ground instead of a distribution system? What can be done to stop this ground current that is too high in homes?*

Ground current electricity or "stray voltage" as it is sometimes known occurs due to the grounding of the neutral wire on electrical distribution systems or from incorrect wiring on the electrical customer's premises. The former is an intentional practice, recommended by the *Canadian Electrical Code*, to prevent the possibility of electrocution in the event a live wire falls to the ground. However, by grounding at multiple points throughout the system, an alternate path for neutral currents to flow through the ground is presented.

From a health perspective, the issue of "stray voltage" originally arose in the context of dairy farms. The flow of neutral currents in the earth, which give rise to voltages between metal objects and the ground, were implicated in the economic losses incurred by dairy farmers due to the effects of small electrical shocks experienced by their cows. The phenomenon has been extensively studied and documented for farm animals. It is essentially a direct effect of contact with an electrical conductor (the earth) and does not involve radiation. Humans are somewhat less at risk from the effects of stray voltage than cows owing to their higher resistance to current flow. However, electric current flow and electrocution in humans has also been studied extensively and a large bibliography on this subject exists. A reference on this subject is: "Applied Bioelectricity: From Electrical Stimulation to Electropathology" by J. Patrick Reilly, Springer-Verlag New York, Inc., 1998. This 560-page book contains approximately 1000 references to published works on the subject of electrical interactions with the human body.

In terms of responsibilities for ground current or stray voltages, each province has its own electrical safety organization either as a government department or agency that develops and enforces standards and procedures for preventing electrical contact hazards. In Newfoundland and Labrador, this is the responsibility of the Department of Government Services.

6. *Have the ministers been fully briefed about the serious dangers posed by Electro Magnetic Radiation?*

In terms of EMF exposures in the frequency range of 3 kHz to 300 GHz, it is Health Canada's scientific opinion that current scientific evidence does not suggest any harm to humans provided that exposures do not exceed the exposure limits outlined in Health Canada's Safety Code 6. For frequencies below 3 kHz, it is Health Canada's scientific opinion that exposure to EMFs at levels normally encountered in our daily lives does not cause any health effects.

9. *As a Canadian citizen, I have been researching for 1.5 years for causes and effects of EMS. I am unable to return back to the workforce, sick to the point of human body exhaustion, and spent savings to prove that my life was a healthy one, and to not let doctors shove me aside as depressed. Why does the patient have to find, research, and spend their own savings, when our doctors are supposed to be doing this for us? How can they? When Health Canada does or will not recognize this as an illness.*

I hope Health Canada and our Governments, Provincial and Federal are taking these Allergy and Health concerns as another wake up call. We with these allergies to the Magnetic and Electrical Fields are suffering in pain and discomfort, and not to mention the Chemicals that are overpowering our Earth.

Health Canada continues to research interactions on the human body from exposure to EMFs from 60 Hz to 300 GHz, not only by conducting its own research, but also by following up on worldwide peer-reviewed scientific studies in this field. Health Canada's up-to-date information and position on exposures to EMFs is available on its website (www.hc-sc.gc.ca) and the information is readily available to the general public and doctors alike. There is no question that the symptoms attributed to EHS conditions are real; however, numerous scientific studies to date have failed to demonstrate that they are actually associated with EMF exposure.



Aug 15, 2008

The Auditor General of Canada
Commissioner of the Environment and Sustainable Development
240 Sparks St.
Ottawa, ON
K1A 0G6

Attn. Petitions
Auditor General,

Please accept the following petition under the Auditor General Act.

We have previously submitted petitions to the Auditor General concerning a cell tower located atop the Simcoe water tower. The whole process of locating and erecting the tower went without any public involvement. A decision was made to radiate a whole community including a school, nursing home, hospital and neighbourhood without any consultation with the parties to be radiated. This is **significant**. Our rights were overridden in a most unCanadian fashion. When we brought this to the attention of Industry Canada (IC) they changed their protocol on informing nearby neighbours but it was too late for us.

When questioned through the petition process the responses we received from Health Canada and Industry Canada do not do justice to our inquiries and we respectfully resubmit further questions that we insist be taken seriously.

Our immediate concern revolves around an "Application for License" to install and operate a microwave station in Canada, form IC 060815-1905 reference # CON-18.4D1-C1926-01 dated 2003/08/25 by engineer Milan Vujosevic, Trans. Eng., PEO member number 90376443, 8200 Dixie Rd, Brampton, ON, L6T 0C1, 647-747-4692.

Under the attestation section entitled Preliminary Environmental Information are seven questions.

To the question: "Will any of the proposed antennas and supporting structures be within 30 metres of a body of water, including wetland?" the applicant check-marked "No."

To the question: "Will any of the proposed antennas and supporting structures be a significant modification to an existing antenna installation?" the applicant check-marked "No."

To the question: "Will any of the proposed antennas and supporting structures be attached to, or within 15 metres of a building?" the applicant check-marked "No."

It is our interpretation that these questions were wrongly answered.

Question (Q) 1 - If the attested answers were wrong, what is the process to censure the engineer or censure Industry Canada (IC)?

When IC was asked what verification process is associated with a cell tower application it became evident the towers are not verified on site as a matter of procedure. It appears the engineer's attestation is enough. This puts the engineer's attestation under a large level of trust by IC. It appears the application process, the attestation process and the construction process is not verified on site by IC. It appears the application process, the attestation process and the construction process are self regulating by the applicant. This is highly irregular.

Q 2 – Are the application process, the attestation process and the construction process self regulating?

Q 3 – What federal guidelines are contradicted when an applicant is also the regulator of their application?

Q 4 - How many attestations has this engineer submitted?

Q 5 - How many errors has he made on other attestations?

Q 6 – Since IC does not inspect every tower site that is approved, how would IC possibly know if an error was made on an application or attestation?

Q 7 - How do we access all approval documents relative to the attestation completed by engineer Milan Vujosevic on 2003/08/25 for the Simcoe tower?

Q 8 - Who from IC audited this attestation?

Q 9 - Can we see the documentation?

Therefore if any errors occur in the application process, the attestation process or the construction process they will be undetectable by IC. If cables were attached to the only ladder access to the water tower, this significant safety violation would never come to the attention of IC. If the water tower by virtue of definition was a large body of water, IC would be unaware. If the cell tower was a significant modification to an existing tower, IC would be unaware. If there were buildings of two different owners within 15 metres of supporting structures, IC would be unaware.

On at least three occasions Jack Holt, B. Tech., Director, Central and Western Ontario District of Industry Canada was made aware of these problems with the application and he dismissed them. Due diligence should require Jack to investigate. When Jack Holt was forced by the municipality to take electromagnetic measurements at the site, he was standing in the Pennington's driveway within 15 metres of the cell tower. A building was situated between him and the cell tower. When asked to measure by Frank Woodcock, he failed to measure or take any note of the attestation inaccuracy. According to him no one looks at the "Preliminary Environmental Information" section of the attestation because it is not important. He said, "These guys know what they are doing, they have done this hundreds of times."

Q 10 – Why did Jack Holt when taking measurements within 15 metres of the tower leg, and when told of the measurement breach of the attestation, and when asked to measure the distance, fail to do as requested?

The engineer check-marked on page 3 of the application for a cell tower in Simcoe "new" as opposed to "modification" or "cancellation". The engineer also check-marked on page 5 of the application for a cell tower in Port Dover "modification" as opposed to "new" or "cancellation". Clearly there was a distinction between the Simcoe tower and the Port Dover tower. Considering the engineer noted the Simcoe tower was "new" as opposed to the Port Dover tower, the implication is the Simcoe tower must be significantly different from the one in Port Dover in some respect. Previously there were two RF antenna of inconsequential power on the Simcoe water tower. The "new" tower was to have significant **microwave** power in comparison. The

new tower could potentially have the full power allotted by Safety Code 6 (SC6). When the full power of SC6 comes just short of frying someone, this is very significant. Clearly Industry Canada was aware of the issue of significance prior to the Simcoe Installation. The Federation of Canadian Municipalities had repeatedly asked IC to clarify its definition of significance over the last decade in particular during the consultation period.

Q 11 - Can we access the current definition of significance?

Q 12 - Why was this issue not addressed and essentially ignored in the Simcoe situation which occurred after the consultation process?

We would like the documentation on the decisions taken to determine the significance of the Simcoe tower given that it was determined to be "new".

Q 13 - How do we access these documents?

At a later meeting with four concerned citizens and Jack Holt, he again emphasized the lack of importance of the Preliminary Environmental Information section. Jack was at the meeting to prepare a report for his superiors to which we were denied access. We asked him to include our problems with the attestation and insisted it be part of his report.

Q 14 - Were our concerns about the attestation included in his report?

Q 15 - Is it part of Jack Holt's job to report our concerns?

Q 16 - If he reported our concerns what action should have been taken?

Q 17 - What action was taken?

Q 18 - How do we get access to the actions taken by Jack Holt and the resulting decisions taken by his superiors?

Q 19 - How do we get this documentation?

Q 20 - Would IC even know if an engineer ever visited a site?

Q 21 - Was the engineer ever on site?

Q 22 - Would visiting a site after construction be due diligence for an engineer?

Q 23 - Did the engineer see the buildings within 15 metres of the tower?

Q 24 - Did the engineer see the buildings and then lie on the attestation?

Q 25 - If he was never on site isn't he professionally required to not answer related questions?

Q 26 - If the engineer was never on site how could he possibly answer the 15 metre question?

Q 27 - If the engineer did not answer that question would the application go forward?

Q 28 - Why would such an application go forward?

Q 29 - If the question was answered in the negative to avoid complications should some action be taken?

Q 30 - How do we get access to the audit, if any, done by Industry Canada to confirm the details in the attestation? We would like this documentation.

Minister of Industry



Ministre de l'Industrie

Ottawa, Canada K1A 0H5



29/1/09

Dear

I am writing to provide you with Industry Canada's response to Environmental Petition No. 264, received on August 19, 2008, concerning the installation of a radiocommunication antenna system on the Union Street water tower in Simcoe, Ontario. This petition was forwarded to the Minister of Health and the Minister of Industry by the Commissioner of the Environment and Sustainable Development. I am pleased to respond to your questions that fall within Industry Canada's area of responsibility.

Question 1: If the attested answers were wrong, what is the process to censure the engineer or censure Industry Canada?

In the event that there are errors or omissions on an application or attestation, any subsequent approval or authorization reliant on such application or attestation is imperiled and the person who made the submission is contacted and updated information is obtained. There is no process of "censure" that Industry Canada would employ. As explained herein, in response to your Question 10, Industry Canada did not rely on the answer to the question of whether the proposed antenna installation was within 15 metres of an existing building in its determination of whether the proposal is excluded from environmental assessment.

.../2

Canada

There is not an established process to censure Industry Canada. However, this federal department is established by the Government of Canada under the *Department of Industry Act*. Accordingly, it answers to the Parliament of Canada through the Minister of Industry.

Question 2: Are the application process, the attestation process and the construction process self-regulating?

Question 3: What federal guidelines are contradicted when an applicant is also the regulator of their application?

Industry Canada, not the applicant, regulates the radio authorization processes and proceeds on the basis that the people providing information are acting in a truthful manner.

Industry Canada evaluates all applications for radio station authorizations, including any required attestations, in order to ensure the orderly development and efficient use of the radio frequency spectrum.

Question 4: How many attestations has this engineer submitted?

Question 5: How many errors has he made on other attestations?

Question 7: How do we access all approval documents relative to the attestation completed by engineer Milan Vujosevic on August 25, 2003, for the Simcoe Tower?

Question 8: Who from Industry Canada audited this attestation?

Industry Canada does not maintain a database of names of individuals who submit the *Preliminary Environmental Information and Municipal/Land-Use Consultation Attestation*, including the engineers employed or otherwise engaged by applicants. Therefore, Industry Canada cannot readily provide the information you are requesting.

The radio station application and attestation forms were reviewed and processed by staff from Industry Canada's Central and Western Ontario District Office.

.../3

Question 6: Since Industry Canada does not inspect every tower site that is approved, how would the department possibly know if an error was made on an application or attestation?

Currently, there are over 100,000 antenna sites across Canada, of which approximately 8,000 are cellular and PCS antenna sites. Given this large number, Industry Canada conducts various sampling audits and inspection surveys to ensure continued compliance with authorized parameters.

Question 9: Can we see the documentation?

Question 18: How do we get access to the actions taken by Mr. Jack Holt and the resulting decisions taken by his superiors?

Question 19: How do we get this documentation?

Question 30: How do we get access to the audit, if any, done by Industry Canada to confirm the details in the attestation? We would like this documentation.

The department would like to take this opportunity to inform you that the *Access to Information Act*, gives Canadian citizens the right to access information in federal government records. You may wish to file a request under this enactment with Industry Canada's Access to Information and Privacy (ATIP) Office. The ATIP Coordinator may be reached at:

Access to Information and Privacy Coordinator
Industry Canada
C.D. Howe Building, West Tower, 5th Floor
235 Queen Street
Ottawa, Ontario K1A 0H5
Telephone: 613-952-5766
Facsimile: 613-941-3085

Further information on Industry Canada's Information and Privacy Rights Administration Office may be found at www.ic.gc.ca/eic/site/atip-airpr.nsf/eng/home.

.../4

Question 10: Why did Mr. Jack Holt, when taking measurements within 15 metres of the tower leg, when told of the measurement breach of the attestation, and when asked to measure the distance, fail to do as requested?

The department comprehends that your concern is that the person who submitted the attestation incorrectly completed Industry Canada's form entitled *Preliminary Environmental Information and Municipal/Land-Use Consultation Attestation*. This attestation was submitted for the antenna system located on the Union Street water tower in Simcoe, Ontario. The question on the attestation, to which I understand your concern relates, is whether the proposed antenna installation was attached to, or within 15 metres of, an existing building.

This question is used as part of a series of questions that assists the Industry Canada officer who is reviewing the application to decide whether the proposal is excluded from environmental assessment under the *Exclusion List Regulations* of the *Canadian Environmental Assessment Act*. A radiocommunication antenna and its supporting structure is excluded from environmental assessment when, among other things, they are either located entirely within 15 metres of a building or, as is the case in this situation, affixed to a building. On review of all available information, including information gathered during site visits, my officials concluded that the installation is excluded from environmental assessment under the *Exclusion List Regulations* of the *Canadian Environmental Assessment Act*.

Question 11: Can we access the current definition of significance?

Question 12: Why was this issue not addressed and essentially ignored in the Simcoe situation which occurred after the consultation process?

We would like the documentation on the decisions made to determine the significance of the Simcoe tower given that it was determined to be "new."

Question 13: How do we access these documents?

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Industry Canada used the term “significant modification” and “significant antenna structure” in its document, Client Procedure Circular (CPC) 2-0-03, Issue 3, June 1995, entitled *Environmental Process, Radiofrequency Fields and Land-Use Consultation*, which included the attestation form previously mentioned. Though no longer in force, Issue 3 of CPC-2-0-03 is available at www.ic.gc.ca/antenna. The document did not define significance, though under the process it generally came to be understood to mean an antenna structure for which it was felt that community concerns could be raised.

In January 2008, Issue 4 of CPC-2-0-03, entitled *Radiocommunication and Broadcasting Antenna Systems*, came into effect. It is also available at www.ic.gc.ca/antenna. This issue of the document lists types of installations that are excluded from consultation. This includes installations that national experience has shown generally do not cause significant community concern. The installation of the radiocommunication antennas on the Union Street water tower in Simcoe, Ontario, meets Industry Canada’s exclusion criteria under the current procedure, although it is still required to comply with procedure’s general requirements.

Question 14: Were our concerns about the attestation included in his report?

Question 15: Is it part of Mr. Jack Holt’s job to report our concerns?

Question 16: If he reported our concerns, what action should have been taken?

Question 17: What action was taken?

In their consideration of this antenna system, Industry Canada officials considered the information submitted by the antenna proponent. This included the attestation, any associated discrepancies, as well as comments and concerns raised during interviews with the community including nearby residents. The department is confident that the antenna proponent has complied with all departmental requirements for the establishment of a radiocommunication installation on the Union Street

.../6

water tower in Simcoe, Ontario. Industry Canada officials, with consideration of established process, issued a radio station licence for the installation and operation of the microwave radiocommunication system.

Question 20: Would Industry Canada even know if an engineer ever visited a site?

Question 21: Was the engineer ever on site?

Question 22: Would visiting a site after construction be due diligence for an engineer?

Question 23: Did the engineer see the buildings within 15 metres of the tower?

Question 24: Did the engineer see the buildings and lie on the attestation?

Question 25: If he was never on site, is he not professionally required to abstain from answering related questions?

Question 26: If an engineer was never on site, how could he possibly answer the 15 metre question?

Industry Canada's process does not require proponents of antenna systems, including engineers, to visit sites.

Question 27: If the engineer did not answer that question, would the application go forward?

Question 28: Why would such an application go forward?

In the event that an application or attestation is incomplete, Industry Canada officials would normally contact the proponent to obtain any needed information.

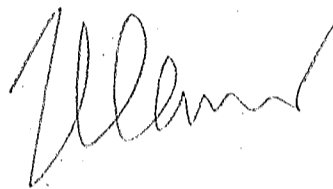
Question 29: If the question was answered in the negative to avoid complications, should some action be taken?

.../7

For this particular site, whether or not a building is within 15 metres of the antenna would not alter the conclusion that the installation is excluded from environmental assessment under the *Exclusion List Regulations* of the *Canadian Environmental Assessment Act*.

I appreciate this opportunity to respond to your petition, and trust this information is of assistance.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Tony Clement', written in a cursive style.

Tony Clement

c.c. Mr. Scott Vaughan
Commissioner of the Environment
and Sustainable Development

Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

OCT 15 2014

Dear

I am writing with regard to your environmental petition no. 365 of May 25, 2014, regarding the web publication "Busting Myths on Safety Code 6".

Please find enclosed the response to your environmental petition questions. For further background, please find enclosed the *Safety Code 6 (2013) – Rationale* document.

Thank you for your interest in this important matter.

Yours sincerely,

A handwritten signature in black ink that reads "Rona Ambrose".

The Hon. Rona Ambrose, P.C., M.P.

c.c. Ms. Julie Gelfand
Commissioner of the Environment and Sustainable Development

Enclosure

Canada

Health Canada Response to Environmental Petition no. 365

Question: Can Health Canada refute with specific, unbiased and conflict-of interest free scientific evidence the statements made by Canadians for Safe Technology?

Response:

On May 22, 2014, the group Canadians for Safe Technology (C4ST) posted a criticism of Health Canada's "Busting Myths on Safety Code 6" website publication, claiming that Health Canada used false and unsubstantiated claims to instil public confidence in safety exposure limits for wireless radiation. Health Canada is aware of public messaging and comments made by C4ST in relation to the Department's radiofrequency (RF) exposure guideline, Safety Code 6, *Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz, 2009*.

Health Canada's mandate on the issue of human exposure to RF electromagnetic energy is to carry out research into possible health effects, monitor the scientific literature related to such effects, and develop exposure guidelines such as Safety Code 6. Health Canada's Safety Code 6 is based upon credible, unbiased and conflict-of-interest free scientific evidence and analysis. In conducting scientific risk assessments, the Department gathers, assesses, and integrates multiple sources of scientific evidence into an overall conclusion; an approach that is judged to be consistent with international practices in risk assessment.

Research Considered

When developing the exposure limits in Safety Code 6, Health Canada scientists consider all peer-reviewed scientific studies and employ a weight-of-evidence approach to evaluate possible health risks from exposure to RF energy. This approach takes into account both the quantity of studies on a particular endpoint (whether adverse or no effect), but more importantly, the quality of those studies. Poorly conducted studies (e.g. inadequate exposure evaluation, lack of appropriate control samples or inadequate statistical analysis) receive relatively little weight, while properly conducted studies (e.g. all controls included, appropriate statistics, complete exposure evaluation) receive more weight.

It is important to note that when thousands of research studies are conducted on any test agent (e.g. RF fields), statistical chance dictates that a small number of studies (even if conducted properly) will demonstrate a "false positive" or "false negative" result. Furthermore, studies with inappropriate study design or methodology can lead to erroneous results that are scientifically meaningless. It is for these reasons that the scientific literature on a given test agent must be evaluated both for the quality of the studies conducted but also for the strength of the evidence. Such analysis must consider all relevant properly conducted studies on the test agent. While some studies

have reported biological effects or adverse health effects of RF fields at levels below the limits in Safety Code 6, these studies only form part of the dataset and do not represent the prevailing line of scientific evidence in these respective areas.

Electromagnetic Hypersensitivity

Based on a thorough review of scientific data, Health Canada has concluded that there is no scientific basis for the existence of any short- or long-term adverse health effects or of cumulative effects associated with RF exposure at levels below the limits outlined in Safety Code 6. This includes an assortment of health symptoms that some people attribute to exposure to RF fields (termed electromagnetic hypersensitivity [EHS]). While the symptoms attributed to EHS are real, numerous scientific studies to date have failed to demonstrate that these health effects are actually associated with RF field exposure. In studies where subjects were intentionally exposed to RF fields, there was no evidence that individuals were able to detect whether RF fields were present or not, nor any evidence that the individuals' symptoms correlated with their actual exposure condition. While the causes of these symptoms are unclear, the existing scientific literature does not support the notion that the symptoms attributed to EHS are actually caused by exposure to RF fields.

International Comparisons

The exposure limits in Safety Code 6 are consistent with the science-based standards used in most countries (e.g. the United States, the European Union, Japan, Australia and New Zealand). Internationally, while a few jurisdictions (cities, provinces or countries) have applied more restrictive limits for RF field exposures from cell towers, in many instances these more restrictive limits are not applied to other wireless devices and the supportive rationale is not science-based.

Protection for Children

The exposure limits in Safety Code 6 are based on the lowest exposure level at which scientifically established human health hazards occur. Safety factors are also incorporated into these limits to add an additional level of protection for the general public and personnel working near RF sources. The limits recommended for general public exposure to RF energy are designed to provide protection for all age groups, including children, on a continuous basis. While children can absorb relatively more RF energy than adults at certain frequencies (i.e. due to body size resonance) due to anatomical differences, the Reference Levels in the proposed Safety Code 6 (2014) are based upon the worst-case resonance frequencies in children (and infants). Therefore, if the Reference Levels in Safety Code 6 are respected, no adverse health effects will occur since the thresholds for adverse effects have not been exceeded. For more information on how Safety Code 6 addresses exposure from multiple sources, including prolonged exposures and exposure in children, please consult the Safety Code 6 Rationale document (attached).

IARC Classification

The International Agency for Research on Cancer (IARC) classified RF energy as “possibly carcinogenic to humans” (Class 2B). A Health Canada scientist was part of the IARC Expert Working Group that examined this issue. The IARC classification on RF energy reflects the fact that some (limited) evidence exists that RF energy may be a risk factor for cancer. However, the vast majority of scientific research to date does not support a link between RF energy exposure and human cancers. Based upon the IARC Class 2B Classification, Health Canada updated its advice to cell phone users describing practical ways of reducing exposure to RF energy from these devices. This advice pertains only to cell phone use and not to RF energy exposures from other wireless devices (such as Wi-Fi, smart meters, baby monitors) or cell towers, since the intensity and distribution of the RF energy absorbed within the body from these devices are very different than from that of cell phones.

Authority for Regulating Wireless Equipment

Note that Industry Canada is the federal agency responsible for regulating wireless communications equipment (e.g. cell phones, cell sites, smart meters, Wi-Fi) in Canada. To ensure that public exposures fall within acceptable guidelines, Industry Canada has developed regulatory standards that require compliance with the human exposure limits outlined in Health Canada’s Safety Code 6.

Safety Code 6 Updates

Health Canada scientists monitor the scientific literature on this issue on an ongoing basis and Safety Code 6 is periodically updated to take into account recent scientific data from animal, in vitro and epidemiological studies carried out worldwide. The most recent version of the Code, Safety Code 6 (2009), is currently under review to ensure that the most up-to-date scientific studies on the potential effects of RF energy on human health are reflected in the Code.

In 2013, Health Canada contracted the Royal Society of Canada (RSC) to ensure that the results of emerging research related to the safety of RF energy were reflected in a proposed revised Safety Code 6. The Expert Panel of the RSC concluded that “...the balance of evidence at this time does not indicate negative health effects from exposure to RF energy below the limits recommended in the Safety Code.” The RSC Expert Panel report, released on April 1, 2014, can be found at: <http://rsc-src.ca/en/expert-panels/rsc-reports/review-safety-code-6-2013-health-canadas-safety-limits-for-exposure-to>

Among the recommendations made by the RSC, it was suggested that some of the proposed reference levels in Safety Code 6 be made slightly more restrictive in some frequency ranges to ensure large safety margins for all Canadians, including newborn infants and children. This recommendation takes into account recent dosimetry studies (which measure radiation dose) examined by the RSC, one of which became available after Health Canada had developed the proposed revision of Safety Code 6. Health Canada incorporated this feedback from the RSC into a proposed revision of Safety

Code 6. From May 16, 2014 to July 15, 2014, Health Canada held a 60-day public consultation to provide interested parties the opportunity to comment on the proposed revisions to Safety Code 6. These proposed revisions will make Canada's limits among the most conservative science-based limits in the world.

At this time, advice from the RSC's Expert Panel, as well as comments of a scientific nature that were received during the public consultation, are being considered in the development of the final revised version of Safety Code 6.

Reviews by Other Health Authorities

While Safety Code 6 references a number of large international reviews of the scientific literature, this document was intended as an exposure guideline document and not a scientific review article. Therefore, most individual scientific studies are not referenced in this document. However, this does not mean that Health Canada did not consider all relevant scientific information when deriving the science-based exposure limits in Safety Code 6. Similar conclusions to those reached by Health Canada have been reported in recent reviews of the scientific evidence by a range of national and international health authorities:

- International Commission on Non-Ionizing Radiation Protection (ICNIRP, 2009): "With regard to non-thermal interactions, it is in principle impossible to disprove their possible existence but the plausibility of the various non-thermal mechanisms that have been proposed is very low. In addition, the recent in vitro and animal genotoxicity and carcinogenicity studies are rather consistent overall and indicate that such effects are unlikely at low levels of exposure."
(www.icnirp.de/documents/RFReview.pdf)
- Health Council of the Netherlands (2011): "In summary, the Committee concludes that there is no cause for concern based on the knowledge of short-term effects outlined in this advisory report. Available data do not indicate that exposure to radiofrequency electromagnetic fields affect brain development or health in children."
(<http://www.gezondheidsraad.nl/en/publications/environmental-health/influence-radiofrequency-telecommunication-signals-children-s-brai>)
- Advisory Group on Non-Ionizing Radiation (AGNIR, 2012): "In summary, although a substantial amount of research has been conducted in this area, there is no convincing evidence that RF field exposure below guideline levels causes health effects in adults or children."
(www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1317133826368)
- Norwegian Institute of Public Health (2012): "For exposure at levels below the ICNIRP reference values, the ICNIRP has found no documented adverse effects, despite extensive research. No mechanisms have been identified which could account for any such effect." (www.fhi.no/dokumenter/545eea7147.pdf)

- French Agency for Food, Environmental and Occupational Health and Safety (ANSES, 2013): “The findings of the risk assessment have not brought to light any proven health effects.” “Given this evidence, proposing new exposure limits for the general population on health grounds does not seem justified.” (www.anses.fr/en/content/anses-issues-recommendations-limiting-exposure-radiofrequencies)
- Preliminary Opinion of the Scientific Committee on Emerging and Newly Identified Health Risks (European Commission - SCENIHR, 2014): “Epidemiological studies on RF EMF exposure do not unequivocally indicate an increased risk of brain tumours, and do not indicate an increased risk for other cancers of the head and neck region, or other malignant diseases including childhood cancer.” “Overall, there is evidence that exposure to RF fields does not cause symptoms or affect cognitive function in humans.” “Therefore, it is concluded that there is strong overall weight of evidence against an effect of low level RF fields on reproduction or development.” (http://ec.europa.eu/health/scientific_committees/consultations/public_consultations/scenihr_consultation_18_en.htm)

In conclusion, Health Canada reminds all Canadians that their health is protected from RF fields if the human exposure limits recommended in Safety Code 6 are followed. The current Safety Code establishes and maintains a human exposure limit that is far below the threshold for potentially adverse health effects. These limits provide protection against all known adverse health effects for all individuals.

You may wish to visit the following links for more information:

- Health Canada – RF Exposure Guidelines (Safety Code 6)
http://hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct/index-eng.php
- Health Canada – Consultation on Proposed Revisions to Safety Code 6
http://hc-sc.gc.ca/ewh-semt/consult/_2014/safety_code_6-code_securite_6/index-eng.php

We hope you find this information useful.

Safety Code 6 (2013) –Rationale

This document provides an overview of the rationale for the proposed basic restrictions and derived reference levels within the revised version of Safety Code 6 (SC6, 2013). This document is not intended as an authoritative scientific review of the relevant literature, as that would entail a much more thorough discussion of the relevant scientific literature. Where appropriate, references are provided to authoritative reviews of the scientific literature or to some individual studies which form the scientific basis on specific issues. Since SC6 provides guidance for maximum human exposure to electromagnetic radiation across a wide frequency spectrum and the thresholds for adverse health effects are based upon different biological phenomena at different regions within this frequency range, this document has been subdivided into four (4) sections, namely:

1. Electric and Magnetic Fields (3 kHz – 10 MHz)
2. Induced and Contact Current (3 kHz – 110 MHz)
3. Electric-fields, Magnetic-fields and Power Density (10 MHz – 6 GHz)
4. Electric-fields, Magnetic-fields and Power Density (6 GHz – 300 GHz)

In the 3 – 100 kHz band, the threshold for adverse health effects is based upon the avoidance of peripheral nerve stimulation (PNS) by induced fields within the body from external electric and magnetic fields. Basic restrictions in this frequency band are proposed for internal electric field strength within the body. In the 100 kHz – 10 MHz frequency range, the threshold for adverse health effects are based upon the avoidance of both PNS and thermal effects. As such, basic restrictions are proposed for both internal electric field strength and specific absorption rate (SAR; whole body average and peak spatially-averaged SAR). In the frequency range 10 MHz – 6 GHz, the threshold for adverse effects is based upon the avoidance of tissue heating and basic restrictions are proposed for whole-body average SAR and spatially-averaged peak SAR. In the frequency range from 6 - 300 GHz, since measurements of whole-body SAR and peak spatially-averaged SAR are not readily achievable or appropriate due to the superficial nature of tissue heating within the body, reference levels for electric- and magnetic-fields and power density form the basis of the human exposure limits in this frequency range.

The basic restrictions outlined in SC6 (2013) are intended to protect against all known adverse health hazards from electromagnetic radiation in the frequency range 3 kHz – 300 GHz. In the WHO Framework for the Development of EMF Standards (2006), adverse health hazards are defined as “a biological effect that has health consequences outside the compensation mechanisms of the human body and is detrimental to health or well-being”. It is important to note that the WHO endorses international guidelines that are based upon a weight-of-evidence risk assessment of the scientific literature, such as those established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the Institute of Electrical and Electronics Engineers (IEEE), and it encourages member states to adopt these international guidelines or to base national exposure limits on similar risk assessment principles. Where practical, revisions to SC6 (2013) have adopted portions of the ICNIRP guidelines (ICNIRP 2010, for frequencies

below 100 kHz; ICNIRP 1998, for frequencies from 100 kHz – 300 GHz) in an effort to harmonize with international standards.

Section 1 Electric and Magnetic Fields (3 kHz – 10 MHz)

Basic Restrictions

In the frequency range 3 kHz – 10 MHz, the threshold for adverse health effects in SC6 (2009) and other science-based human exposure limits have been based upon the avoidance of both PNS and thermal effects from externally applied electric and/or magnetic fields (ICNIRP 1998, 2010; IEEE C95.1, 2005; Lin, 2007). PNS predominates at the lower end of this frequency range, while tissue temperature elevation due to energy absorption (SAR) generally predominates at higher frequencies. In the 100 kHz – 10 MHz range, low-duty cycle electromagnetic fields may elicit PNS before thermal effects arise, while continuous-wave exposures may elicit thermal effects before PNS occurs, therefore basic restrictions for both biological endpoints are required in the revised version of SC6, and both must be respected for compliance with SC6. While central nervous system (CNS) tissue and cardiac tissue can also be stimulated by induced internal electric fields, the thresholds for these effects occur at higher exposure levels than that for PNS in this frequency range. Since the last version of SC6 (2009), no newly identified adverse health effects have been established in this frequency range. Therefore, the avoidance of PNS and thermal effects remains the basis for the basic restrictions in this frequency range.

Peripheral Nerve Stimulation (PNS)

In unperturbed conditions, voltage-gated ion channels maintain the “resting” membrane potential of neurons at approximately -60 to -75 mV. Externally applied electric or magnetic fields can induce internal electric fields that can perturb the “resting” membrane potential on neurons and can stimulate action potentials in peripheral nerve axons if the induced membrane depolarization is above a threshold value sufficient for the opening of voltage-gated sodium channels to become self-sustaining (WHO, 2007). Numerous studies have estimated that the minimum threshold for PNS is in the range of 4 - 6 Vm⁻¹ using theoretical calculations of nerve stimulation thresholds (Reilly 1998, 2002) and empirical data from volunteers exposed to switched gradient magnetic resonance (Nyenhuis et al., 2001, So et al., 2004).

In recent years, several studies have refined dosimetric calculations for induced electric fields and currents within anatomically-derived heterogeneous models of various sizes of the human body (including those of children), using voxel sizes below 4 mm (Dimbylow 2005, 2006; Bahr 2007; Hirata 2009; Nagaoka 2004). This approach is advantageous over previous modelling methodologies that have employed homogeneous ellipsoidal human models. These studies have indicated that maximum induced electric fields from externally applied electric and magnetic fields, relevant to PNS, occur in the skin and associated fatty tissue in the peripheral region of the body near the waist region. As such, induced electric fields within skin tissue, represents the worst-case scenario upon which

to establish basic restrictions for the avoidance of PNS in the 3 kHz - 10 MHz frequency range for all parts of the body (ICNIRP, 2010).

Based upon this information, the ICNIRP have recently issued updated safety recommendations for human exposure to low frequency electric and magnetic fields entitled “Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz to 100 kHz). As there remains uncertainty about the precise thresholds for PNS and the accuracy of current dosimetry models, the guidelines established by ICNIRP in the 3 kHz – 10 MHz frequency range provide a conservative approach for the avoidance of PNS since exposure uncertainties have been factored into the derivation of the basic restrictions within ICNIRP (2010). According to ICNIRP (2010), these basic restrictions provide a 5-fold safety margin for exposure in the Controlled Environment, and a 10-fold safety margin for exposures in the Uncontrolled Environment, against PNS.

In the previous version of SC6 (2009), reference levels were provided that would prevent the occurrence of PNS in this frequency range, but basic restrictions were not specified. It is recommended that the revised version of SC6 (2013) should specify separate basic restrictions for the avoidance of PNS and that of thermal effects. Since the ICNIRP (2010) guidelines are based upon the most updated dosimetric information and approaches, it is recommended that the basic restrictions in SC6 (2013) for the avoidance of PNS should be harmonized with those of ICNIRP (2010) in the 3 kHz – 10 MHz frequency range.

The basic restrictions for the avoidance of PNS proposed for SC6 (2013) are:

Exposure Group	Frequency range	Internal E-field (Vm^{-1}) (for any part of the body)
Controlled Environment	3 kHz – 10 MHz	$2.70e^{-4}f$
Uncontrolled Environment	3 kHz – 10 MHz	$1.35e^{-4}f$

- f denotes frequency in Hz

Thermal effects

In the 100 kHz – 10 MHz frequency range, SC6 (2009) specified basic restrictions for the avoidance of thermal effects. These basic restrictions specified limits on whole-body average (WBA) specific absorption rate (SAR; a measure of energy deposition rate within the body), and peak spatially-averaged SAR (maximum energy deposition rate within a discrete tissue volume). These basic restrictions are based upon scientific consensus of a threshold value of approximately 4 W/kg for thermally-related ($\sim 1^{\circ}C$ colonic temperature rise) behavioural changes in rodents, non-human primates and in human volunteers (reviewed in IEEE C95.1, 2005; Foster and Adair, 2004; Adair and Black, 2003; Foster and Glaser, 2007). Existing international (ICNIRP 1998; IEEE C95.1, 2005) and national (SC6, 2009; FCC, 2006) science-based exposure standards have incorporated safety margins of 10 and 50 in the derivation of basic restrictions for the avoidance of thermal effects for exposures in Controlled and Uncontrolled Environments, respectively. These safety factors ensure that worst-case human exposures to RF fields incurred in uncontrolled- and controlled-environments, within the prescribed

exposure limits, do not result in alterations in core body temperature of the individual of more than a few tenths of 1°C (reviewed in IEEE C95.1, 2005).

The basic restrictions for WBA-SAR in SC6 (2009) are identical to those in ICNIRP (1998) and IEEE C95.1 (2005). It is recommended that these basic restrictions remain unchanged in the revised version of SC6 (2013) since no new adverse health effects have been identified at exposures below these levels since the last version of SC6 (2009).

The basic restrictions proposed for WBA-SAR in SC6 (2013) are:

Exposure Group	Frequency range	WBA-SAR limit (W/kg)*
Controlled Environment	100 kHz – 10 MHz	0.40
Uncontrolled Environment	100 kHz – 10 MHz	0.08

* - averaged over any 6 minute reference period.

In addition to basic restrictions on WBA-SAR, SC6 (2009) also includes basic restrictions for peak spatially-averaged SAR within discrete volumes of tissue. The original derivation of peak spatially-averaged SAR limits in SC6 and other international standards were based upon dosimetric estimates of a 20:1 variation in peak spatially-averaged SAR to WBA-SAR within the human body, whereby a 1.6 W/kg peak spatially-averaged SAR limit for the uncontrolled environment was based upon a WBA-SAR limit of 0.08 W/kg. With refinements in dosimetry, it was later determined that the actual variation among peak spatially-averaged SAR to WBA-SAR was more approximately a 100:1 ratio (Bernardi et al., 2003). If a similar approach were used, based upon a WBA-SAR limit of 0.08 W/kg, this would translate to a peak spatially-averaged SAR limit of 8 W/kg.

On the other hand, numerous studies have demonstrated cataract formation in experimental animals at peak spatially-averaged SARs of ~100-150 W/kg (Elder, 2003), presumably due to thermal effects in the eye (tissue volume ~ 10 g). However, recently Hirata et al. (2008) used modern computational approaches to re-examine some of the early work on cataract formation in rabbit eyes conducted by Guy et al. (1975). They found that the threshold for the occurrence of cataracts in rabbit eyes observed by Guy et al. (1975) may actually have occurred at a lower SAR (~67 W/kg) than previously estimated, although the use of anaesthesia in the Guy et al. (1975) study predisposed the animals to thermal effects in the lens. Additional work is required to study the effect of localized RF exposure in the near-field on temperature responses in the eye. Based upon a considerable breadth of historical information on cataract induction in animals, ICNIRP (1998) and IEEE C95.1 (2005) have established Uncontrolled Environment peak spatially-averaged SAR limits of 2 W/kg averaged over 10 g tissue, based upon an estimated 50-fold reduction below the threshold for cataract formation in animals (~100 W/kg).

Studies modelling the thermal response to RF fields in discrete volumes of human tissue have indicated that temperature changes in the eye from exposures at the ICNIRP (1998) Controlled Environment peak spatially-averaged SAR limits of 10 W/kg averaged over 10 g of tissue, are no more 1.4°C above pre-exposure levels (Wainwright, 2007). This is

well below the temperature threshold required for the induction of thermally-induced cataract effects, which requires lens temperature to reach $\sim 41^{\circ}\text{C}$. Similarly, studies on temperature increases in brain tissue at the ICNIRP (1998) Controlled Environment peak spatially-averaged SAR limit of 10 W/kg averaged over 10 g of tissue, found maximum discrete (10 g) temperature responses in the brain ranging from 0.6-1.2 $^{\circ}\text{C}$ (reviewed in IEEE C95.1, 2005). These increases are also well within the normal physiological range for brain tissue and well below the threshold required to induce pathological effects. Since SC6 (2009) specifies peak spatially-averaged SAR limits that are 20% lower than those in specified in ICNIRP (1998) and IEEE C95.1 (2005), and are averaged over 1 g of tissue (instead of 10 g), the relative temperature increases in human brain and eye tissues from peak spatially-averaged SARs at the Controlled Environment peak spatially-averaged SAR limit outlined in SC6 (2009) would be much lower than that estimated above.

The following table lists the basic restrictions on peak spatially-averaged SAR in SC6 (2009), ICNIRP (1998) and IEEE C95.1 (2005):

Exposure Group	Tissue	Frequency range	Peak spatially-averaged SAR limit (W/kg)	Averaging Volume (g)
SC6- Controlled Environment	Head, trunk	100 kHz- 6 GHz	8*	1
	Limbs		20*	10
SC6- Uncontrolled Environment	Head, trunk	100 kHz- 6 GHz	1.6*	1
	Limbs		4*	10
ICNIRP/IEEE-C95.1 Controlled	Head, trunk	100 kHz- 6 GHz	10*	10
	Limbs		20*	10
ICNIRP/IEEE-C95.1 Uncontrolled	Head, trunk	100 kHz- 6 GHz	2	10
	Limbs		4	10

*averaged over any 6 minute reference period.

While the peak spatially-averaged SAR limits in ICNIRP (1998) and IEEE C95.1 (2005) are biologically-based (cataract formation) and those in SC6 (2009) and FCC (2006) were derived from early dosimetric considerations, the peak spatially-averaged SAR limits in ICNIRP (1998) and IEEE C95.1 (2005) are less restrictive than those in SC6 (2009) for two reasons: 1) for localized exposures in the head, neck and trunk, SC6 (2009) specifies a maximum SAR of 1.6 W/kg and 8 W/kg for Uncontrolled and Controlled Environments, respectively, compared to 2 W/kg and 10 W/kg in the ICNIRP (1998) and IEEE C95.1 (2005) guidelines for the Uncontrolled and Controlled Environments, respectively; and 2) the peak spatially-averaged SAR in the head, neck and trunk is calculated over 1 g of tissue in the SC6 (2009) standard, whereas the peak spatially-averaged SAR is calculated over 10g of tissue in the ICNIRP (1998) and IEEE C95.1 (2005) standards. The lower tissue averaging volume in SC6 (2009) results in a more restrictive peak spatially-averaged SAR limit, as it provides more protection against the occurrence of small regions with thermal hot-spots. Based upon the uncertainties in

exposure assessment, the occurrence of relatively higher brain peak spatially-averaged SARs in children compared to adults from near-field sources (e.g. cell phones) (Wart et al., 2008; Christ et al., 2010), the uncertainty in possible long-term health risks associated with cell phone use and ongoing public concern about cell phone safety, it is recommended that the basic restriction for peak spatially-averaged SAR limits in SC6 (2013) remain unchanged from those in the previous version of SC6 (2009) to maintain an additional margin of safety.

Reference Levels

In this frequency range, electric and magnetic fields display characteristics similar to static fields in that they are, to a large extent, uncoupled and therefore can be treated separately. In addition, due to the long wavelengths at these frequencies, exposure from a source is typically in the near-field region and power density is not a useful metric. This means that, in general, both the electric field strength and magnetic field strength should be characterized when assessing electromagnetic safety.

In the quasi-static frequency range, the induction of internal voltages and currents in the body due to externally applied electric and magnetic fields is strongly determined by the constituent electrical parameters of tissue, namely the magnetic permeability, electrical permittivity and conductivity. The magnetic permeability of tissue is identical to that of free space and the induction of electric fields and currents in tissues from externally applied magnetic fields is governed by Faraday's law. For electric field exposure, the high permittivity and conductivity of tissues result in the coupling of strong surface charges on the body and relatively weak electric field strengths and currents within the body.

As indicated above, two biological phenomena exist that require two separate basic restrictions in this frequency range. Since PNS and thermal effects have significantly different latency times (onset from exposure to effect), the specification of two different sets of reference levels is warranted. PNS-based basic restrictions and reference levels require an effectively instantaneous reference period, for comparison to the exposure limits in SC6 (2013), due to the ability of induced electric fields to cause an instantaneous alteration of the resting membrane potential of neurons. Therefore, basic restrictions and reference levels for the avoidance of PNS require limits on the instantaneous peak (RMS) amplitudes of internally-coupled or external fields. Alternatively, SAR-based basic restrictions and reference levels are related to thermal effects and are therefore influenced by the thermal time constant of the human body to externally applied thermal influences. For the purposes of establishing SAR-based basic restrictions and reference levels, a six-minute reference period, based upon the thermal time constant of living tissues (i.e. the time it takes for tissue temperature to begin to rise in the case of sufficiently high exposure), has been selected to restrict the temporally averaged internally-coupled or external fields.

For pulsed RF field strengths at frequencies where both types of basic restrictions exist (0.1-10 MHz for magnetic fields and 1-10 MHz for electric fields), the effect of having

the two sets of reference levels is to limit both the peak amplitude and duty factor, such that both sets of basic restrictions are respected.

Magnetic Fields

Two simultaneous criteria were considered in the setting of reference levels for SC6 (2013) in the 3 kHz to 10 MHz frequency range. These were: 1) the adoption of separate basic restrictions for PNS and thermal effects, and 2) harmonization with the ICNIRP (1998) and ICNIRP (2010) exposure guidelines, where feasible. For protection against PNS, the ICNIRP (2010) magnetic field strength reference levels (uncontrolled and controlled) are proposed for adoption in SC6 (2013) (see Figures 1 and 2).

For SAR-based magnetic field reference levels, the sloped portion of the ICNIRP (1998) limits, extended back to 100 kHz (uncontrolled) or beginning at 100 kHz (controlled) are proposed for SC6 (2013). Both sets of frequency dependent limits are extended to 10 MHz as shown in Figs. 1 and 2. This approach gives a common start frequency for controlled and uncontrolled reference levels and the same frequency dependency (f^{-1}). The ICNIRP (1998) magnetic field reference levels below 100 kHz were meant to protect against PNS, however this frequency range is covered by the new PNS-based reference levels proposed in SC6 (2013). Therefore, it was decided to begin the proposed SAR-based reference levels only at 100 kHz. The resulting reference levels are slightly more restrictive than the SAR-based reference levels in SC6 (2009).

In order to verify that the proposed reference levels ensure compliance with the basic restrictions, data from the dosimetry literature published up to the current date was used to estimate the external field strength that would produce basic-restriction level internal electric fields and/or SARs. These are also plotted in Figs 1 and 2.

A number of computational dosimetry studies utilizing realistic voxel models of the human body and establishing levels of induced electric field (99th percentile) for worst-case uniform magnetic field exposure have been reported. Most have used calculations at the power frequency of 50/60 Hz, which can be scaled to SC6-relevant frequencies under the quasi-static assumption. An example is the data from Caputa et al. (2002) that is plotted in Figs. 1 and 2. This data is an average of the induced electric field (99th percentile) for fat and skin tissues in the torso, which represent some of the highest magnetic field coupled doses of all body tissues and organs. Since the quasi-static scaling assumes a f^{-1} frequency dependence while the PNS basic restrictions also have a f^{-1} frequency dependence, the external magnetic field required to induce basic restriction-level internal electric fields show up as a flat line in the figures.

In addition, a few studies have made computational dosimetry calculations directly at frequencies of 3 kHz and beyond (Dimbylow, 2005; Bakker et al., 2012). Their results are shown in Figs. 1 and 2, also. Their results, when plotted, are almost flat with frequency, indicating that the quasi-static assumptions remain valid in this frequency range. From Figs 1 and 2, it can be seen that the proposed PNS-based reference levels provide an adequate level of protection against exceeding the proposed basic restrictions for PNS.

Also shown in the Figures 1 and 2 are the lowest external uniform magnetic field strengths required to produce the worst-case WBA-SAR basic restrictions, based on calculations on adult-sized homogeneous ellipsoidal models (Note: in this frequency range, child-sized models respond with lower WBA-SARs for exposures at the same magnetic field strength; Kaune et al., 1997). Based upon the dosimetry data depicted in Figures 1 and 2, there is a large margin of compliance of the proposed SAR-based reference levels to the basic restrictions. This may be warranted given the high level of approximation used in the homogeneous ellipsoid model. The margin of compliance for the PNS-based reference levels is much smaller, however, given that the dosimetry models for this case are much more refined (numerical voxel models), the margin is deemed adequate.

Electric Fields

As with magnetic fields, two simultaneous criteria were considered when establishing the proposed electric field reference levels for SC6 (2013). These were: 1) the adoption of separate basic restrictions for PNS and thermal effects, and 2) harmonization with the ICNIRP (1998) and ICNIRP (2010) exposure guidelines, where feasible. Over the frequency range 3 kHz to 10 MHz, the ICNIRP (2010) electric field strength reference levels (uncontrolled and controlled) are proposed for adoption in SC6 (2013) (see Figures 3 and 4). The relevant dosimetry literature (Dimbylow, 2005) shows that these electric field strength reference levels provide a high level of protection against exceeding the PNS basic restrictions for the case of the body coupling to an external, unperturbed electric field. These calculations correspond to the case of grounded, adult-sized voxel-model bodies exposed to a vertically polarized uniform electric field (the worst case scenario for all body sizes and field orientations). (For illustration purposes only, the dosimetry data for isolated ellipsoidal models from Kaune et al. (1997) are shown in Figures 3 and 4 demonstrating that much higher electric field strengths are necessary to meet the basic restrictions for ungrounded or isolated bodies).

In the case of the SAR-based reference levels, harmonization of the reference levels in SC6 (2013) with those of ICNIRP (1998) is relatively straight-forward for Uncontrolled Environments since the SAR-based and PNS based curves intersect at approximately 1 MHz (the precise frequency is 1.10 MHz). Therefore, the proposed Uncontrolled Environment SAR-based reference level for SC6 (2013) was applied at 1.10 MHz and follows the ICNIRP (1998) Uncontrolled Environment reference level up to 10 MHz. This also provides a match to the 10 MHz – 6 GHz electric field strength reference levels where the two frequency ranges meet and results in a convenient $f^{-0.5}$ frequency dependency.

For Controlled Environments, harmonization with ICNIRP (1998) was somewhat more difficult because of the f^{-1} frequency dependency of ICNIRP (1998) SAR-based Controlled Environment reference level. It was decided that matching the Controlled Environment electric field strength reference level at 10 MHz to the value proposed for the 10 MHz - 6 GHz range and maintaining the same frequency dependency as for the Uncontrolled Environment, were the most important factors. The resulting Controlled

Environment SAR-based reference level curve is shown in Figure 4. It can be seen that the SAR-based and PNS-based reference level curves do not conveniently intersect at 1 MHz. The precise frequency of intersection is 1.29 MHz and therefore, it was decided to apply the Controlled Environment SAR-based reference levels at 1.29 MHz.

Comparison of the proposed SAR-based electric field strength reference levels to the minimum electric field strengths required to meet the basic restrictions in Figures 3 and 4, demonstrates that compliance for whole body SAR is achieved (Durney et al., 1986), however peak spatially-averaged SAR in the limbs at ~10 MHz is not (Gandhi et al., 1985). At this specific frequency, the margin of non-compliance is small (this case is due to induced current flowing in the ankles, with good contact to the ground and a vertically polarized electric-field). However, this situation is likely also non-compliant with induced current reference levels proposed in SC6 (2013), see Section 2. This reinforces the notion that even though electric field strength levels may be compliant with the reference levels, induced current reference levels may be exceeded. Therefore, measurement of induced current is a necessary component of a complete RF compliance assessment.

Similarly, this same situation can occur with contact currents, as illustrated in Figures 5 and 6. In these figures, the levels of incident electric field strength of sufficient intensity to cause perception-level and let-go level contact currents are plotted for different ungrounded objects and are compared to the proposed Uncontrolled- and Controlled-Environment electric field strength reference levels in SC6 (2013). Let-go level currents are defined as the maximum current at which a person can release an energized conductor using muscles that have been stimulated by the current. The amount of current is highly variable from person to person and is dependent upon the type of contact (finger touch versus hand grasp). All data represents the 50th percentile response (Gandhi et al., 1982; Bernhardt, 1988).

In Figures 5 and 6, it can be seen that both the proposed Uncontrolled and Controlled Environment reference levels provide a greater level of protection from potential contact currents as compared to SC6 (2009). It also helps to explain why the reference levels are set so far below the threshold for direct coupling effects as illustrated in Figures 3 and 4; that is electric field reference levels are designed more for protection of indirect effects (i.e. contact currents) as opposed to direct effects (IEEE C95.1, 2005).

It should also be emphasized that there are still situations in the Uncontrolled Environment where the electric field reference levels may be complied with, but contact current limits are exceeded. Therefore, in situations where contact with energized, ungrounded conductors can occur, assessment of compliance to the contact current reference levels in SC6 (2013) is necessary.

Based upon the above dosimetric information, the proposed electric- and magnetic-field strength reference levels in the 3 kHz – 10 MHz frequency range of SC6 (2013) are:

Proposed Electric Field Strength Reference Levels in SC6 (2013)

Frequency (MHz)	Reference Level Basis	Reference Level E_{RL} , (V/m) (rms)		Reference Period
		Uncontrolled Environment	Controlled Environment	
0.003 – 10	PNS	83	170	Instantaneous
1.0 – 10	SAR	$87 / f^{0.5}$	$193 / f^{0.5}$	6 minutes

- Frequency, f , is in MHz.
- PNS, peripheral nerve stimulation
- SAR, specific absorption rate
- The precise frequencies at which SAR-based electric field strength reference levels for Uncontrolled and Controlled Environments begin are 1.01MHz and 1.29 MHz, respectively.

Proposed Magnetic Field Strength Reference Levels in SC6 (2013)

Frequency (MHz)	Reference Level Basis	Reference Level H_{RL} , (A/m) (rms)		Reference Period (min)
		Uncontrolled Environment	Controlled Environment	
0.003 – 10	PNS	21	80	Instantaneous
0.1 – 10	SAR	$0.73 / f$	$1.6 / f$	6 minutes

- Frequency, f , is in MHz.
- PNS, peripheral nerve stimulation
- SAR, specific absorption rate

Recommendations for Spatial Averaging:

In this frequency range the proposed basic restrictions for PNS effects are given in terms of internally induced electric field strength. The value to be compared to the BR is the 99th percentile value of the induced electric field strengths that are averaged over a cube of tissue that is 2 mm on a side. For both external magnetic field and electric field exposures, higher induced electric field strengths tend to occur in low conductivity tissues while higher induced current densities occur in high conductivity tissues.

For electric field exposure, the highest induced field strengths and current densities occur for the condition where the external electric-field vector is parallel to the long axis of the body and the body is standing on a conductive earth. At these frequencies, the body behaves similarly to a conductor where the distorted external field lines terminate perpendicularly on the surface of the body and induce a surface charge. At any horizontal cross-section through the body, the total current flowing towards ground is dependent on the total surface charge above that cross-section (Dimbylow, 2005). The result is that the highest current densities and induced electric field strengths occur in the ankle area and are a function of the surface area of the body above. This implies that a spatial average over the vertical extent of the body is a reasonable estimate of the equivalent uniform electric field strength that was used in the derivation of the reference levels.

For magnetic field exposure, the highest internally induced electric field strengths occur for geometries of the tissue or organs with the lowest conductivities that present the highest cross-sectional area to the field vector. A low-conductivity tissue or organ surrounded by high-conductivity tissue will selectively respond with higher induced electric-field strengths than the surrounding tissues despite the fact that the exposure field is uniform (Dimbylow, 2005). This implies that a spatially non-uniform external magnetic field and a uniform one with the same spatial peak magnitude could potentially induce the same internally induced electric-field strength in a target tissue or organ. In this case, spatial averaging of the non-uniform external magnetic field would give an under-estimate of the corresponding internally induced electric field strength. Thus, to ensure that the basic restriction for PNS is complied with, comparison of the spatial peak magnetic field strength (instead of the spatially-averaged magnetic field strength) should be made to the reference level at frequencies less than 100 kHz.

At frequencies where both PNS- and SAR-based BRs exist and beyond, spatial averaging of both the external electric- and magnetic-field strength are permitted since the SAR-based reference levels are based on whole-body absorption.

Section 2 Induced and Contact Currents (3 kHz – 110 MHz)

Introduction

Contact currents can occur when a person simultaneously touches two conductive objects that are at different electrical potentials, resulting in current flowing through the body. The magnitude of the current is proportional to the electrical resistance between those two points (WHO 2007). Induced currents can occur when a person is exposed to EMF, typically in close proximity to the source, whereby internal body electric currents are induced by external fields. The magnitude of the induced current is dependent on the proximity to the source, frequency, orientation/polarization of the body to the incident field and grounding (e.g. footwear).

In the previous version of SC6 (2009), the induced and contact current limits were based upon avoidance of PNS (perception and/or pain) at frequencies from 3 – 100 kHz and thermal effects (thermal perception and/or pain) for frequencies from 0.1 – 110 MHz. These effects are known to be frequency-dependent in the 3 - 100 kHz frequency range, but quite stable at frequencies from 0.1 -110 MHz. However, the basic restrictions in SC6 (2009) were derived from volunteer studies conducted using adult men.

Additional studies assessing men, women and children exposed to EMF in the 3- 100 kHz range have identified the threshold for PNS (perception of tingling sensation) of induced/contact current to be in the range of ~1 – 25 mA for the most sensitive individuals under worst-case conditions across this frequency range. For finger-touch contact current, the threshold for pain on finger contact is estimated to be in the range of ~2 – 33 mA, dependent on frequency. The let-go threshold for painful shocks are estimated to be ~15 – 112 mA, dependent on frequency. Based upon this information, IEEE 95.1 (2005) and ICNIRP (2010) have established maximum contact current limits

of $167f$ and $200f$ (f is frequency in MHz), respectively, for exposures in the Uncontrolled Environment in the 3 – 100 kHz frequency range. While the basic restrictions in SC6 (2009) for contact current are below the threshold for the occurrence of painful let-go shocks for both the Uncontrolled and Controlled Environments, the occurrence of field perception (tingling sensation) and painful finger-contact shocks cannot be ensured. While perception of a tingling sensation is not considered an adverse health outcome and therefore the avoidance of this phenomenon is not considered mandatory for the development of reference levels for contact current, it is recommended that the contact current limits in SC6 (2013) be revised to avoid the occurrence of finger-touch shocks in the 3 – 100 kHz frequency range.

Studies on volunteers exposed to EMF in the 0.1 – 110 MHz frequency range have indicated thermal perception in the limbs at an internal current of 100 mA and the possibility of burns at exposure levels of 200 mA. This effect is not frequency-dependent. The current version of SC6 (2009) set basic restrictions for the avoidance of thermal effects from induced and contact currents (one foot) at 100 mA and 45 mA for the Controlled and Uncontrolled Environments, respectively. Alternatively, IEEE C95.1 (2005) and ICNIRP (2010, 1998) have established exposure limits for contact currents at lower levels, providing an additional margin of safety from the occurrence of such effects.

Basic restrictions on Induced- and Contact Currents at 3 – 100 kHz specified in SC6 (2009), ICNIRP (2010) and IEEE C95.1 (2005) are:

Exposure Group	Type of Exposure (Environment)	Maximum Induced Current (mA) (One foot)	Maximum Contact Current (mA)
SC6 (2009)	Controlled	$1000f$	$1000f$
	Uncontrolled	$450f$	$450f$
ICNIRP (2010)	Controlled	n/a	$400f$
	Uncontrolled	n/a	$200f$
IEEE C95.1 (2005)	Controlled	$500f$	$500f$
	Uncontrolled	$167f$	$167f$

f – denotes frequency in MHz

Basic restrictions on Induced- and Contact Currents in the 0.1 – 110 MHz range specified in SC6 (2009), ICNIRP (1998, 2010) and IEEE C95.1 (2005) are:

Exposure Group	Type of Exposure (Environment)	Maximum Induced Current (mA) (One foot)	Maximum Contact Current (mA)
SC6 (2009)	Controlled	100	100
	Uncontrolled	45	45
ICNIRP (2010,	Controlled	n/a	40

1998)	Uncontrolled	n/a	20
IEEE C95.1 (2005)	Controlled	100	50
	Uncontrolled	45	16.5

f – denotes frequency in MHz

While the basic restrictions in SC6 (2009) are below the threshold for the occurrence of RF shocks and burns for both the Uncontrolled and Controlled Environments, the occurrence of thermal perception in the Controlled Environment cannot be excluded. It is recommended that the induced- and contact-current reference levels in SC6 (2013) should be revised to take into account recent dosimetric information and to provide a larger safety margin for the avoidance of painful RF shocks and burns.

Since induced- and contact current limits are actually derived from the basic restrictions for internal electric field strength and SAR (except for contact current below 100 kHz whose limits are based on results from human volunteer studies), these limits should be specified as reference levels in SC6 (2013).

Reference levels

Induced Current

For the purposes of most electromagnetic exposure guidelines, induced current is usually defined as the longitudinal flow of current through a body that is in good electrical contact with the ground (often defined as standing barefoot). At frequencies at and below the whole body resonance, the response of a grounded body to an incident vertically-polarized electric field is to behave somewhat like a short-circuited metallic monopole where the induced current distribution is greatest near the ground and diminishes towards the upper parts of the body (Gandhi et al., 1986). The implication of this is that the largest currents flow through the ankles, which have a narrow cross-section of conductive tissue to carry the current. This results in relatively high SAR in the ankle at frequencies where tissue heating is of concern or results in high current density and induced electric field strength for frequencies where PNS is the limiting factor.

The empirical formula that relates induced current magnitudes to electric field strength states that the ratio of current to field strength is proportional to frequency and to the square of the body height (Gandhi et al., 1985; 1986). This would imply that for the same frequency, taller individuals would be subjected to greater induced currents. This relationship is valid up to the whole body resonance frequency (under grounded conditions), which is approximately 40 MHz for a 1.75m adult, 51 MHz for a 1.38m (10y old) child and 63MHz for a 1.12m (5y old) child (Gandhi et al., 1986).

The resulting SAR or current density is a function of the effective cross sectional area, A_e , of current flow. In the case of SAR, it is equal to $SAR = I^2 / (A_e^2 \sigma \rho)$, where I is the induced current through one limb, σ is the conductivity of the current carrying wet tissues and ρ is the mass density (usually taken to be 1000 kg/m³). In the case of current density J, it is given by $J = I / A_e$, while the resulting induced electric field, E_i , is related to the current density through Ohm's law: $E_i = J / \sigma$. Thus, the resulting SAR or induced electric

field is strongly dependent on the reciprocal of the effective cross section, $1/A_e$, which would typically be larger for smaller sized bodies (short adults and children). This effect partially compensates for the increase in induced current for larger sized bodies, suggesting that at the same frequency, SARs between children and adults may be similar. However, it is also noted that induced current magnitudes reach a peak at whole body resonance and given the higher frequencies at which these occur for children and the fact that conductivity increases with frequency, it is expected that worst-case ankle SAR for constant incident electric field strength would be higher for smaller bodies. This can be observed in Figure 16 both from the empirical data from (Gandhi et al., 1986) and the numerically-simulated data from realistic voxel models of a male and female (Dimbylow, 2002; 2006).

Since the conditions for optimal induction of current are not common in practice, separate reference levels for induced current are usually provided in most exposure standards. This allows electric field strength reference levels to be less restrictive than if they had to protect against peak spatially-averaged SAR in the ankles, however the measurement of induced current becomes an additional requirement in order to demonstrate compliance to all of the basic restrictions. Admittedly, it is not always easy to judge under what circumstances measurement of induced current is warranted. Some guidance on this is given in IEEE C95.1 (2005, p22-23), where it is suggested that for electric field strengths greater than approximately 16 or 17% of the reference levels, the induced current reference level may be exceeded (for frequencies from about 1 MHz to whole body resonance). Induced current can also be mitigated by footwear and in occupational settings, by floor coverings and operator training.

3 kHz to 400 kHz

ICNIRP (1998) does not specify reference levels for induced current at frequencies below 10 MHz, while ICNIRP (2010) makes no recommendations for induced current reference levels. Thus harmonization with these two standards would involve removing induced current reference levels from SC6 (2013) in this frequency range. There is also a paucity of human experimental data on the stimulatory effects of induced current in the frequency range 3 - 400 kHz in the scientific literature upon which to base reference levels. However, estimation of induced currents in the ankles of sufficient magnitude to exceed the basic restrictions for induced electric field can be made. This was the approach used to derive reference levels for induced current in the 3 kHz to 400 kHz range.

In this frequency range, the basic restrictions for both Controlled- and Uncontrolled Environments for induced electric field has the form $E=kf$, where f is the frequency in hertz and k is a constant. An approximation of the reference level current flowing through the ankles, I_{RL} required to meet the basic restriction can be written as $I_{RL} = \sigma A_e E$ where the terms σ and A_e are defined in the paragraphs above. If the effective area and conductivity are assumed to be constant over this frequency range, then it can be seen that the reference level induced current should have a f^1 frequency dependency.

Figures 7 and 8 depict the proposed induced current reference levels in SC6 (2013) and calculated estimates of the induced currents necessary to meet the basic restrictions for

PNS (induced electric field) in the 3 kHz – 1 MHz frequency range. The sloped portions of the reference level curves (controlled and uncontrolled) were designed to have a f^{-1} frequency dependency and approximately follow the dosimetric data derived from (Dimbylow, 1988). The flat portion was based on thermal considerations and is discussed in the following section. The two curves intersect at 400 kHz (thus explaining why 400 kHz was chosen as the frequency boundary between PNS and SAR-based reference levels). Extending the PNS (sloped) reference level curve beyond the intersection frequency (as was done for electric field reference levels) may result in unacceptably high induced currents in the 400 kHz – 10 MHz frequency range that could lead to RF burns. Therefore, it was decided to extend the PNS-based induced current reference levels, with their associated reference time, only to 400 kHz where they meet the frequency independent SAR-based reference levels (with a reference period of 6 minutes).

The method for estimating the dosimetric data derived from Dimbylow (1988) in Figures 7 and 8, was based on calculations of current densities in the ankle of a realistic voxel model of an adult. For comparison to the basic restriction, the maximum current densities given in Table 4 (model C) of Dimbylow (1988) were divided by the conductivity of muscle to obtain the equivalent maximum induced electric field for a predefined induced current amplitude. It should be remembered that the proposed basic restrictions for PNS in SC6 (2013) refer to the 99th percentile value of induced electric fields, averaged over a 2x2x2 mm³ volume of contiguous tissue. The values derived from the data in Dimbylow (1988) pertain to voxel sizes of approximately 4 mm on a side. Thus the effective averaging volume can be considered to be larger than that stipulated by the proposed basic restrictions in SC6 (2013). This would probably lead to a somewhat lower estimate of the maximum induced electric field strength required to meet the basic restrictions, however, this is offset by the fact that the values reported in Dimbylow (1988) are peak values and not based upon the 99th percentile of electric field strength.

The method for estimating the other dosimetric data in Figures 7 and 8 is from the formula: $I = \sigma A_e E_{BR}$ where $A_e = 9.5 \text{ cm}^2$ for the effective cross-section of current flow along with values of muscle conductivity ranging from 0.44 S/m at 10 kHz to 0.55 S/m at 1 MHz (Gandhi, [7]). As seen in Figures 7 and 8, the resulting estimates using this method are only slightly lower than the ones derived from the voxel model calculations (Dimbylow, 1988). In either case, given the approximate nature of the dosimetric data, it is difficult to estimate to what extent the proposed induced current reference levels are protective of the basic restrictions.

400 kHz to 110 MHz

Figure 9 shows the proposed Uncontrolled induced current reference level of 40 mA for this frequency range, which is based on avoidance of peak spatially-averaged SAR in the ankles. A proportionate value of 90 mA is proposed for Controlled environments based on the standard ratio 2.2:1 for SAR-based current or field strength quantities.

In the frequency range from 400 kHz to 110 MHz, the magnitude of induced current required to meet the basic restriction for SAR in the limbs rises slowly with frequency.

This can be observed in Figure 9 where the induced currents in the ankles required to meet the Uncontrolled Environment basic restriction for SAR of 4 W/kg (averaged over 10 g) are plotted. The data from Gandhi et al. (1986) was calculated using the relationship between SAR and induced current I : $SAR=I^2/(A_e^2\sigma\rho)$, where the effective cross-sectional area estimated by Gandhi was 9.5 cm² (for a 1.75m adult) and conductivity data versus frequency was obtained from Dimbylow (1997). The SAR, so calculated, is effectively averaged over an approximate area of 10 cm². If it is assumed that the longitudinal SAR distribution is uniform over a 1 cm vertical distance, then the SAR values can be considered to be an approximate 10 g average as well.

These values can also be compared to actual 10 g averaged SARs computed from realistic voxel models of a 1.76m male (Dimbylow, 1997) and a 1.63m female (Dimbylow, 2006). In all cases, it can be seen that the proposed Uncontrolled Environment induced current reference level in SC6 (2013) provides sufficient protection to ensure that the basic restriction for SAR in the ankles is not exceeded. The same relationships hold for the proposed Controlled Environment induced current reference levels in SC6 (2013), since the reference levels and the basic restrictions have the same ratio for controlled-to-uncontrolled on a power basis (5:1).

Proposed Induced Current Reference Levels in SC6 (2013)

Frequency (MHz)	Reference Level Basis	Reference Level (I_{RL}), through a single foot (mA) (rms)		Reference Period
		Uncontrolled Environment	Controlled Environment	
0.003 – 0.4	PNS	100 f	225 f	Instantaneous
0.4 – 110	SAR	40	90	6 minutes

- Frequency, f , is in MHz.
- PNS, peripheral nerve stimulation
- SAR, specific absorption rate

Contact Current

Contact current is usually termed an indirect effect of exposure to electromagnetic fields. It can be defined as the flow of current from an insulated, conductive object energized by an ambient electromagnetic field, through a body that is in physical contact with the object, to ground. Conversely, it can also be defined as the current that flows from an insulated, energized body in contact with a grounded conductive object. In either case the factor that makes contact current potentially hazardous is the current flowing through parts of the body with narrow cross-section (fingers, wrists, ankles) that can give rise to large current densities and limb SARs.

As seen from Figures 5 and 6, adherence to the electric field reference levels may not preclude contact currents that can be perceived either as a tingling sensation or if flowing long enough, as heat. Unlike all other dosimetric quantities, contact currents not only depend on the electrical parameters of the human body and the field intensity and polarization, but also on the shape and size of the conductive object being contacted as

well as the type of contact (finger touch as opposed to hand grasp). Since finger touch appears to have the lowest perception thresholds (Chatterjee et al., 1986), it forms the basis for the proposed contact current reference levels in SC6 (2013).

Finger touch can be described as touching the energized conductor with the tip of a single finger, while hand grasp implies that the conductor is gripped in a closed hand. Human volunteer experiments on perception and pain from contact current in Chatterjee et al. (1986) suggest a marked delineation of effects at ~100 kHz. Contact currents at frequencies below 100 kHz, at sufficient intensities, typically results in a tingling sensation, while sufficiently intense contact currents at frequencies above 100 kHz tend to cause heating effects. Perception of tingling or warmth during a finger touch is usually localized in the finger near the point of contact. Hand grasp, with its significantly larger surface area of contact, results in much higher perception thresholds. At frequencies below 100 kHz, the location of sensation is near the electrode being grasped while above this frequency, it is localised in the wrist where current flow is restricted to a small area of relatively high conductivity tissue (Chatterjee et al., 1986).

In terms of latency times, Chatterjee et al. (1986) observed that perception-level currents applied for only 10 to 20 seconds caused pain when the frequency was greater than 100 kHz, but painful sensations were not experienced at frequencies below 100 kHz for similar durations of exposure. This would suggest that a latency time considerably less than 6 minutes needs to be adopted for the contact current reference levels for frequencies up to 10 MHz. Therefore, as a precautionary measure, it is recommended that the effective reference period for contact current reference levels should be specified as instantaneous for frequencies from 3 kHz to 10 MHz, and 6 minutes for frequencies from 10 MHz to 110 MHz. In view of this, overlapping stimulation-based and SAR-based reference levels in the frequency range from 100 kHz to 10 MHz were deemed unnecessary.

The proposed Uncontrolled- and Controlled-Environment contact current reference levels are plotted in Figures 10 to 13. Figures 10 and 11 depict the proposed Uncontrolled- and Controlled Environment contact current reference levels in the 3 – 100 kHz range, while Figures 12 and 13 depict the proposed contact current reference levels in the 100 kHz – 10 MHz frequency range. In keeping with the goal of harmonization, the proposed contact current reference levels in SC6 (2013) are identical to those specified in ICNIRP (1998) and ICNIRP (2010). Also plotted are the experimentally- and dosimetrically-derived threshold contact currents required to meet the basic restrictions in SC6 (2013).

In Figure 10, it can be seen that estimated perception thresholds for children are almost one half of that for male adults. ICNIRP (2010) uses this as the rationale for setting their general public (Uncontrolled Environment) reference levels to be one half of those for the Controlled-Environment. Considering that the perception threshold data is based upon the 50th percentile of a given population group, it can be assumed that some members of the population group would perceive contact currents at the reference levels. This is also true for the Controlled Environment (Figure 11). Thus, the proposed reference levels in SC6 (2013) for contact current in the 3 – 100 kHz frequency range provide some protection

against, but do not prevent, the occurrence of perception (tingling sensation or warmth). However, these reference levels do provide protection against painful contact current exposures.

In the 100 kHz – 110 MHz frequency range, experimental perception data from Chatterjee et al. (1986) is nearly frequency independent. The Uncontrolled-Environment contact current reference level in Fig 12 appears to protect against the 50th percentile for perception by children with the same proviso that some members of the child population group may perceive contact currents at reference levels.

Fig 13 demonstrates that the Controlled-Environment contact current reference level is approximately at the 50th percentile perception threshold for adult males and below the corresponding pain threshold for the same group. It is not known what percentage of adult males would experience pain at reference level contact currents. However, opportunities for mitigation of painful contact current exposures are readily available in occupational environments for the avoidance of such effects.

Wrist currents that meet the basic restriction for SAR, averaged over 10 g in the limbs and calculated from realistic voxel models, are also plotted in Figures 12 and 13. This data is pertinent to the case of hand grasp, where the bulk of the power deposition is in the wrist. Unfortunately no similar data on SAR in the finger resulting from a finger touch could be found. The result is that the empirical data from human volunteer studies constitutes the foundation for establishing reference levels.

Proposed Contact Current Reference Levels in SC6 (2013)

Frequency (MHz)	Reference Level Basis	Reference Level (I_{RL}), (mA) (rms)		Reference Period
		Uncontrolled Environment	Controlled Environment	
0.003 – 0.10	PNS	$200 f$	$400 f$	Instantaneous*
0.10 – 10	SAR	20	40	Instantaneous*
10 – 110	SAR	20	40	6 minutes

- Frequency, f , is in MHz.
- PNS, peripheral nerve stimulation
- SAR, specific absorption rate

Section 3 Electric fields, Magnetic Fields and Power Density (10 MHz – 6 GHz)

Basic Restrictions

In the frequency range 10 MHz – 6 GHz, the threshold for adverse effects in SC6 (2009) was based upon the avoidance of tissue heating and basic restrictions have been specified for whole-body average SAR and peak spatially-averaged SAR. Since the last revision of SC6 (2009), no new adverse health effects have been established in this frequency range (SCENHIR 2009; ICNIRP 2009; AGNIR 2012). Therefore, the avoidance of thermal effects remains the basis for the basic restrictions in this frequency range.

Recently, the International Agency for Research on Cancer (IARC) classified RF energy as “possibly carcinogenic to humans” (Class 2B) (Baan et al., 2011). The IARC classification on RF fields reflects the fact that some (limited) evidence exists that RF fields may be a risk factor for cancer. This classification was largely based upon epidemiological investigations of brain cancer incidence in cell phone users over time. While the largest of these studies (INTERPHONE Study Group, 2010) found no overall risk among cell phone users, they identified a subset of long-term ‘heavy-users’ in which elevated odd-ratios were observed. It is unclear whether these observations were the result of methodological confounding or represent a true biological effect. The vast majority of supporting scientific information to date, from animal and cellular studies, does not support a link between RF energy exposure and carcinogenesis. Recent studies of national brain cancer incidence rates (Northern Europe, UK, US) have also reported no relative increase in glioma rates over the past 10-15 years, despite a dramatic increase in cell phone users over the same time period (Deltour et al., 2009, 2012; Frei et al., 2011; De Vocht et al., 2011; Little et al., 2012). Such information, while tentative at this time due to a possible delayed latency time for the onset of neoplasms from cell phone use, adds to the weight of evidence that does not support a causal link between cell phone use (and therefore exposure to RF fields in the 900-1900 MHz range) and brain cancer development. At present, no national or international science-based exposure standards have established basic restrictions or reference levels for the avoidance of cancer risks from radiofrequency fields in the frequency range 10 MHz – 6 GHz, as the science supporting this health endpoint is not sufficiently well established.

Based upon the uncertainty surrounding a possible long-term risk of cancer, Health Canada recently updated its advice to cell phone users, describing practical ways of reducing exposure to radiofrequency (RF) energy from these devices (such as reducing call time, using hands-free devices or texting). This advice pertains only to cell phone use and not to RF field exposures from other wireless devices (such as Wi-Fi, Smart Meters, baby monitors), since the intensity and distribution of the RF energy absorbed within the body from these devices are very different than those from cell phones. This is deemed the most appropriate precautionary approach for dealing with the current uncertainty regarding possible long term risks from cell phone use.

As indicated in Section 1, the basic restriction against thermal effects in SC6 (2009) consists of WBA-SAR and peak spatially-averaged SAR limits. The limits outlined for the avoidance of thermal effects in the 100 kHz- 10 MHz range also apply in the 10 MHz- 6 GHz range.

Proposed WBA-SAR and peak spatially-averaged SAR in SC6 (2013):

Exposure Group	Tissue	Frequency range	Peak spatially-averaged SAR (W/kg)	WBA-SAR (W/kg)
SC6- Controlled	Head, trunk	10 MHz - 6 GHz	8	0.4

Environment	Limbs		20	
SC6- Uncontrolled Environment	Head, trunk	10 MHz - 6 GHz	1.6	0.08
	Limbs		4.0	

Since no additional adverse health effects have been established at exposure levels below the basic restrictions specified in SC6 (2009), no changes to the basic restrictions are recommended for SC6 (2013). Since the last revision of SC6 (2009), it is now recognized that when anatomically-derived models of children are used to assess the adequacy of the existing reference levels, the basic restrictions for WBA-SAR may not be respected in the frequency range of body resonance (~100 MHz) and from 1 - 4 GHz for the Uncontrolled Environment for the WBA-SAR limit of 0.08 W/kg (Wang et al., 2006; Dimbylow and Bolch 2007; Conil et al., 2008; Nagaoka et al., 2008; Kühn et al., 2009). For this reason, it is recommended that the reference levels in SC6 (2013) should be re-evaluated in the 10 MHz- 6 GHz frequency range based upon these dosimetric refinements.

Note: Ocular Effects

As mentioned in Section 1, ocular effects on cataractogenesis from intense RF field exposures have been established for many years with a threshold response of ~100-150 W/kg in experimental animals. In previous versions of SC6 (1991, 1999, 2009), basic restrictions and/or recommendations were specified for the local SAR in the eye. This guidance was not based upon the avoidance of cataractogenesis, but rather represented a conservative approach based upon observations of transient lesions in the corneal endothelium of anaesthetized monkeys following exposure to pulsed or continuous-wave 2.45 GHz RF fields at 2.6 W/kg from one laboratory (Kues et al., 1985; 1992). This effect was reported to be enhanced by pre-treatment with the ophthalmic drug timolol maleate, whereby the threshold for effect was reduced to 0.26 W/kg (Kues et al., 1992). A similar study by the same group reported transient changes in electroretinogram activity in conscious monkeys following exposure to 1.25 GHz pulsed RF fields at a SAR of 4.0 W/kg (Kues and Monohan, 1992). However, later studies by Kamimura et al. (1994) and Lu et al., (2000) found no evidence of optical (including corneal) lesions in the eyes of conscious monkeys following exposure to 1.25 or 2.45 GHz RF fields at similar or higher intensities than those employed by Kues et al. (1985, 1992). Lu et al. (2000) did observe changes in the electroretinogram response in conscious monkeys at SARs > 8 W/kg, but the authors noted that these were transient changes and that no pathological changes were observed.

The use of anaesthesia in exposed animals (rabbits and monkeys) has been suggested to have compromised heat dissipation in the eyes of RF exposed animals, potentially leading to an artificially enhanced sensitivity to thermal effects in early RF field studies (Kamimura et al, 1994). This phenomenon was observed by Kojima et al. (2004) and Hirata et al. (2006) in rabbit eyes following exposure to 2.45 GHz RF fields, where markedly increased temperatures were observed in anaesthetized animals compared to non-anaesthetized animals. Observations of corneal lesions and vascular leakage in the eyes of anaesthetized monkeys in early studies in one laboratory were not confirmed in later studies in other laboratories using conscious monkeys.

Overall, there is an inadequate body of scientific evidence upon which to support the causality of adverse health effects of RF fields on the human eye at exposure levels below the peak spatially-averaged SAR limits in SC6 (2013). Despite the widespread use of a variety of consumer devices (e.g. cell phones, push-to-talk radios) over the past 15 years by the general population in Canada and abroad, Health Canada has not received any complaints and is not aware of any ocular injuries that have occurred from RF field exposures at levels below the current basic restrictions on peak spatially-averaged SAR outlined in SC6 (2009). Since the basic restrictions and reference levels in SC6 (2013) are intended to be based upon established adverse health effects, it is not considered scientifically-justifiable to establish basic restrictions or to maintain separate ‘recommendations’ for peak spatially-averaged SAR for the eye, since the available scientific evidence for non-cataractogenic effects on the eye below the current peak spatially-averaged SAR limits in SC6 (2009) is extremely limited, contradictory and not causally-established. A similar conclusion has been established by IEEE C95.1 (2005), ICNIRP (1998) and ICNIRP (2009, 2010).

Health Canada will continue to monitor the scientific literature related to this issue and will revise/create relevant basic restrictions if/when scientifically warranted.

Reference Levels

Recent developments in electromagnetic dosimetry using MRI-derived voxel models of the human body have shown that for certain body dimensions and frequencies, the basic restriction of whole-body SAR may be exceeded for exposure field strengths (or power densities) at reference levels corresponding to SC6 (2009) and ICNIRP (1998). This is shown in Figure 14 and Figure 15 for Uncontrolled- and Controlled-Environments, respectively.

When establishing the proposed Uncontrolled- and Controlled-Environment reference levels, the criteria considered were to harmonize with ICNIRP (1998) where feasible, while ensuring that basic restrictions were maintained at all frequencies. In response to these goals, the proposed Uncontrolled- and Controlled-Environment reference levels were established at levels equal to those of ICNIRP (1998) in the 10 to 65 MHz frequency range. However, for frequencies from 65 - 100 MHz, the proposed reference levels in SC6 (2013) deviate from those of ICNIRP (1998) by decreasing with increasing frequency (at a chosen rate of f^{-1}) to accommodate the dosimetry data that point to greater whole body resonance absorption for children than previously thought (Conil et al., 2008; Kühn et al., 2009; Nagaoka et al., 2008); Dimbylow and Bolch, 2007).

In the 100 MHz to 6 GHz frequency range, the proposed reference levels are allowed to increase with frequency at a rate that provides protection from exceeding basic restrictions for small children in the 2–4 GHz range, as shown by the data in Figures 14 and 15. The uppermost frequency of the sloped line corresponds to 6 GHz, which is the proposed upper limit for consideration of SAR as a basic restriction. The rate of increase with frequency was chosen to be $f^{0.5}$ for power density and $f^{0.25}$ for field strength. The

first frequency break point, 65 MHz, and the reference level value at 100 MHz are consequences of the choice of rates of frequency dependence for the two sloped parts, and the choice of 100 MHz and 6 GHz as beginning and end-points for the positively sloped part of the curve.

The proposed Uncontrolled-Environment reference levels meet the goal of compliance to the basic restrictions, as seen in Figure 14, but the proposed Controlled-Environment reference levels may appear to be slightly over-protective in view of the fact that most of the dosimetry data below the ICNIRP (1998) line in Figure 15 (1-4 GHz range) pertain to small children. However, to take into account that adults of small stature may possibly occupy Controlled-Environments for occupational purposes and for the sake of preserving the 5:1 ratio between Controlled- and Uncontrolled-Environment power density reference levels (2.2:1 for field strengths), it was decided to maintain the same frequency dependence for the two reference level curves.

The dosimetry data in Figures 14 and 15 correspond to the case of an isolated body and worst-case polarization of the incident fields. Usually this occurs when the incident electric field vector is oriented parallel to the long axis of the body. In situations where the body is standing and in good electrical contact with the ground and where the polarization of the incident electric field is vertical (aligned along the long axis of the body), large induced currents can flow through the feet to ground, resulting in relatively high ankle SAR.

Estimates of ankle SAR for the 10 MHz to 100 MHz frequency range can be found in references (Gandhi et al., 1986; Dimbylow, 2002, Tofani et al., 1995; Dimbylow, 2006). From these estimates, the smallest incident electric field strength required to meet the Uncontrolled-Environment basic restriction of 4 W/kg (limbs) for different body sizes is plotted in Figure 16, along with the proposed- and current Uncontrolled-Environment reference levels for electric field strength. It should be noted that the data derived from Dimbylow (2002, 2006) are based on actual peak spatially-averaged SAR (10 g averaged) calculations, while those of Gandhi et al. (1985) and Tofani et al. (1995) are based on the calculation of SAR from ankle currents passing through an effective area of 9.5 cm² [7] (physical ankle cross-sections are closer to 40 cm²). A similar situation occurs in the Controlled-Environment (Figure not shown) since the Controlled-to-Uncontrolled Environment ratio of 5:1 for power, and 2.2:1 for field strength, is maintained.

From Figure 16, it can be observed that the proposed Uncontrolled Environment electric field strength reference levels, along with the current SC6 (2009) and other reference levels, do not protect against excessive limb SAR (SAR in the limbs as averaged over 10 g of tissue) for grounded individuals. However, separate reference levels are specified in SC6 (2013) for contact- and induced-currents that provide protection. Thus, assessment of limb current is an important factor to be considered in compliance assessment with SC6 (2013) in situations where personnel are in contact with a conductive ground and polarization of the incident fields are favourable for the generation of significant limb current.

Proposed Uncontrolled Environment Reference Levels for Electric- and Magnetic-field strength and Power Density in the 10 MHz – 6 GHz frequency range in SC6 (2013).

Frequency (MHz)	Electric Field Strength, E_{RL} (V/m) (rms)	Magnetic Field Strength, H_{RL} (A/m) (rms)	Power Density, S_{RL} (W/m ²)	Reference Period (minutes)
10 – 65	27.5	0.073	-	6
65 – 100	$221 / f^{0.5}$	$0.585 / f^{0.5}$	$129.1 / f$	6
100 – 6000	$6.97 f^{0.25}$	$0.0185 f^{0.25}$	$0.129 f^{0.5}$	6

Frequency, f , is in MHz.

Proposed Controlled Environment Reference Levels for Electric- and Magnetic-field strength and Power Density in the 10 MHz – 6 GHz frequency range in SC6 (2013).

Frequency (MHz)	Electric Field Strength, E_{RL} (V/m) (rms)	Magnetic Field Strength, H_{RL} (A/m) (rms)	Power Density, S_{RL} (W/m ²)	Reference Period (minutes)
10 – 65	61.4	0.163	-	6
65 – 100	$493 / f^{0.5}$	$1.309 / f^{0.5}$	$645.5 / f$	6
100 – 6000	$15.6 f^{0.25}$	$0.0414 f^{0.25}$	$0.6455 f^{0.5}$	6

Frequency, f , is in MHz.

Peak Pulsed RF field levels

SC6 (2009), IEEE C95.1 (2005) and ICNIRP (1998) have all contained provisions to limit the intensity of individual or infrequent RF field pulses. This is to avoid excessive pressure waves in the head from rapid thermo-elastic expansion of tissues caused by absorption of intense RF field pulses (Elder and Chou, 2003). The proposed limits for power density in Tables 5 and 6 of Safety Code 6 (2013) include a note (6) which limits the temporal peak power density for pulsed RF fields (in the 10 MHz – 300 GHz frequency range) to no more than 1000 times the reference level for power density. This provision was included as part of the harmonization effort with the ICNIRP (1998) exposure limits, and replaces the previous guidance on pulsed RF field power density in SC6 (2009). The following analysis demonstrates that the adoption of note 6 in Tables 5 and 6 of SC6 (2013) provides approximately equivalent protection as the specifications for peak power density of pulsed RF fields contained in SC6 (2009).

In Section 2.2.1 of SC6 (2009), the limit for the peak power density was specified as:

$$\sum S_{PK} T_p \leq (S_{RL} * T_a)/5 \quad (\text{Criterion 1})$$

where S_{PK} = peak power density limit

S_{RL} = power density reference level

T_p = pulse duration

T_a = averaging time

and the summation on the left hand side is over 0.1s

Criterion 1 states that the total energy density in any 0.1s period within the averaging time should not exceed one-fifth of the total energy density permitted during the entire averaging time of a continuous field. A maximum of 5 pulses with pulse durations of less than 0.1s are permitted in any period equal to the averaging time. If it is assumed that either a single pulse occurs in the 0.1s period or 5 or fewer pulses occur all having the same amplitude, the criterion for the peak power density, S_{PK} , can be written as:

$$S_{PK} \leq (S_{RL} * 72) / \sum T_p \quad (\text{Criterion 2})$$

Here it is assumed that the frequency range corresponds to the one for which the averaging time is 6 minutes or 360s.

The criterion in note 6 of Tables 5 and 6 of SC6 (2013) can be written as,

$$S_{PK} \leq (S_{RL} * 1000) \quad (\text{Criterion 3})$$

Examination of the Criterion 2 reveals that the allowable peak power density is inversely proportional to the amount of pulse “ON” time in the 0.1s period (given by the term $\sum T_p$). Thus, the criterion for peak power density is the most restrictive (i.e. has the smallest value) when, for a single pulse, the pulse period is the full 0.1s allowed, or in the case of multiple pulses, their “ON” times occupy almost the full 0.1s. In either case the resulting criterion for peak power density becomes: $S_{PK} \leq (S_{RL} * 720)$.

The criterion in note 6 of SC6 (2013) and that in SC6 (2009) become identical for cases where the sum of the pulse periods, $\sum T_p$, is equal to 72 ms, while for smaller pulse periods, note 6 of SC6 (2013) becomes more restrictive. In the worst case, the criterion in note 6 of SC6 (2013), allows 39% higher pulsed power density amplitudes for pulse durations between 72-100 ms, when compared to the criterion in SC6 (2009). However, the proposed provisions in SC6 (2013) still provides several orders of magnitude of protection against the pressure wave effect (Elder and Chou, 2003).

Section 4 Electric fields, Magnetic Fields and Power Density (6 GHz – 300 GHz)

Basic Restrictions

In the frequency range from 6 - 300 GHz, since measurements of whole-body SAR and peak spatially-averaged SAR are not readily achievable or appropriate due to the superficial nature of energy deposition within tissue, reference levels for electric- and magnetic-fields and power density form the basis of the human exposure limits in this frequency range. Since the last revision of SC6 (2009), no new health effects have been established in this frequency range (SCENHIR 2009; ICNIRP 2009). Therefore, the avoidance of thermal effects remains the basis for the reference limits in this frequency range and no changes in the basic restrictions are required.

Reference Levels

The proposed reference levels for RF fields in the 6 – 300 GHz range remain unchanged from SC6 (2009).

Proposed Uncontrolled Environment Reference Levels for Electric- and Magnetic-field strength and Power Density in the 6 – 300 GHz frequency range in SC6 (2013).

Frequency (GHz)	Electric Field Strength, E_{RL} (V/m) (rms)	Magnetic Field Strength, H_{RL} (A/m) (rms)	Power Density, S_{RL} (W/m ²)	Reference Period (minutes)
6 – 15	61.4	0.163	10	6
15 – 150	61.4	0.163	10	$616000 / f^{1.2}$
150 – 300	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000 / f^{1.2}$

Frequency, f , is in MHz.

Proposed Controlled Environment Reference Levels for Electric- and Magnetic-field strength and Power Density in the 6 – 300 GHz frequency range in SC6 (2013).

Frequency (GHz)	Electric Field Strength, E_{RL} (V/m) (rms)	Magnetic Field Strength, H_{RL} (A/m) (rms)	Power Density, S_{RL} (W/m ²)	Reference Period (minutes)
6 – 15	137	0.364	50	6
15 – 150	137	0.364	50	$616000 / f^{1.2}$
150 – 300	$0.354 f^{0.5}$	$9.40 \times 10^{-4} f^{0.5}$	$3.33 \times 10^{-4} f$	$616000 / f^{1.2}$

Frequency, f , is in MHz.

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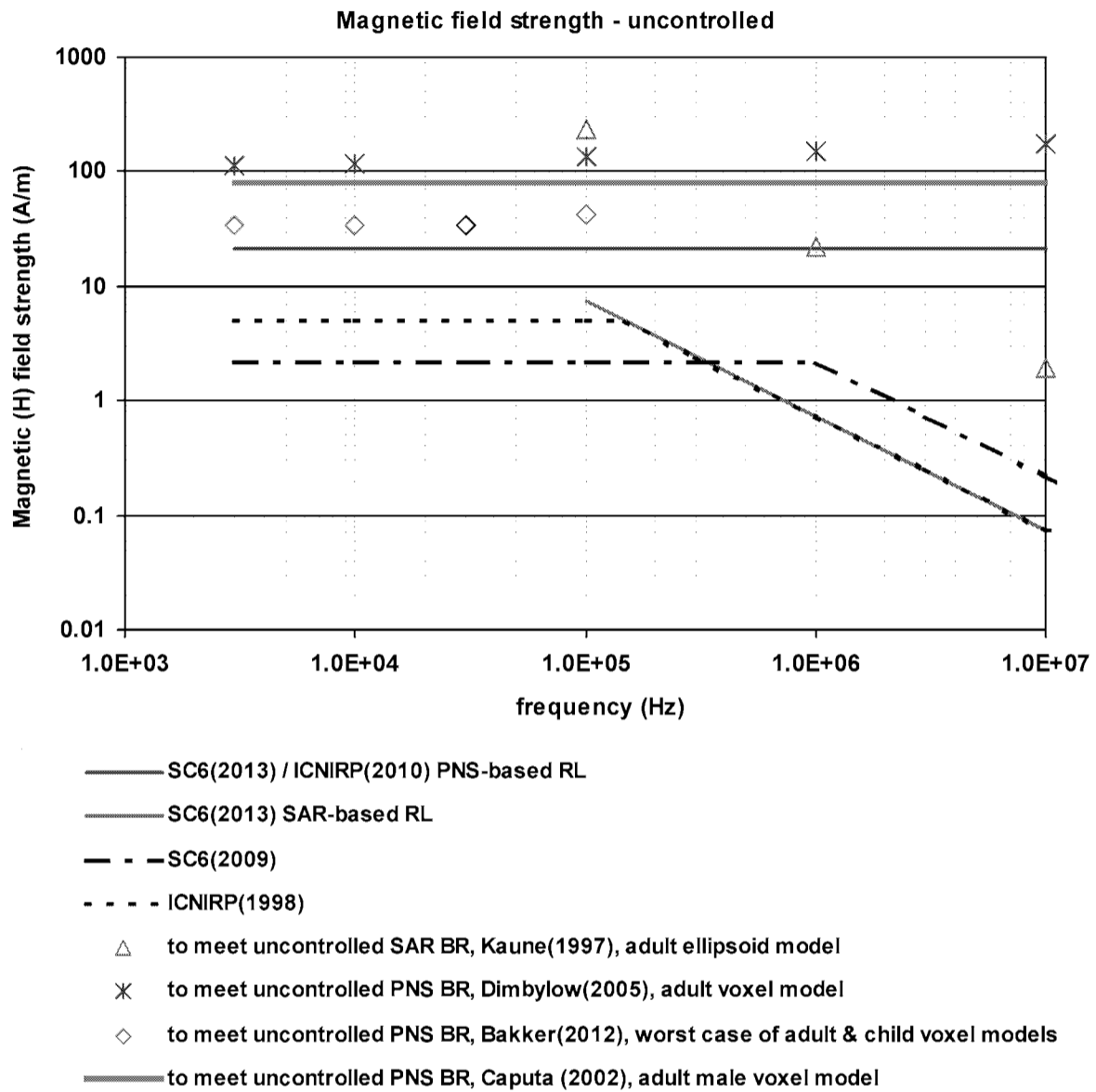


Figure 1. Proposed magnetic field strength reference levels for Uncontrolled Environments in SC6 (2013) and magnetic field strengths required to meet the PNS and/or SAR-based Uncontrolled Environment basic restrictions in SC6 (2013) (in various numerical models exposed under worst-case conditions).

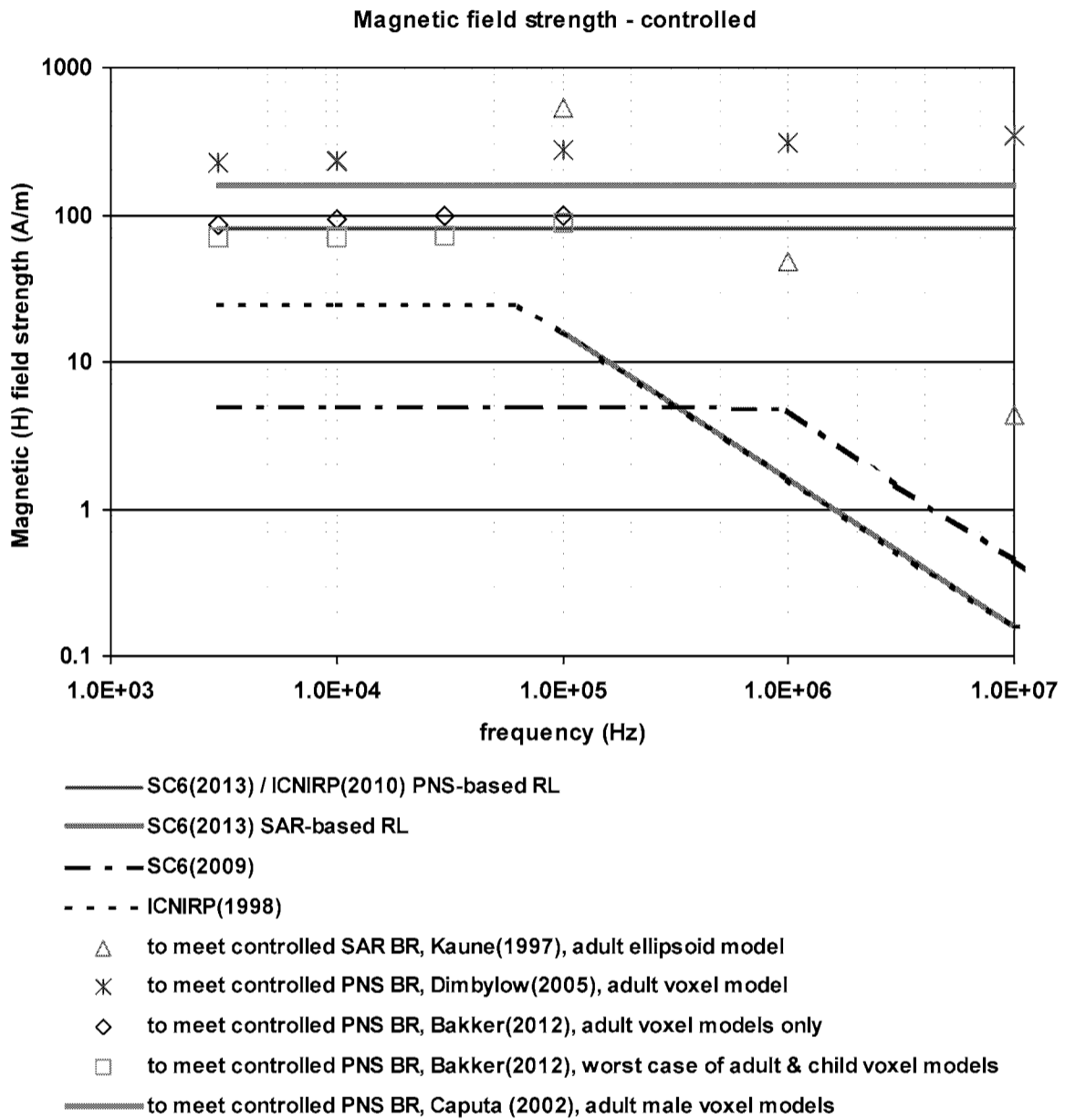


Figure 2. Proposed magnetic field strength reference levels for Controlled Environments in SC6 (2013) and magnetic field strengths required to meet the PNS and/or SAR-based Controlled Environment basic restrictions in SC6 (2013) (in various numerical models exposed under worst-case conditions).

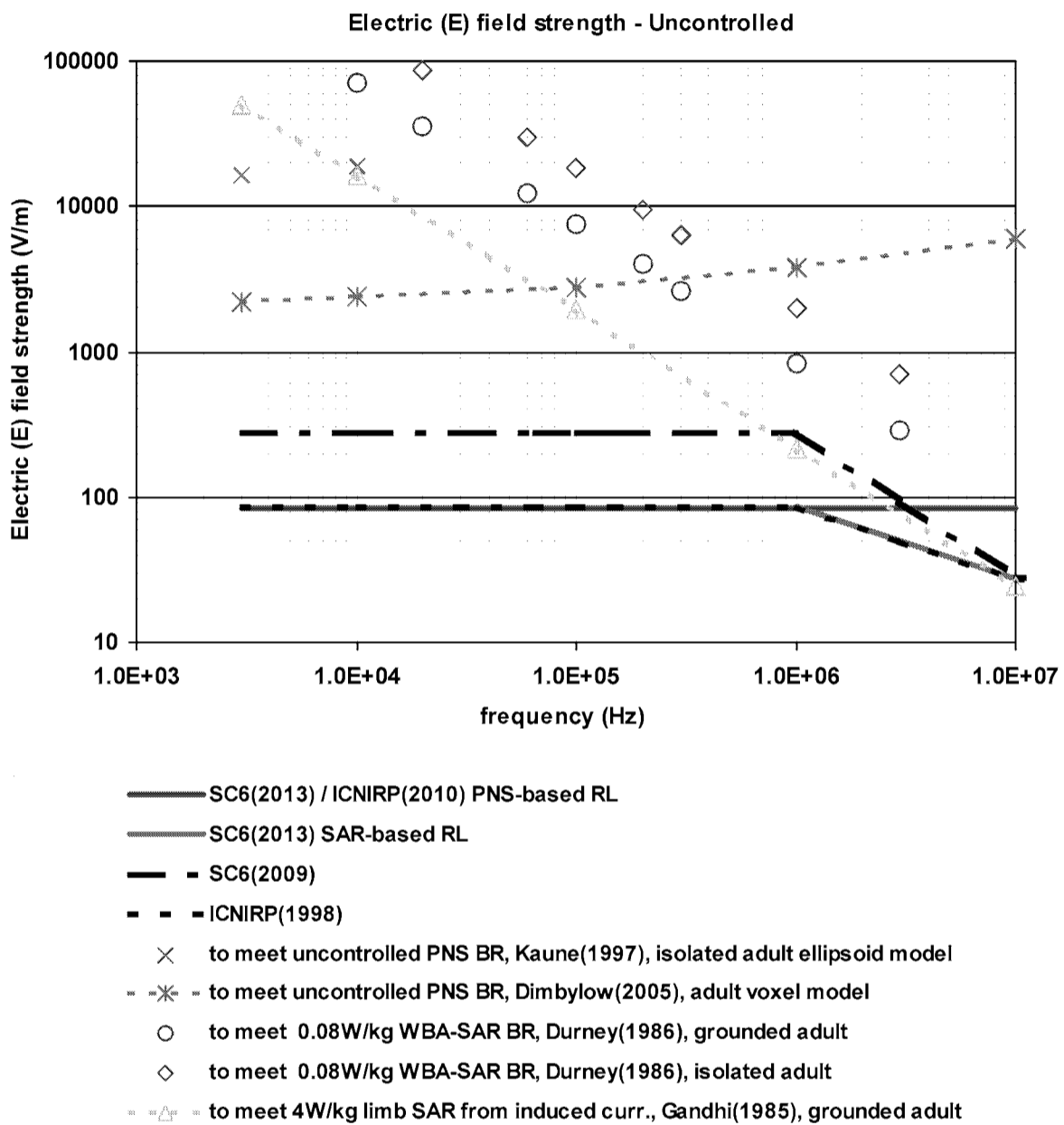


Figure 3. Proposed electric field strength reference levels for Uncontrolled Environments in SC6 (2013) and electric field strengths required to meet the PNS- and/or SAR-based Uncontrolled Environment basic restrictions in SC6 (2013) (in various numerical models exposed under worst-case conditions).

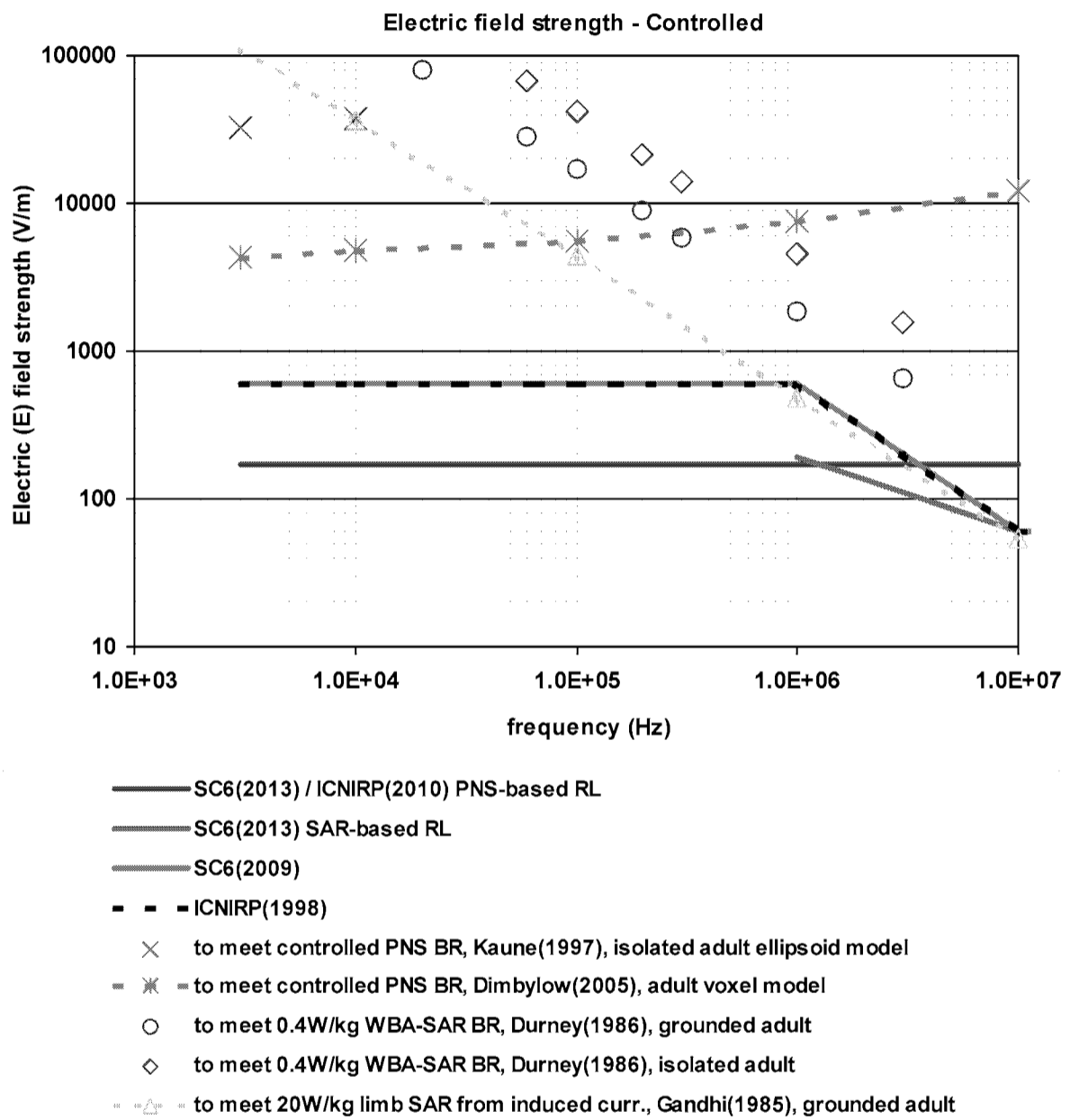


Figure 4. Proposed electric field strength reference levels for Controlled Environments in SC6 (2013) and electric field strengths required to meet the PNS- and/or SAR-based Controlled Environment basic restrictions in SC6 (2013) (in various numerical models exposed under worst-case conditions).

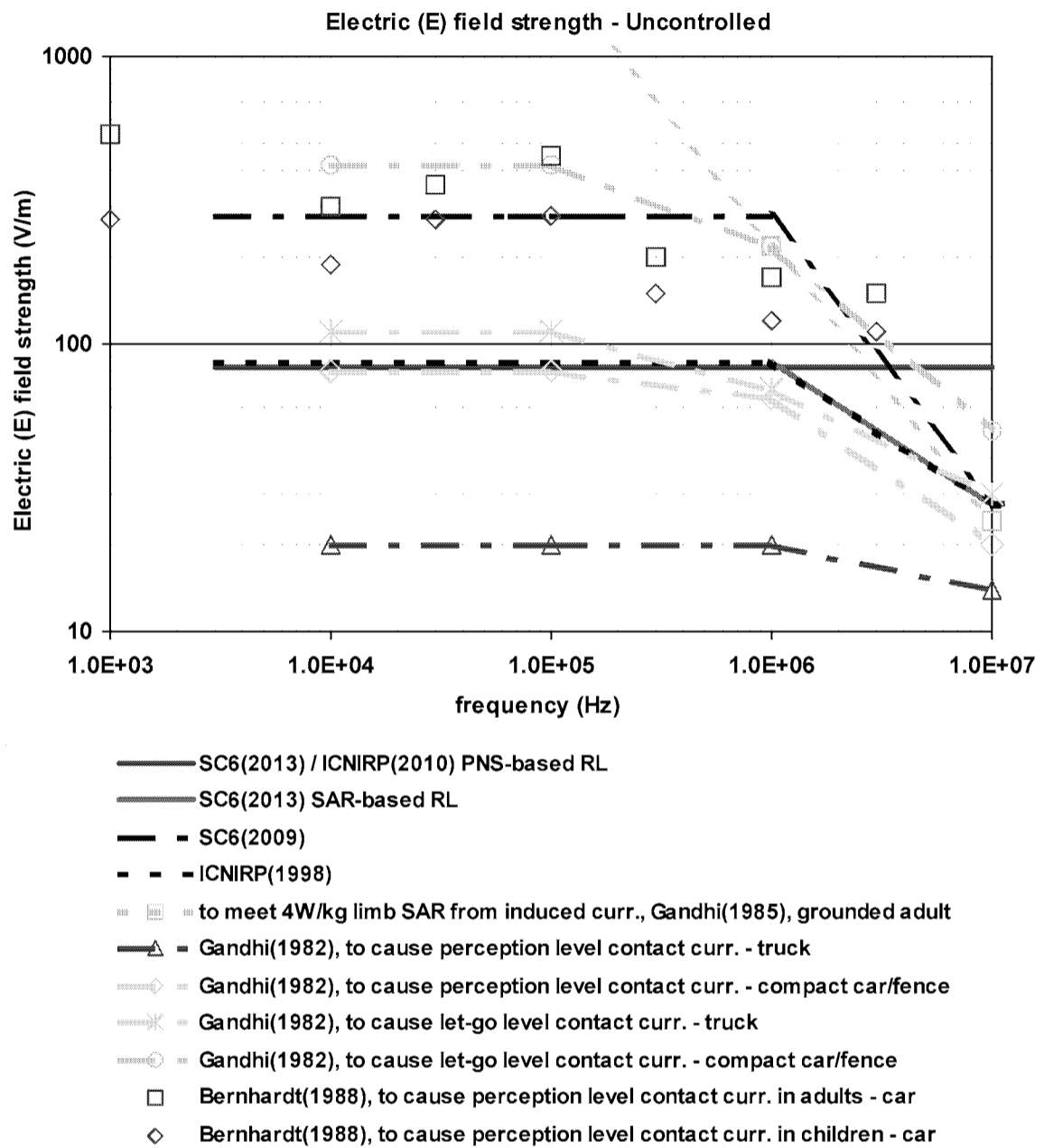


Figure 5. Proposed electric field strength reference levels for Uncontrolled Environments in SC6 (2013) and electric field strengths of sufficient intensity to cause perception-level and let-go level contact currents for different objects under worst-case conditions.

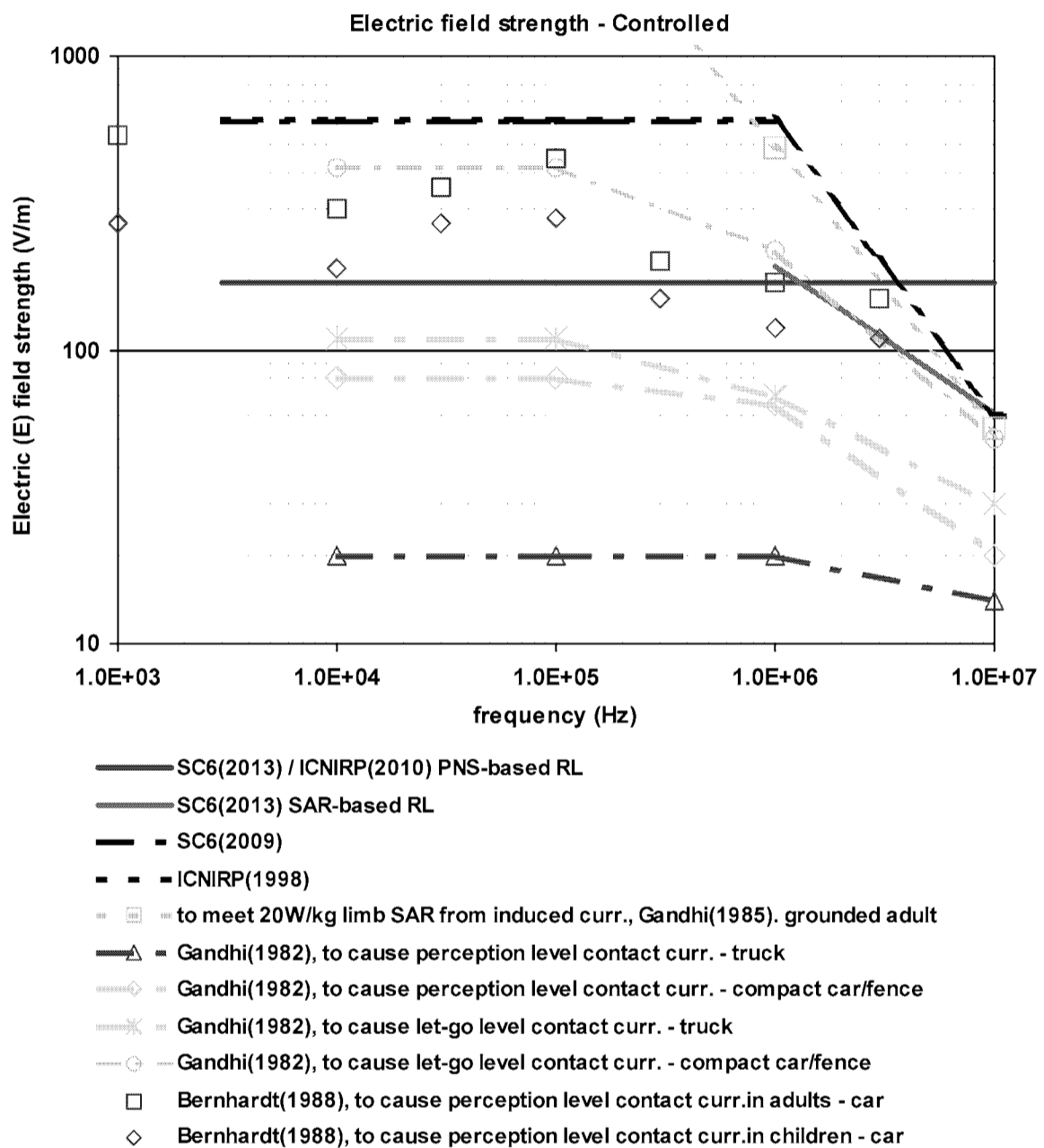


Figure 6. Proposed electric field strength reference levels for Controlled Environments in SC6 (2013) and electric field strengths of sufficient intensity to cause perception-level and let-go level contact currents for different objects under worst-case conditions.

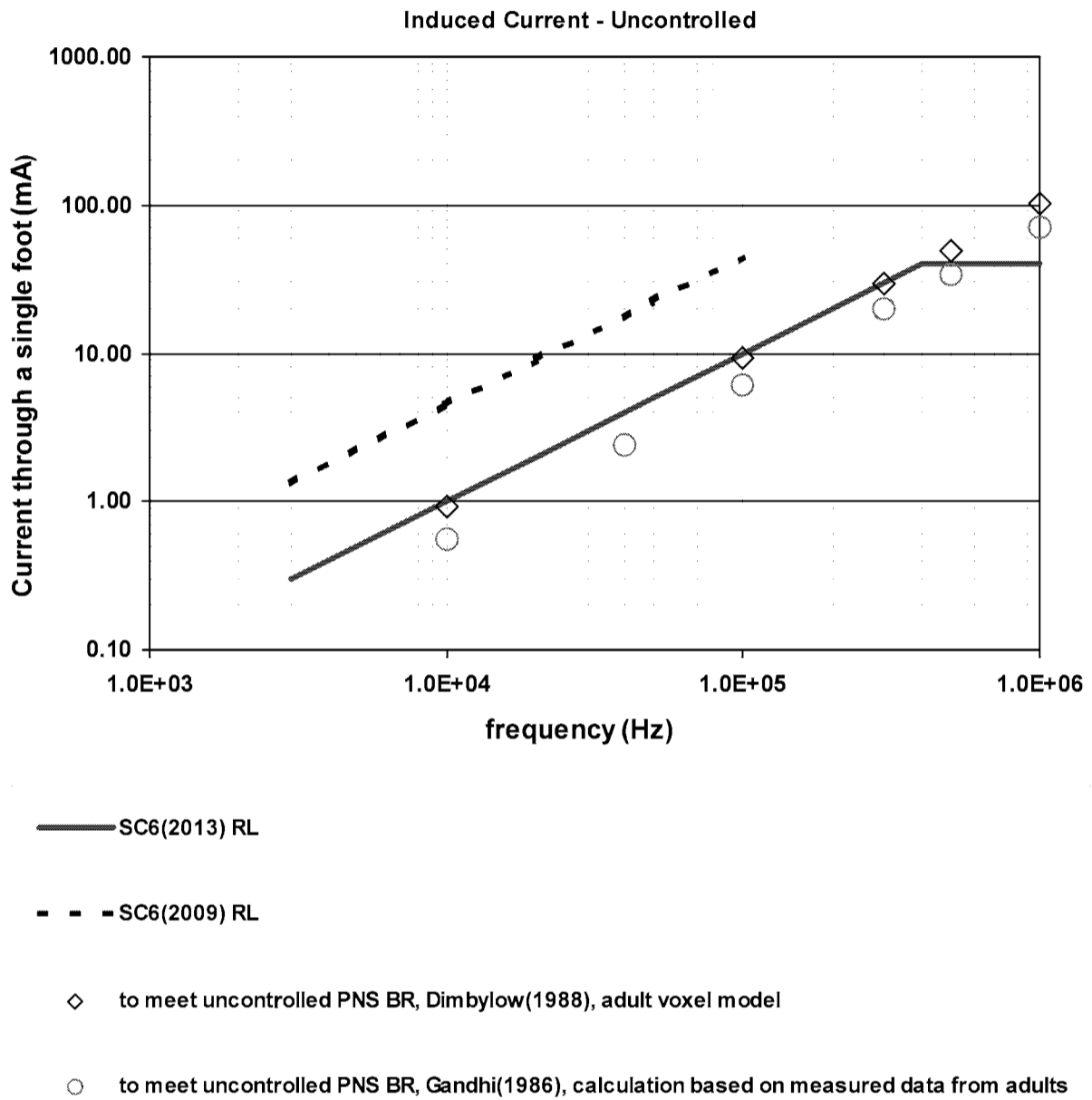


Figure 7. Proposed induced current reference levels for Uncontrolled Environments for the frequency range 3 kHz to 1 MHz in SC6 (2013). Also shown are estimates of induced current required to meet the Uncontrolled Environment basic restriction for induced electric field.

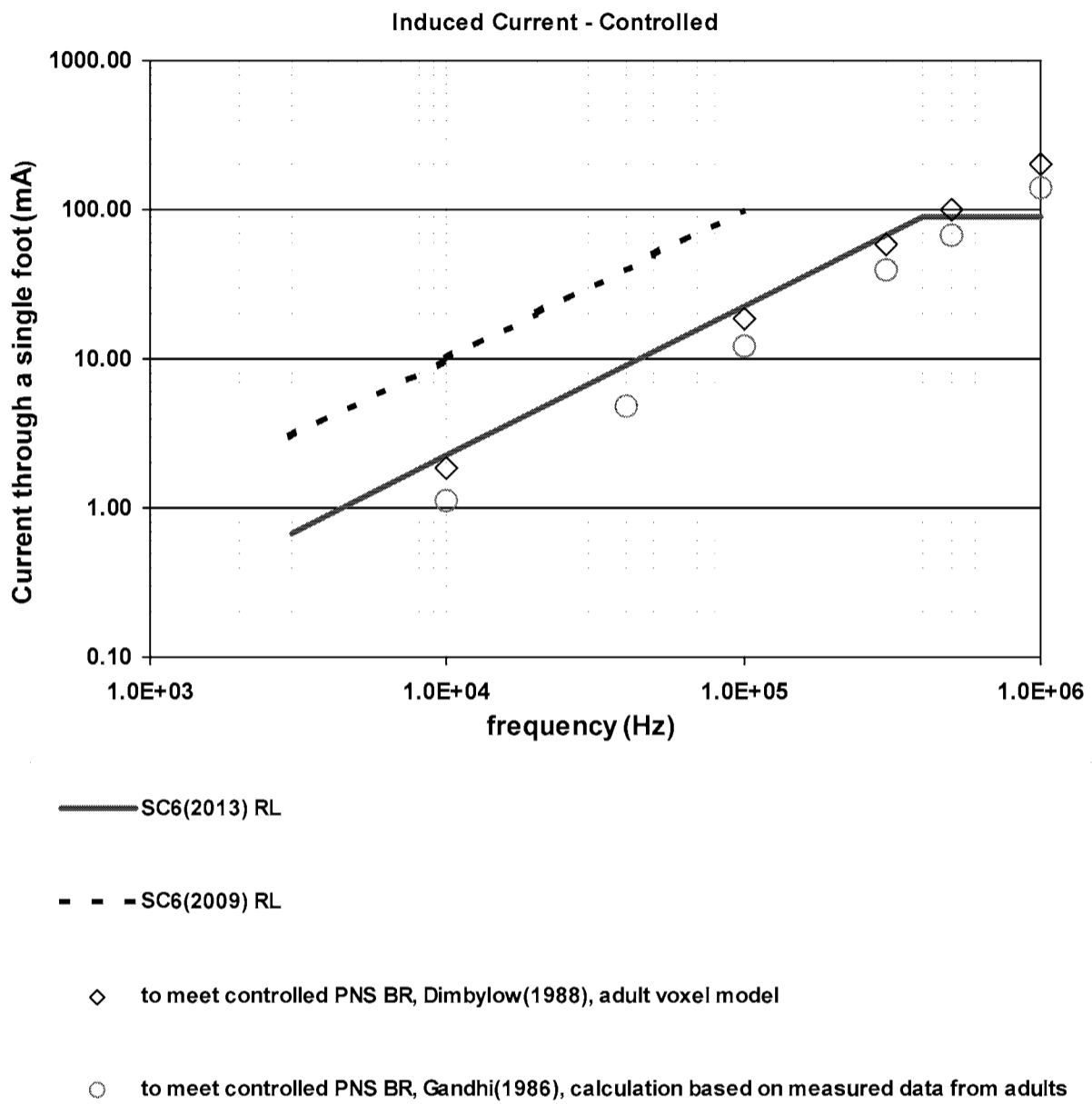


Figure 8. Proposed induced current reference levels for Controlled Environments for the frequency range 3 kHz to 1 MHz in SC6 (2013). Also shown are estimates of induced current required to meet the Controlled Environment basic restriction for induced electric field.

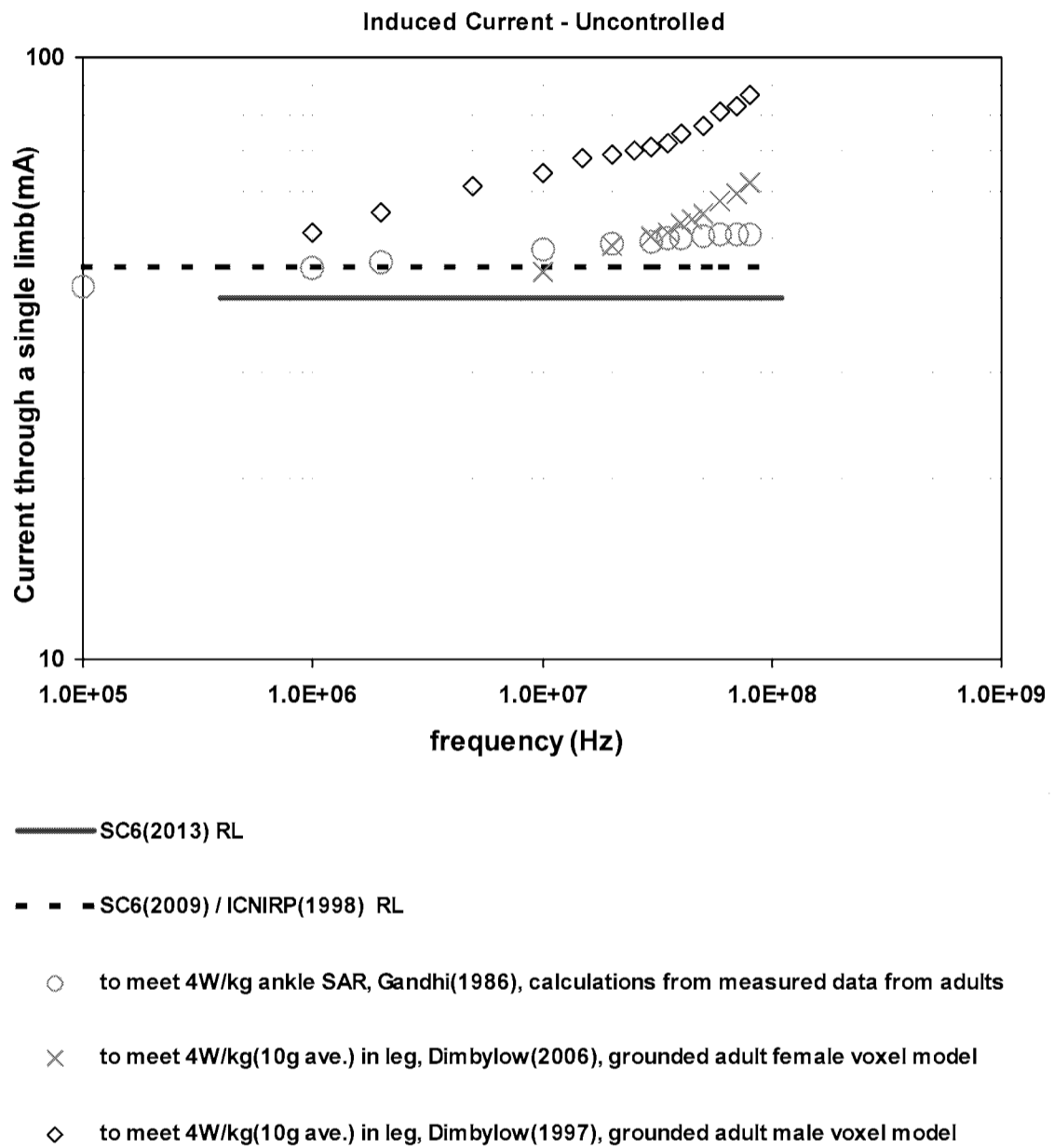


Figure 9. Proposed induced current reference levels for Uncontrolled Environments for the frequency range 400 kHz to 10 MHz in SC6 (2013). Also shown are estimates of induced current required to meet the Uncontrolled Environment basic restriction for peak spatially-averaged SAR in the limbs (4 W/kg averaged over 10 g).

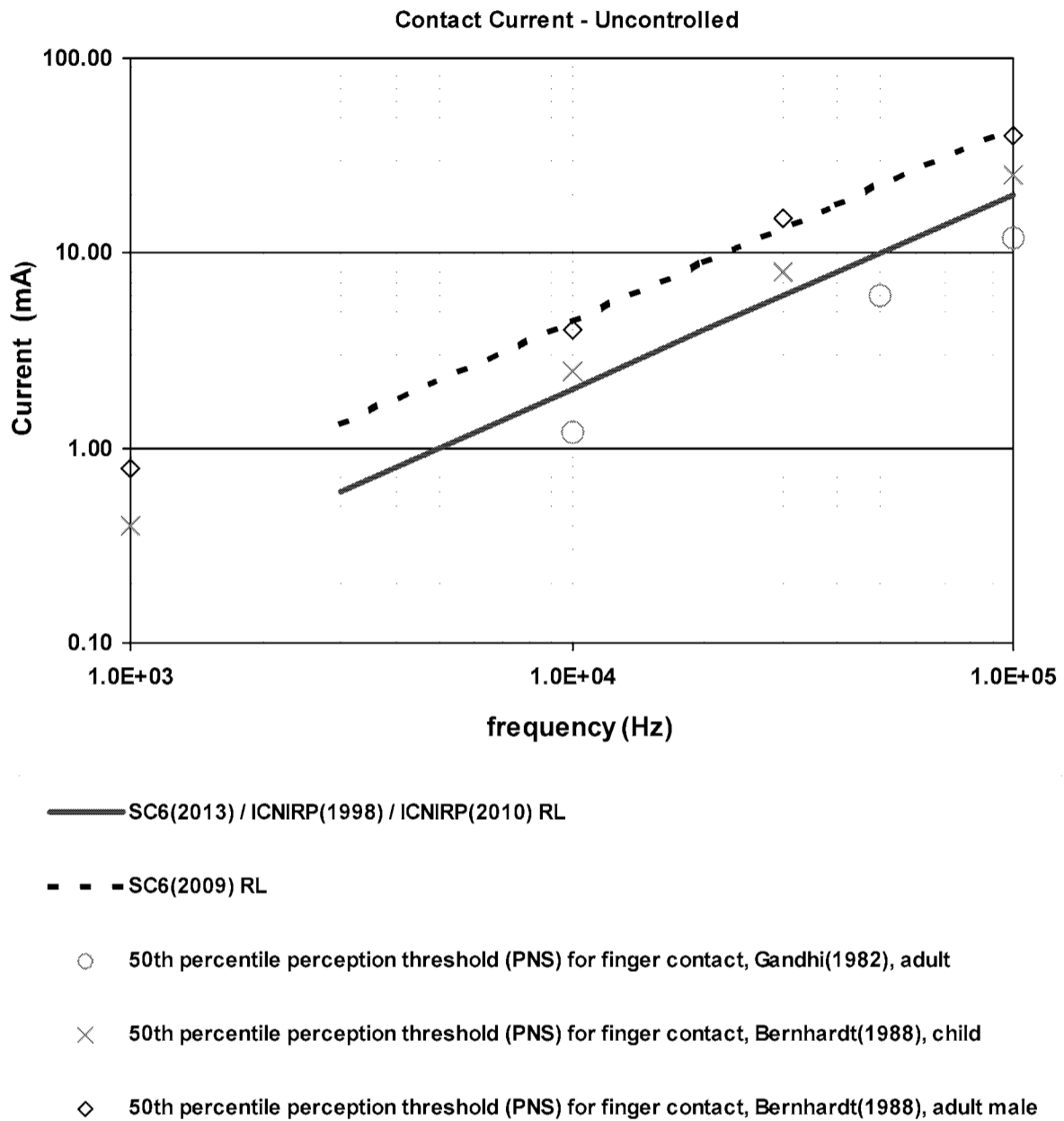


Figure 10. Proposed Uncontrolled-Environment contact current reference levels for the 3 - 100 kHz frequency range in SC6 (2013). Also depicted are the 50th percentile perception threshold currents (adult and children) for finger contact.

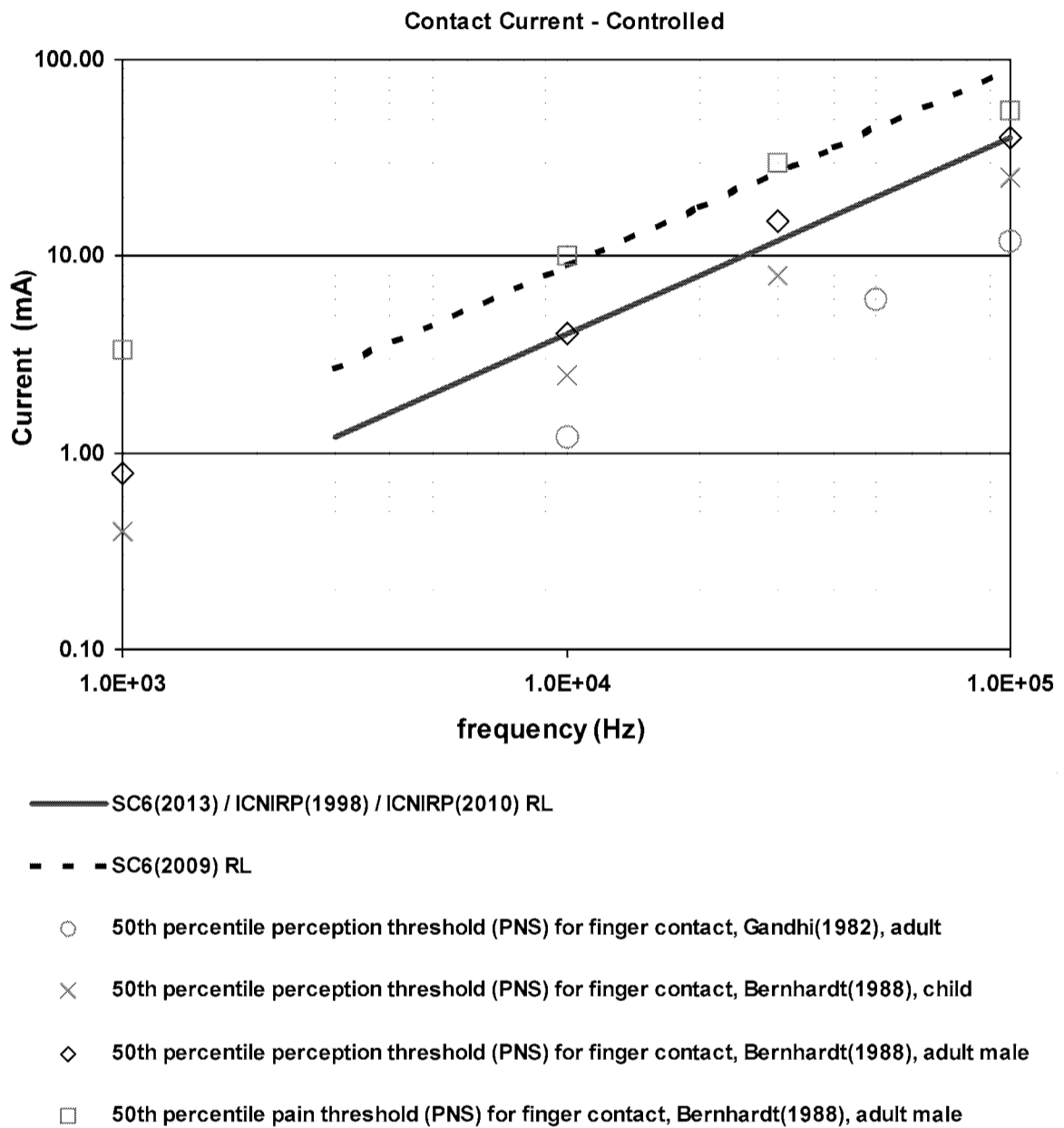


Figure 11. Proposed Controlled-Environment contact current reference levels for the 3 - 100 kHz frequency range in SC6 (2013). Also depicted are the 50th percentile perception threshold currents (adult and children) for finger contact.

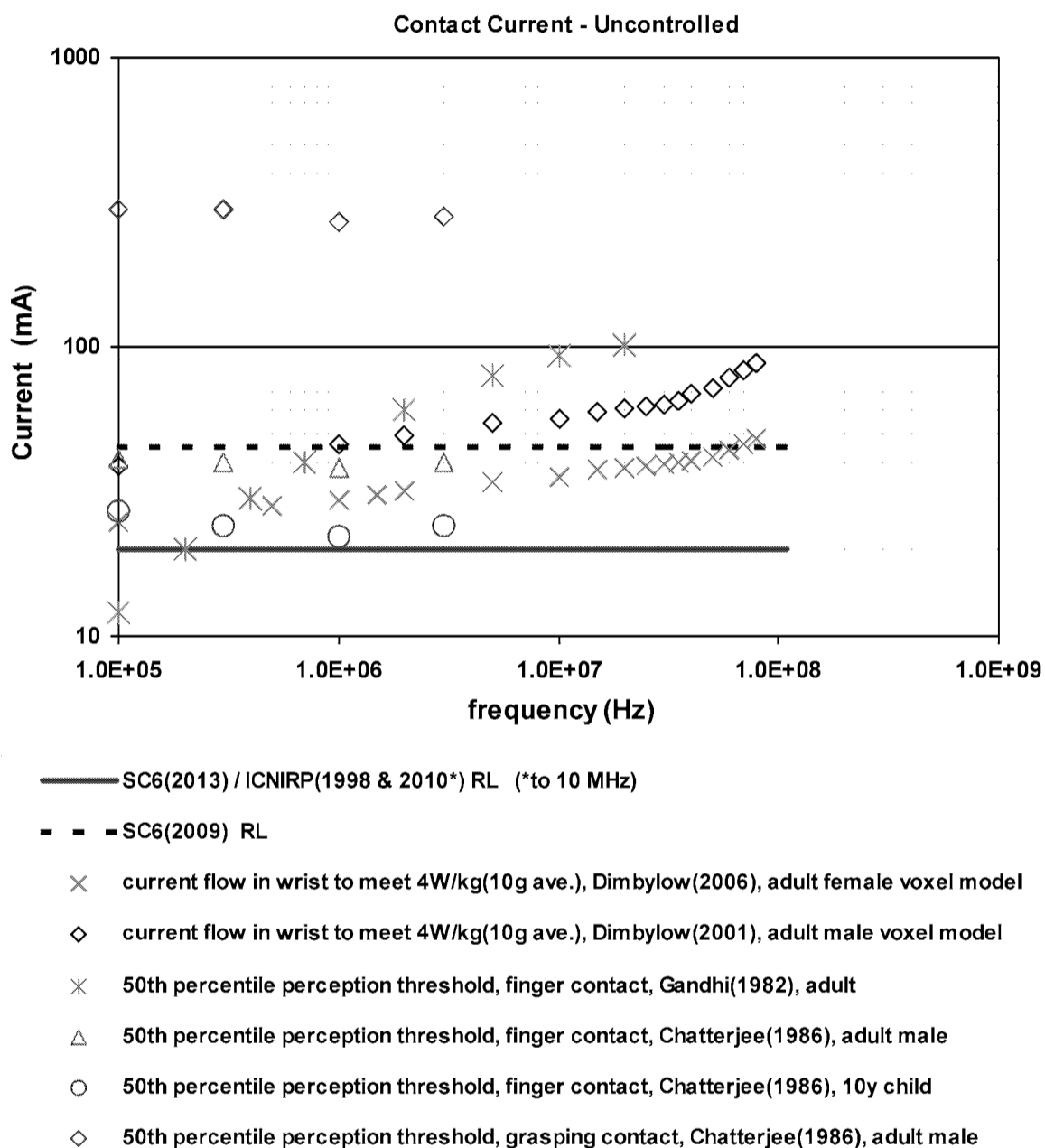


Figure 12. Proposed Uncontrolled-Environment contact current reference levels in SC6 (2013) in the 100 kHz – 110 MHz frequency range. Also plotted are the 50th percentile perception currents for finger-contact for adults and children, and the contact currents flowing in the wrist required to meet the basic restriction on peak spatially-averaged SAR in the limbs of 4 W/kg averaged over 10 g.

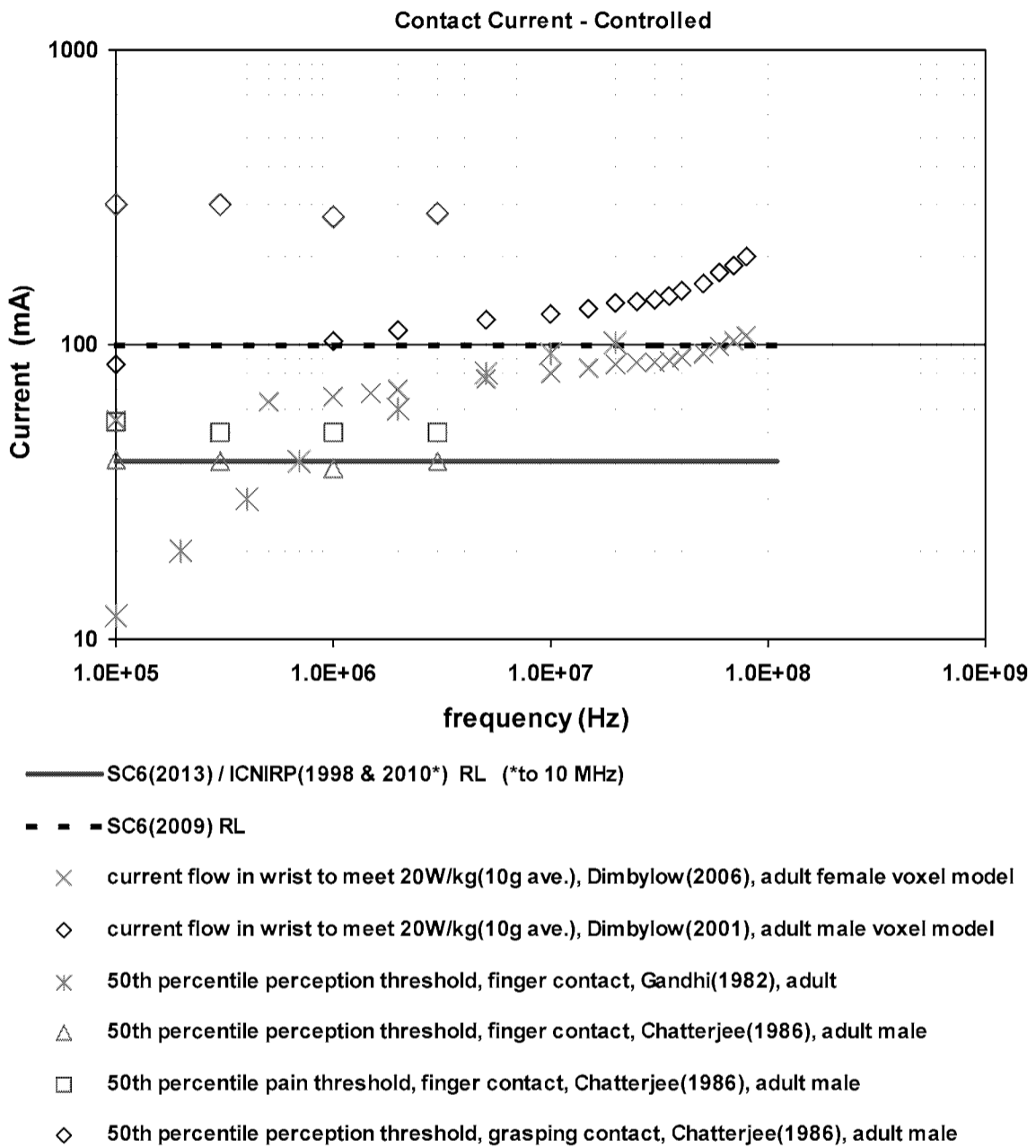


Figure 13. Proposed Controlled-Environment contact current reference levels in SC6 (2013) in the 100 kHz – 110 MHz frequency range. Also plotted are the 50th percentile perception currents for finger-contact for adults and children, the pain threshold for adults for finger contact, and the contact currents flowing in the wrist required to meet the basic restriction on peak spatially-averaged SAR in the limbs of 20 W/kg averaged over 10 g.

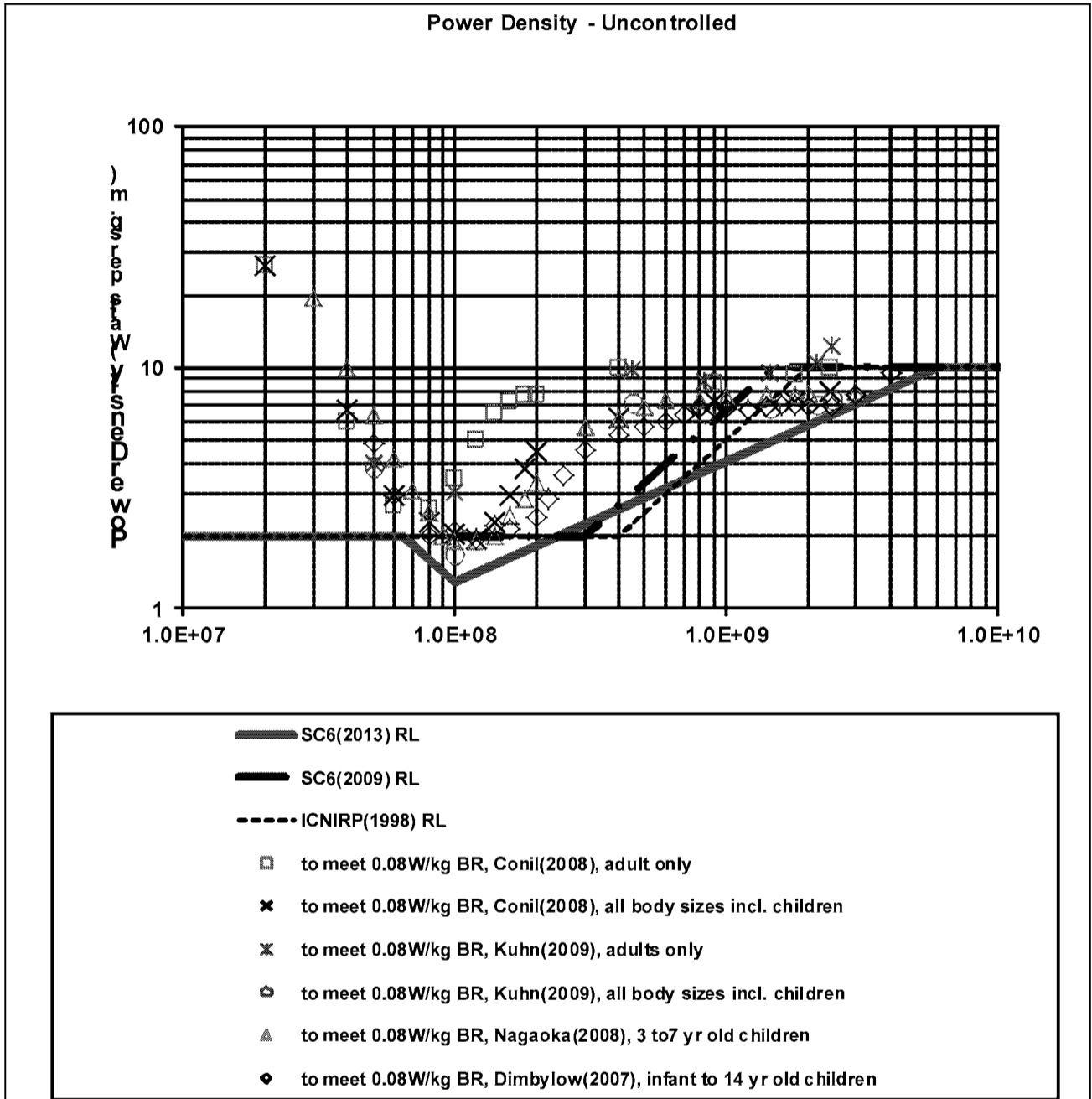


Figure 14. Proposed- and current SC6 Uncontrolled-Environment reference levels for Power Density with respect to frequency. Also shown is the amount of equivalent plane-wave power density required to produce a WBA-SAR of 0.08 W/kg for various body sizes including children and infants as young as 9 months old. These results are based on computational modelling using MRI-based whole-body voxel models.

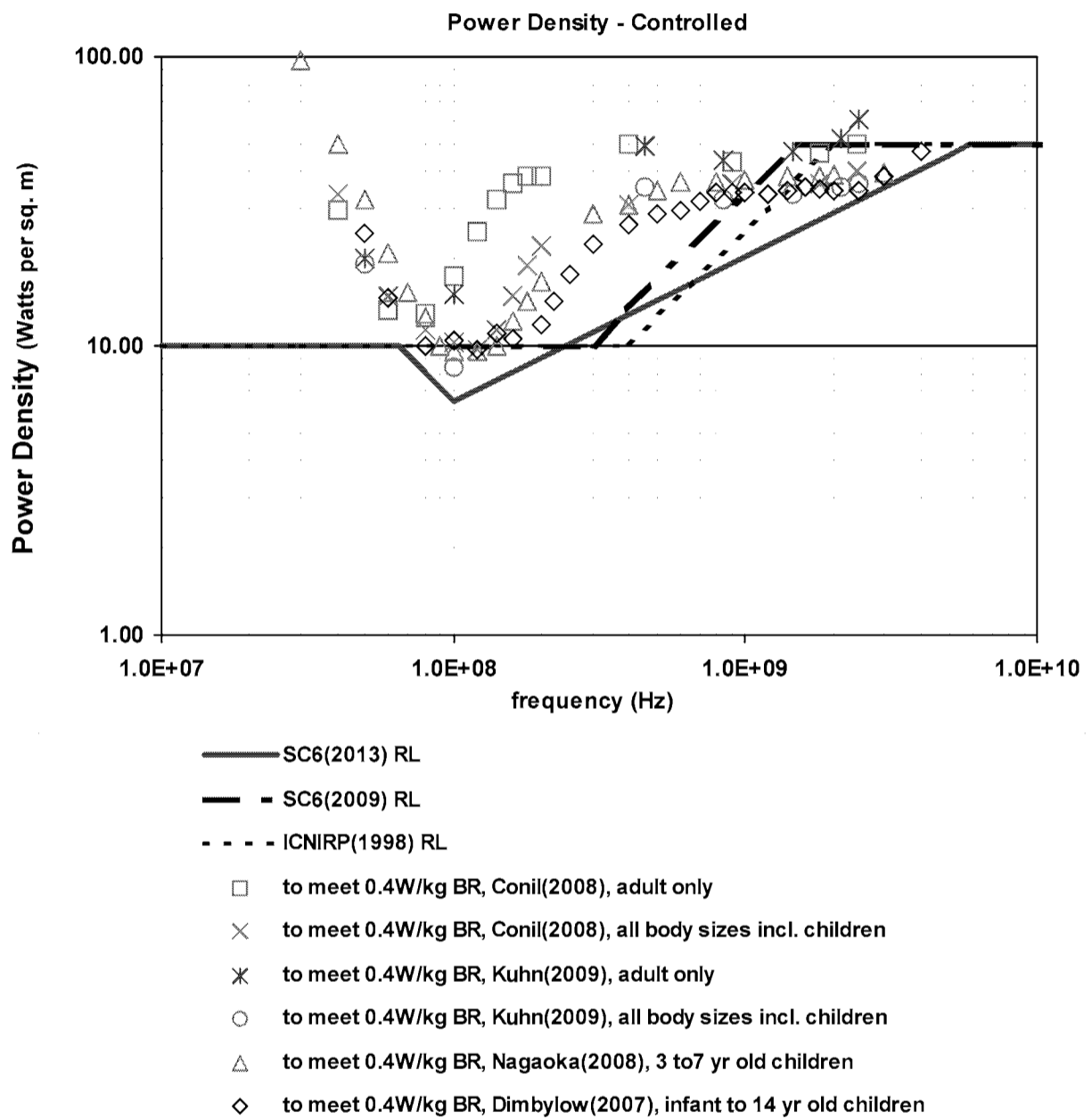


Figure 15. Proposed- and current SC6 Controlled-Environment reference levels for Power Density with respect to frequency. Also shown is the amount of equivalent plane-wave power density required to produce a WBA-SAR of 0.4 W/kg for various body sizes including children and infants as young as 9 months old. These results are based on computational modelling using MRI-based whole-body voxel models.

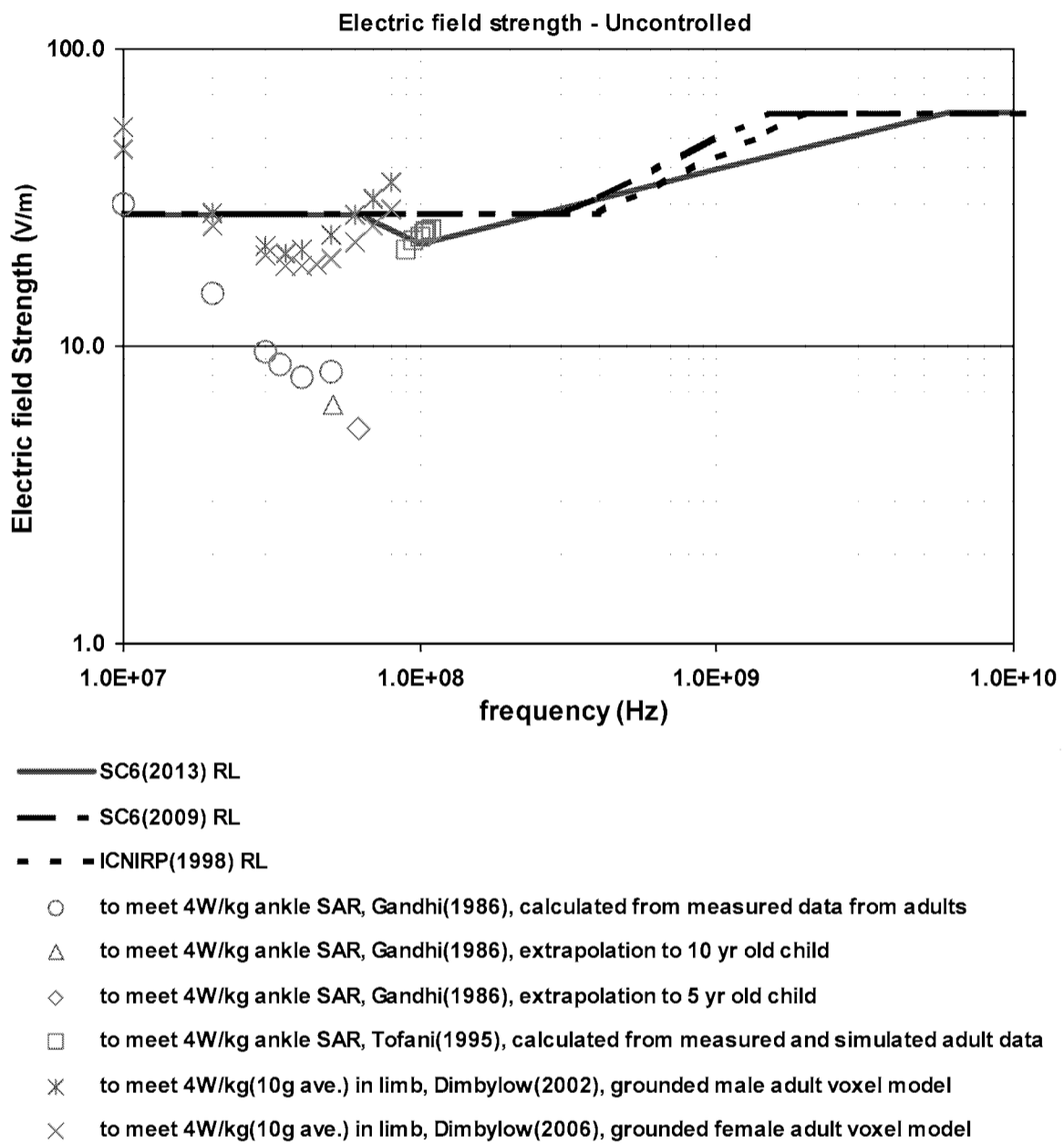


Figure 16. Proposed Uncontrolled Environment electric field strength reference levels and electric field strengths (vertically polarized, plane-wave) of sufficient intensity to produce limb SAR that meet the Uncontrolled Environment basic restriction of 4 W/kg in SC6 (2013).

Addendum to SC6 Rationale (2014)

Update of Uncontrolled Reference levels, 10 MHz – 6 GHz

As pointed out in the 2013 RSC Expert panel review, for specific circumstances, the proposed SC6 2013 reference levels did not provide the 50-fold margin of safety for all population sub-groups in all exposure situations, as originally thought. In other words, meeting the reference levels for these specific cases did not assure compliance with the SC6 (2013) basic restrictions. It was shown that the proposed reference levels needed revision in two general areas:

- 1) *Arms up posture and Grounded, Whole-body Resonance*: Refers to subjects standing on the ground with their arms held vertically in the air and exposed to a plane wave from the front, where the electric field is aligned with the long axis of the body (Lee & Choi, 2012). In this exposure scenario, the whole-body SAR basic restrictions are exceeded at power density exposure levels below the proposed SC6(2013) reference levels in the frequency range where grounded, whole-body resonance occurs for subjects from 1 yr to 20 years old (approximately 30 -90 MHz).
- 2) *Isolated, Newborn Model*: In this scenario, a newborn female voxel model (height= 48.7 cm, mass=3.5 kg) is exposed to a variety of plane wave polarizations under isolated conditions. Calculations showed that the whole-body SAR basic restrictions are exceeded at power density exposure levels below the proposed SC6(2013) reference levels in the frequency ranges from 200-450 MHz and 700-1500 MHz.

As per the recommendations of the RSC Expert Panel, the field strength and power density reference levels in the frequency range 10 MHz to 6 GHz were revised to accommodate these exposure circumstances and are shown (as power density versus frequency) in Figure A-1. Also shown in the figure are various calculations of the power density required to yield the basic restriction for WBA-SAR in an uncontrolled environment derived from the dosimetric calculations published in the literature referenced in the RSC report. The formulas for calculating the revised reference levels as a function of frequency are given at the end of this addendum. Further details of the rationale for arriving at the revised reference levels are given below.

Whole-body Resonance, Children and Adults

As explained above, the term “whole-body resonance” is used to describe the peak in whole-body SAR versus frequency when the electric field is aligned along the long axis of the body (i.e. from head to toes). Whole-body resonance occurs for the whole continuum of proximities to the ground (i.e. from being completely isolated to standing directly on the ground). Generally, for the same subject, WBA-SAR at resonance is higher and the resonance frequency is lower for grounded conditions as opposed to isolated conditions. Whole-body resonance frequencies are dependent on the height of the subject and on grounding conditions. Taller subjects have lower resonance frequencies than shorter ones and grounded subjects of the same height have lower resonance frequencies than isolated ones. For the range of body sizes in the human population (tall adults to newborn infants) and the different possible grounding conditions, the range of resonance frequencies varies from approximately 35 MHz to over 200 MHz.

Since the coupling of RF power into the body is strong at whole-body resonance, the frequency range over which it occurs has the lowest external field strength reference levels. In addition to limiting WBA-SAR, the spatial peak SAR (averaged over 10 g) in the lower limbs is of concern for grounded, whole-body resonance. Induced current limits are specified for this purpose and were assumed (perhaps without sufficient supporting data) to protect also against non-compliance with the WBA-SAR basic restriction. With new data available from Hirata et al. (2012), this assumption was tested and is described further on within this addendum.

WBA-SAR and external field reference levels:

In the RSC Expert panel report, studies were described that indicated that exposures at the proposed SC6 (2013) reference levels in the whole-body resonance frequency range would be non-compliant with the WBA-SAR basic restrictions for children and adults under different exposure scenarios. The following table summarizes these findings:

Table A-1: RSC Expert Panel findings in the whole-body resonance frequency range:

Reference	Subject(s)	Condition	Posture	Non-compliance
Dimbylow (2002)	5yr, 10yr	grounded	Normal standing	Marginal
Findley (2009)	7yr	isolated	Standing, arms up	Marginal
Lee and Choi (2012)	7yr, adult	isolated	Standing, arms up	Marginal
Lee and Choi (2012)	1yr, 5yr, 7yr, adult	grounded	Standing, arms up	Significant

(Note: in the above table, the term “marginal” implies a level of non-compliance to the WBA-SAR basic restriction of 10 % or less)

The last scenario, that of grounded subjects standing with arms up, suggests that the proposed SC6 (2013) reference levels should be revised. The data for the worst case amongst the different ages (i.e. lowest incident power density to produce the WBA-SAR basic restriction) for grounded, arms up (row 4 in Table A-1) is plotted in Figure A-1. Also plotted in Figure A-1 is data from Findley (2009) for a grounded 7yr with arms up posture. This data was not highlighted in the RSC report, but appears to corroborate the data in Lee and Choi (2012).

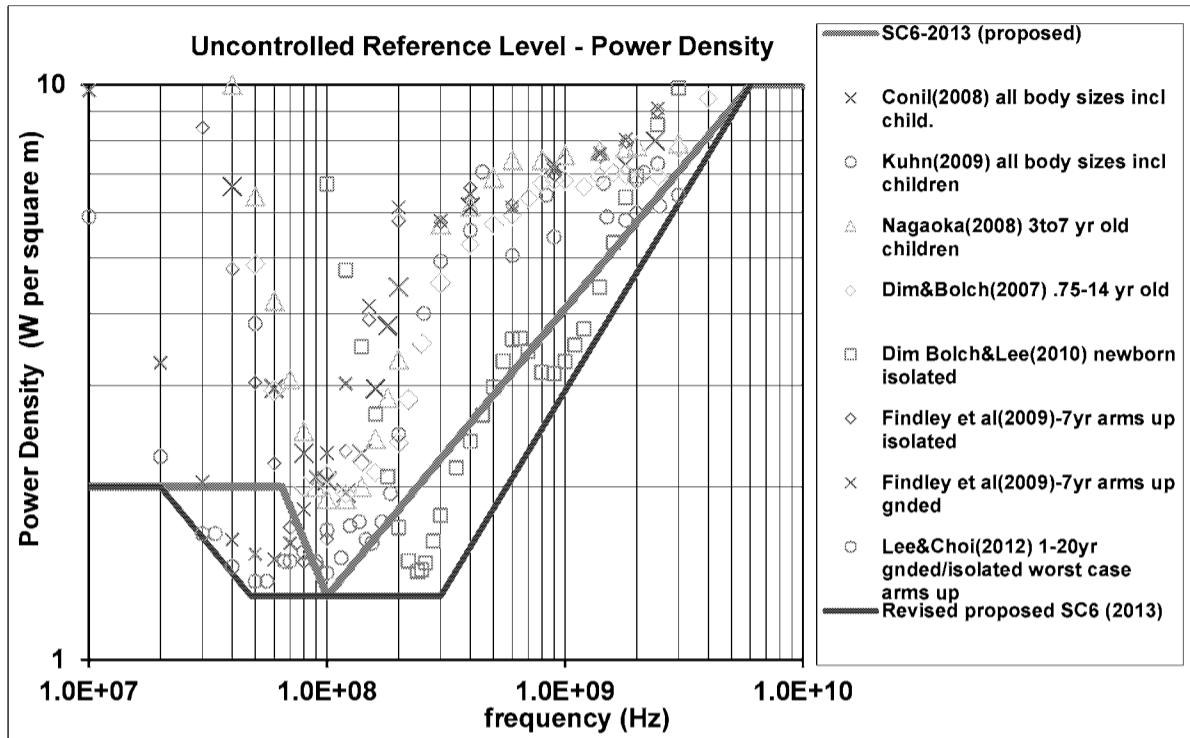


Figure A-1, Plane-wave power densities necessary to produce the WBA-SAR basic restriction of 0.08 W/kg in different voxel models under various exposure conditions. Also plotted are the originally proposed SC6 (2013) uncontrolled power density reference levels (grey line) and the revised power density reference levels (red line) resulting from suggestions made in the RSC report.

Lee and Choi (2012) show from their calculations that for the same aged voxel model, the “arms up” posture has the effect of increasing the WBA-SAR for the same incident power density and slightly decreasing the whole-body resonance frequency. The data in both Lee and Choi (2012), Findley et al. (2009) and others confirm that WBA-SARs at the whole-body resonance frequency are greatest for grounded conditions as opposed to isolated conditions.

The question therefore arises as to what other postures may possibly increase the resonant WBA-SAR further? Some clarity on this question is found in Hirata et al. (2012) where an empirical relationship between the WBA-SAR at grounded, whole-body resonance and body mass index (BMI) is derived. Their analysis shows that the ratio of the WBA-SAR to incident power density (at grounded, whole-body resonance) is directly proportional to the square of the individuals height divided by his or her body mass. Since BMI is defined as the mass divided by the square of the height, the maximum WBA-SAR attained at grounded, whole-body resonance is entirely proportional to the inverse of the BMI. This would suggest that thin individuals (low BMI) have the highest WBA-SARs at resonance per unit incident power density than heavier persons of the same height.

This relationship also helps to explain the results of Lee and Choi (2012), since raising the arms can be seen as a means of increasing the overall body height without increasing the mass (i.e. lowering the effective BMI). In terms of answering what other postures may increase the WBA-SAR at grounded

resonance, the relationship observed by Hirata et al. (2012) suggests that postures that reduce the overall height are likely to reduce the WBA-SAR and that the posture with arms up is likely the worst-case scenario.

Having a formula for predicting the WBA-SAR for grounded, whole-body resonance allows the use of population BMI statistics to predict an upper bound WBA-SAR for a given percentile of the population's BMI distribution. Hirata et al. (2012) presents the upper bound of WBA-SAR per incident power density level for the 2.5th percentile of the Japanese population versus age (Figure 8 in Hirata 2012). The ages with the lowest BMI are in the 5yr to 7yr age range and result in an upper bound of approximately 0.06 W/kg per W/m². This value, when translated to a power density reference level, implies that over the grounded whole-body resonance frequency range and with an "arms down" posture, the power density limit should be 1.3 W/m². The revised proposed SC6 (2013) reference level in this frequency range is 1.29 W/m² which compares favourably with the value extracted from Figure 8 in Hirata, 2012.

A final point to consider is what happens when an individual with low BMI is standing either isolated or grounded with the arms up posture. Lee and Choi present calculations for 1yr, 5yr and 20yr models that have arms up and have been modified to approximately conform to the 10th percentile of the US population in terms of BMI (Figure 2 in Lee and Choi, 2012). The highest WBA-SAR at whole-body resonance is for the isolated 5yr model. The value of reference level power density that would confer compliance to the 0.08 W/kg BR for this case is 1.29 W/m², which is also the revised reference level in the 48-300 MHz range in SC6 (2014).

Applicability of induced current reference levels as a proxy for meeting WBA-SAR basic restriction:

As pointed out in several places in the RSC review (for instance, page 79), reliance that meeting the induced current reference level implied compliance with the WBA-SAR basic restriction was perhaps somewhat unjustified considering the paucity of data available. Data in Hirata et al. (2012) allows this assumption to be tested for a limited number of grounded body models with their hands at their sides (normal posture; these body models are somewhere near the 50th percentile BMI in their respective age classes). Hirata et al. (2012) presents values of the "vertical component of the conduction current I_{v} at their respective resonance frequencies²² for 3yr, 7yr, adult female and adult male (all Japanese models). If the induced current (i.e. leg current) is assumed to be primarily made-up of the vertical conduction current then the response of this reference level quantity can be compared to the WBA-SAR basic restriction at the same exposure level. The results are tabulated in Table A-2.

Table A-2, Grounded, whole-body (WB) resonance frequencies, original SC6(2013; before RSC review) power density reference levels (RLs), revised SC6(2014; after RSC review) power density RLs, fraction of the induced current RL and fraction of the WBA-SAR basic restriction (BR) for 3yr, 7yr, adult female and adult male body models from Hirata et al. (2012).

	Grounded WB resonance freq. (MHz)	Original SC6(2013) Power Density RL (W/m ²)	Revised SC6(2014) Power Density RL (W/m ²)	Fraction of Induced Current RL (0.08A, both feet) for		Fraction of WBA-SAR BR (0.08W/kg) for	
				Exposure at original power density RL (%)	Exposure at revised power density RL (%)	Exposure at original power density RL (%)	Exposure at revised power density RL (%)
Adult male	39	2.0	1.43	200	169	101	72
Adult female	45	2.0	1.33	150	122	91	60
7yr	61	2.0	1.29	113	90	122	79
3yr	85	1.52	1.29	71	65	91	77

Note: Induced current is proportional to the electric field strength or the square root of the power density while WBA-SAR is proportional to the square of the electric field strength or to power density directly.

Adult male and Adult female: The fraction of the induced current RL exceeds the fraction of the WBA-SAR BR for exposure to both the original and revised reference level power densities. Thus, the induced current is the more restrictive quantity for both the original and revised power density RLs and complying with the induced current RL confers compliance to the WBA-SAR BR.

7yr: For the original power density RL, compliance for the induced current also confers compliance for the WBA-SAR since the reduction in power density to comply with the induced current RL is 78% while the reduction required to comply with the WBA-SAR BR is 82%. For the revised power density RL, both are in compliance for exposure at the reference level power density, however, if the exposure level is increased such that the induced current RL is reached, the WBA-SAR will still be in compliance. Thus, for this case, compliance to the induced current RL confers compliance to the WBA-SAR BR.

3yr: For the original and revised power density RLs, both the induced current and WBA-SAR are in compliance for exposures equal to their respective reference level power densities. However, if the exposure level is increased such that the induced current RL is reached, the WBA-SAR will not be in compliance. For both the original and revised limits, compliance to the induced current RL does not confer compliance to the WBA-SAR BR.

To summarize these findings, for grounded adults and probably larger children at their respective resonance frequencies, compliance to the WBA-SAR BR does not confer compliance to the induced current RL (or likely the spatial-peak 10g average SAR in the lower limbs for which the induced current RL is intended to protect against). This is the case for both the original and revised SC6 (2013) RLs. For this reason, induced current measurements are advised at whole-body resonance frequencies of adults and

large children when the exposure field levels begin to be an appreciable fraction of the RL. Conversely, if the induced current limits are respected then the WBA-SAR BRs will also likely be respected.

For smaller children under the same type of exposure conditions, both the WBA-SAR and induced current are likely to be in compliance at reference level power densities. This can partly be explained by the relationship between induced current and body height as pointed out in Gandhi et al. (1985) where the induced current is proportional to the square of the height. Shorter subjects will experience dramatically lower induced currents than taller ones for the same exposure conditions unlike WBA-SAR, which is dependent only on the reciprocal of the BMI. Height plays only a partial role in determining the WBA-SAR at resonance. For small children, there is probably no need to measure the induced current if the power density limits are respected. However, these conclusions are based on a small data set pertaining to average BMI subjects.

Isolated Newborn

The power density levels required to produce the WBA-SAR basic restriction are plotted in Figure A-1 as purple squares. The data is a composite of the worst case (i.e. lowest power density) of a number of polarizations and incidences (i.e. front-to-back, side-to-side, top-to-bottom etc.). There is a primary resonance at approximately 240 MHz and a secondary one at approximately 900 MHz. The primary resonance is a case of isolated, whole-body resonance where the electric field is parallel to the long axis of the body (Dimbylow et al., 2010). In Figure A-1 it can be seen that these two resonances represent significant non-compliance to the originally proposed SC6 (2013) reference levels.

The question arises as to whether the revised power density RLs in SC6 (2014) are sufficiently restrictive to cover WBA-SAR data from potential, yet to be developed, newborn models or postures. Since isolated whole-body resonance occurs at higher frequencies than grounded whole-body resonance, isolated whole-body resonance of newborns will likely form the upper frequency limit for this phenomenon. It has been demonstrated that the frequency of isolated whole-body resonance occurs when the body height is equal to 0.39 (± 0.01) of the free space wavelength (Hirata, 2010). Thus shorter newborn models could potentially have higher resonant frequencies than the one in Dimbylow et al. (2010). The flat portion of the revised reference levels in SC6 (2014) extend to 300 MHz, which could accommodate a model 20% shorter than the one in Dimbylow et al. (2010).

In terms of the WBA-SAR at resonance, Hirata et al. (2010) has developed a formula for estimating WBA-SAR for isolated whole-body resonance that is similar to the one derived for grounded whole-body resonance (Hirata 2012). The main feature of this formula is that WBA-SAR per unit incident power density is again proportional to the reciprocal of the BMI (specifically, $\text{WBA-SAR}/S_{\text{inc}} = 0.752/\text{BMI}$ where S_{inc} is the incident power density). The resonant WBA-SAR for the Dimbylow et al. (2010) newborn predicted by this formula is 11% lower than the calculated value for the voxel model. Thus newborn models with lower BMI may possibly yield higher WBA-SAR at resonance. This might also include newborn models with an “arms up” posture.

To gain some insight on how much the “arms up” posture might increase the WBA-SAR of the newborn, the data in Lee and Choi (2012) was used to calculate the increase in WBA-SAR caused by raising the

arms for isolated resonance amongst the 4 voxel models used in that study. The WBA-SAR increase was 13%, 20%, 19% and 36% for the 1yr, 5yr, 7yr and 20yr models, respectively. The revised limits shown in Figure A-1 can accommodate an increase in WBA-SAR of the newborn of 10% before a state of non-compliance arises. This is commensurate with the increase in WBA-SAR with “arms up” for the 1yr model in Lee and Choi (2012), but below those for the larger models.

More importantly than accommodating for the “arms up” posture, the revised limits can only accommodate a 10% reduction in BMI of the newborn. To investigate further, data for the 5th percentile BMI of newborns versus gestational age were obtained from Brock et al. (2008) and are given in Table A-3. Also shown in the table are the WBA-SAR per unit incident power density calculated using the estimation formula in Hirata (2010) for isolated, whole-body resonance and the power density reference level that would be required to comply with the 0.08 W/kg basic restriction.

Table A-3, Fifth percentile BMI of Brazilian newborns (male and female) for gestational ages 29, 36 and 42 weeks, WBA-SAR per unit incident power density (S_{inc}) estimated using the formula in Hirata (2010) for isolated, whole-body resonance and power density RL to comply with the 0.08 W/kg BR.

Gestational age weeks	5 th percentile BMI (male) kg/m ²	5 th percentile BMI (female) kg/m ²	Greater of the Male or female WBA-SAR/ S_{inc} W/kg per W/m ²	Required PD RL to Maintain 0.08 W/kg W/m ²
29	7.31	7.32	0.103	0.78
36	11.14	11.30	0.0675	1.19
42	12.56	12.25	0.0614	1.30

The uncontrolled power density RL in the whole-body resonance frequency range is 1.29 W/m² in SC6 (2014), which is compliant with the 0.08 W/kg BR for 42 week gestational age (5th percentile BMI). For the younger gestational ages 29 and 36 weeks, the power density RL does not afford the same level of safety margin (e.g. less than 50-fold). Using the Hirata (2010) formula, a critical value of BMI can be calculated such that the 0.08 W/kg BR is complied with at the RL power density of 1.29 W/m². This value is 12.13 kg/m². The data in Brock et al. (2008) was searched to find the percentile BMI that is compliant at the various gestational ages. The results for males is plotted in Figure A-3 (female results are similar). Note that some interpolation of the data in the tables in Brock et al. (2008) was necessary.

The interpretation of the curve in Figure A-3 is that, for a given gestational age, the curve defines the smallest percentile of BMI that is still compliant. All percentile BMI values below the curve are non-compliant in the sense that the WBA-SAR will exceed 0.08 W/kg at an exposure equal to 1.29 W/m² for isolated, whole-body resonance at the resonant frequency. For instance, at 35 weeks gestational age, newborns having BMI equal to or greater than the 50th percentile value will be in compliance.

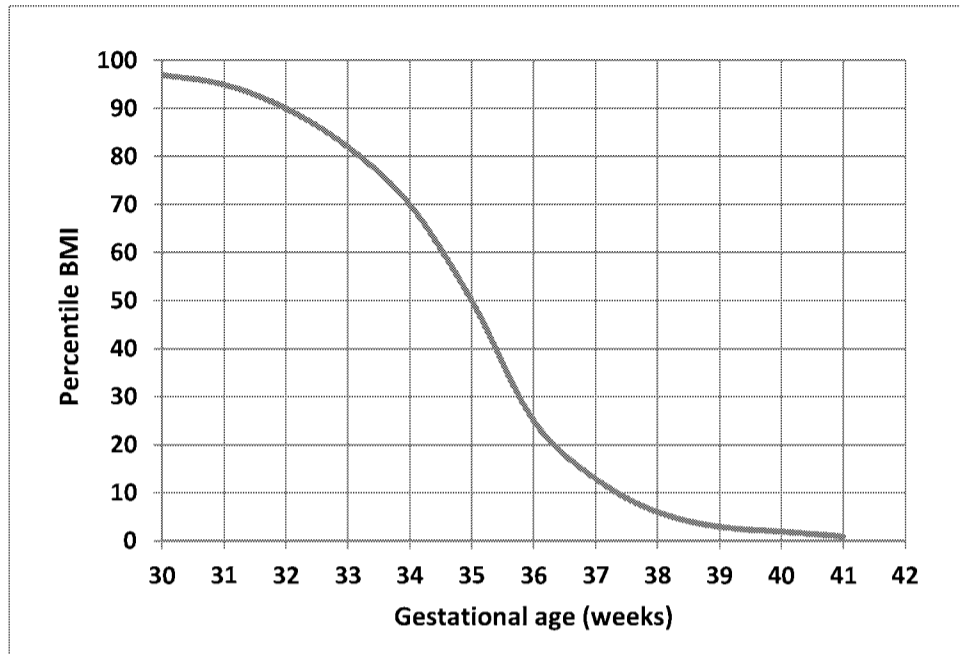


Figure A-3 Percentile BMI versus gestational age for which the power density RL of 1.29 W/m^2 is compliant with the 0.08 W/kg basic restriction based on the isolated, whole-body resonance formula in Hirata (2010).

It should be pointed out that the estimation formula in Hirata (2010) is approximate and that the discrepancy of it versus the SAR calculation of the newborn model in Dimbylow et al. (2010; having a BMI of 14.8 kg/m^2) is an underestimation of 11%. Thus the information in Table A-4 and Figure A-3 should be treated with some caution. However, it can be used to arrive at some qualitative conclusions, the most important of which, is the likelihood that any future calculations of WBA-SAR on models of premature newborns will likely produce non-compliance of the revised power density reference levels to the basic restriction. This cannot be prevented without a further reduction of the power density reference levels at the frequencies of isolated, whole-body resonance. If the revised power density RLs are kept as is, then one can only say that the reference levels provide the full margin of safety (50-fold) for most of the population, but not for all population sub-groups (e.g. low BMI newborns) in all worst-case exposure scenarios. The portion of the population that does not receive the full measure of the intended safety margin (50-fold) is a small one, consisting of low BMI, premature newborns who would be unlikely to be exposed to levels of power density anywhere near the SC6 reference levels, anyway.

Update of Controlled Reference levels, 10 MHz – 6 GHz

The same data that was used to justify the revisions to the uncontrolled reference levels can also be used as a basis for revisions to the controlled environment reference levels. In this case, however, it was decided to exclude data pertaining to body sizes smaller than 7yr since it was felt that this body height (and associated BMI) was a conservative lower bound for adults of short stature. Figure A-2 shows much of the same data in Figure A-1 except scaled to a WBA-SAR of 0.4 W/kg, the controlled basic restriction. The only exceptions are that the data from Findley (2009) and Lee and Choi (2012) only include data for body sizes 7yr and up. Plotted points for the other references contain some data for smaller size bodies but their inclusion does not impact the changes to the RLs required for the whole-body resonance region below 100 MHz.

The revised controlled RLs follow the same slopes and transitional frequencies as the uncontrolled RLs up to 100 MHz. Up to this frequency, the ratio of controlled to uncontrolled PD maintains a value of 5, which is the same as the ratio of the basic restrictions. From 100 MHz to 6000 MHz, the revised controlled environment RLs follow the originally proposed RLs. In this range, the ratio of the two RLs (controlled and uncontrolled) is no longer maintained at 5, but is frequency dependent. At 6000 MHz, both RLs begin to be flat with frequency and again, maintain a ratio of 5.

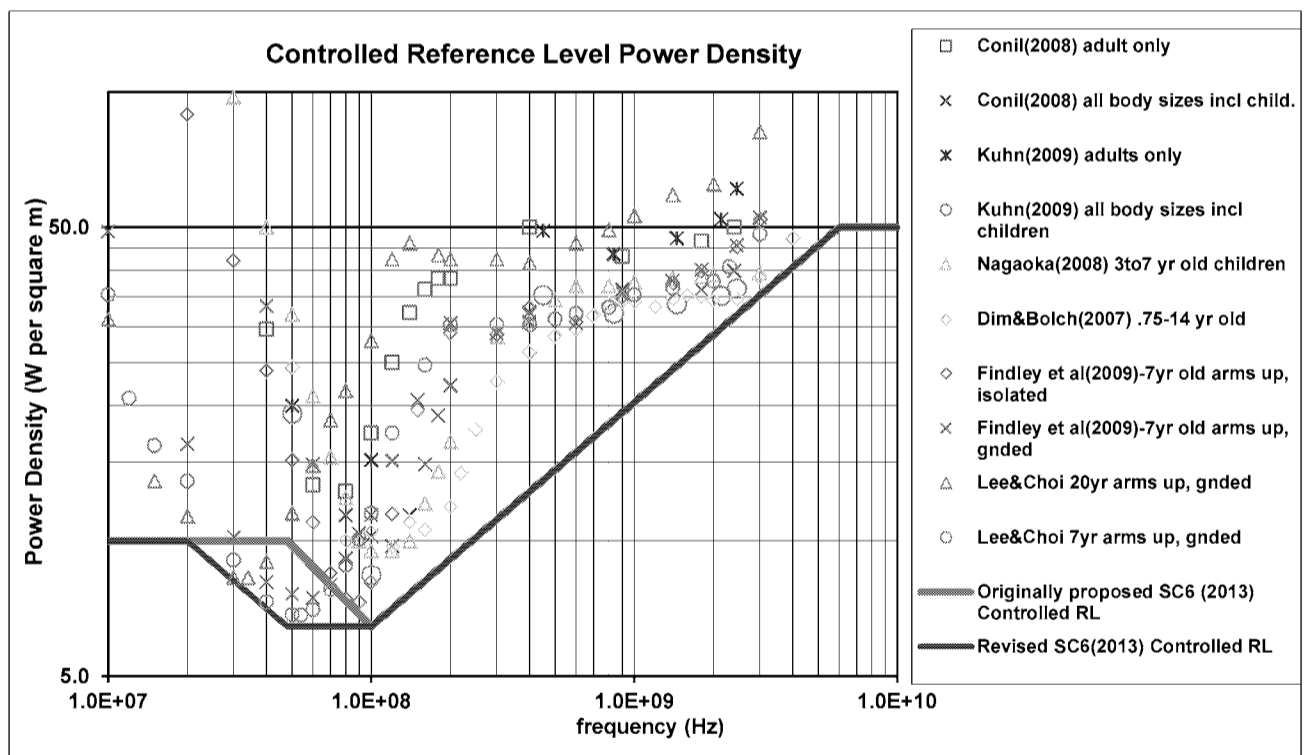


Figure A-2, Plane-wave power densities necessary to produce the WBA-SAR basic restriction of 0.4 W/kg in different voxel models under various exposure conditions. Also, the originally proposed SC6 (2013; grey line) controlled power density reference levels and the revised SC6 (2014; red line) power density reference levels resulting from suggestions made in the RSC report.

Table A-4. Revised Reference Levels for Electric Field Strength, Magnetic Field Strength and Power Density in Uncontrolled Environments

Frequency (MHz)	Electric Field Strength (E_{RL}), (V/m, RMS)	Magnetic Field Strength (H_{RL}), (A/m, RMS)	Power Density (S_{RL}), (W/m^2)	Reference Period (minutes)
10 – 20	27.46	0.0728	2.00	6
20 – 48	$58.07 / f^{0.25}$	$0.1540 / f^{0.25}$	$8.944 / f^{0.50}$	6
48 – 300	22.06	0.05852	1.291	6
300 – 6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000 – 15000	61.4	0.163	10	6
15000 – 150000	61.4	0.163	10	$616000 / f^{1.2}$
150000 – 300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000 / f^{1.2}$

- Frequency, f , is in MHz.

Table A-5. Revised Reference Levels for Electric Field Strength, Magnetic Field Strength and Power Density in Controlled Environments

Frequency (MHz)	Electric Field Strength (E_{RL}), (V/m, RMS)	Magnetic Field Strength (H_{RL}), (A/m, RMS)	Power Density, (S_{RL}), (W/m^2)	Reference Period (minutes)
10 – 20	61.4	0.163	10.0	6
20 – 48	$129.8 / f^{0.25}$	$0.3444 / f^{0.25}$	$44.72 / f^{0.5}$	6
48 – 100	49.33	0.1309	6.455	6
100 - 6000	$15.60 f^{0.25}$	$0.04138 f^{0.25}$	$0.6455 f^{0.5}$	6
6000 – 15000	137	0.364	50	6
15000 – 150000	137	0.364	50	$616000 / f^{1.2}$
150000 – 300000	$0.354 f^{0.5}$	$9.40 \times 10^{-4} f^{0.5}$	$3.33 \times 10^{-4} f$	$616000 / f^{1.2}$

- Frequency, f , is in MHz.

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May 25, 2014

Office of the Auditor General of Canada
 Commissioner of the Environment and Sustainable Development
 Attention: Petitions
 240 Sparks Street
 Ottawa, Ontario K1A 0G6

Attention, Petitions, please accept the following petition under section 22 of the Auditor General Act.

On May 23rd of this year I was sent a link to the following web site <http://www.c4st.org/HCmythbuster>, which I have copied and printed below. Other than adding italics and colons and paragraph spacing I have not made any changes or additions.

As I type I am looking at a cell tower out of my home office window, the only thing between us is a window and tree branches. How safe am I and how safe is my neighbourhood from the electromagnetic radiation we face daily and nightly? Is the environment I live and work in sustainable and safe?

On the one hand Health Canada says my environment is safe whereas C4ST puts Health Canada's position in doubt.

Please read the following information and then I will pose my question.

C4ST Response to Health Canada's Safety Code 6 Myth Buster



On Feb 20th, 2014 Health Canada quietly released a document entitled "Busting Myths on Safety Code 6". This attempt to instill public confidence in safety exposure levels to wireless radiation is using false and unsubstantiated claims. This was again repeated on the newly released 60 day public consultation web page posted May 16th, 2014.

Gone are the days where the public will accept you are safe just because Health Canada says you are....Canadians and scientists want and deserve proof with an open and transparent review inclusive of the current evidence showing biological harm from wireless radiation.

C4ST and experts from around the world have come together to provide the real facts around the specific points Health Canada addresses in their Myth Buster document. Here it is:

Health Canada: Even a small child, following continuous exposure from multiple sources of RF energy, would not experience adverse health effects provided that the exposure limits set in Safety Code 6 are respected.

The Truth: C4ST has found NO studies on children showing that radiofrequency/microwave radiation is safe and NO studies that prove continuous exposure is safe.

Children are not little adults, their skulls are thinner and the tissues of a child's head, including the bone marrow and the eye, absorb significantly more energy than those in an adult head. A peer reviewed study by Gandhi et. al published in 2012, showed that radiation from a cell phone penetrated 10% of an adult head; 70% of the skull of a five year old.

<http://www.ncbi.nlm.nih.gov/pubmed/21999884>

[Read More](#)

Health Canada: A number of people have described an assortment of health symptoms that they attribute to exposure to electromagnetic fields. While the symptoms attributed to electro hypersensitivity conditions are real, scientific evidence has failed to demonstrate that they are caused by exposure to electromagnetic fields.

The Truth: There is scientific evidence to demonstrate that electromagnetic fields can cause physical symptoms. These authors conclude that they demonstrated the neurological syndrome "electromagnetic hypersensitivity" in the examined subject. <http://www.emf-portal.de/viewer.php?aid=19460&l=e>

This scientific panel of International experts published a paper that recognizes that the body of evidence on EMF requires a new approach to protection of public health. <http://www.ncbi.nlm.nih.gov/pubmed/21268443>

Canada: The Canadian Human Rights Act (CHRA) recognizes environmental sensitivities as a disability. <http://www.chrc-ccdp.ca/eng/content/policy-environmental-sensitivities> CHRA's medical perspective on environmental sensitivities states that "approximately 3% of Canadians have been diagnosed with environmental sensitivities and many more are somewhat sensitive to traces of chemicals and/or electromagnetic phenomena in the environment." http://www.chrc-ccdp.gc.ca/sites/default/files/envsensivity_en_1.pdf

[Read More](#)

Health Canada: There is no evidence that children and teenagers are at increased risk when Safety Code 6 exposure limits are respected.

The Truth: There is very concerning evidence that children and teenagers are at an increased risk at exposure levels well below Safety Code 6. Manufacturers put warnings, some especially for children, in their manual that comes with their devices.

Cell phone manufacturers' cautionary statements:

Every major manufacturer of cell phones in the world issues warnings to keep their devices away from direct contact with the body. <http://www.c4st.org/news/major-device-safety-warnings.html>

Blackberry: Warns people to keep their phones an inch away from any part of your body when on “including the abdomen of pregnant women and the lower abdomen of teenagers.”

Apple: "...keep iPhone at least 15 mm (5/8th inch) away from the body, and only use carrying cases, belt clips or holsters that do not have metal parts and that maintain at least 15 mm (5/8th inch) separation between iPhone and the body."

Schools: The letter from the American Academy of Environmental Medicine (AAEM) to the director of the Peel District school board (Ontario) strongly advised the Board to turn off the Wi-Fi and hardwire computers to avoid “a widespread public health hazard that the medical system is not yet prepared to address.” [http://www.c4st.org/images/documents/cell-tower-situations/Peel-DSB/American Academy of Environmental Medicine Letter to PDSB.pdf](http://www.c4st.org/images/documents/cell-tower-situations/Peel-DSB/American%20Academy%20of%20Environmental%20Medicine%20Letter%20to%20PDSB.pdf)

Read More

Health Canada: Canada's limits are consistent with the science-based standards used in other parts of the world, including the United States, the European Union, Japan, Australia and New Zealand.

The Truth: 40% of the world's population lives in countries with codes safer than Canada.

China, Russia, Italy and Switzerland have wireless radiation safety limits 100 times safer than Canada. http://buildingbiology.ca/media/pdf/rf_exposure_limits_cell_antennas.pdf

Read More

Health Canada: When developing the exposure limits in Safety Code 6, Health Canada scientists consider all peer-reviewed scientific studies and employ a weight-of-evidence approach.

The Truth: Health Canada ignores hundreds of studies showing adverse effects and has not divulged how the evaluation was conducted.

Health Canada never published its criteria, methodology or followed the international best practices associated with a proper evaluation of the scientific evidence for Safety Code 6.

As stated in an article by Dr. Anthony Miller, Professor Emeritus at the University of Toronto: “Still more problematic, was the panel's narrow scope which focused on established medical

risks from radiofrequency waves rather than emerging research.”

http://www.huffingtonpost.ca/2014/04/14/wireless-devices-cancer-risk_n_5148740.html

[Read More](#)

Health Canada: Health Canada scientists consider all peer-reviewed scientific studies and consider many different potential health effects including thermal, non-thermal and biological effects.

The Truth: C4ST has identified over 300 peer-reviewed, studies published since 2009 that have not been considered by Health Canada’s recent analysis of Safety Code 6 that show harm from wireless radiation at levels significantly below Safety Code 6.

In a National Post article, April 15, 2014, Dr. Martin Blank, special lecturer in physiology and cellular biophysics at Columbia University, stated “If you’re making a scientific decision, a scientific decision must bring in all relevant data. They did not. They ignored the data. They deliberately put it off the table.” Dr. Blank is referring to the recent Royal Society panel hired by Health Canada that followed Health Canada’s guidelines on evaluating the scientific evidence. Dr. Blank also stated “The panel has not considered important developments in cell biology.”

<http://news.nationalpost.com/2014/04/15/canadian-scientists-urge-more-research-into-safety-of-wireless-technology-saying-recent-report-downgrades-cancer-risk/>

[Read More](#)

Health Canada: Canadians are protected from the cumulative effects of RF energy when Safety Code 6 is respected.

The Truth: Safety Code 6 does not take into account the total exposure from all sources of RF energy.

There is no government agency, federal, provincial or municipal that currently has the mandate, ability or resources to measure the cumulative effects of wireless radiation from multiple sources: at home, work or school with Wi-Fi, cell phones, portable phones, near a cell tower, nor with smart meters on the exterior building.

https://www.youtube.com/watch?v=aTGINfeRkcg&feature=player_embedded

[Read More](#)

Health Canada: Canadians are protected from continuous exposure to multiple sources of RF energy when Safety Code 6 is respected.

The Truth: Safety code 6 was first published in 1979. It has not had any major changes since then.

In 1979 there were no cell phones (no cell towers), WIFI was in a handful of places at work, smart meters did not exist and portable phones were a rare luxury.

[Read More](#)

Health Canada: The International Agency for Research on Cancer (IARC) did not find a direct link between RF energy exposure and cancer.

The Truth: As stated by Health Canada “the vast majority of research to date does not support a link between RF energy exposure and cancers in humans”. Therefore, there is research data to support a link between RF energy (wireless radiation) and cancers in humans.

[Read More](#)

Health Canada: The exposure limits recommended in Safety Code 6 protect the health of Canadians.

The Truth: Over 100 Canadians and international scientists requested to and were not able to present at the public consultation on Oct. 28, 2013.

C4ST is encouraged by Health Canada’s commitment to consult further before finalizing Safety Code 6. We hope that this process will be open and transparent and follow international best practices of evaluating the scientific evidence.

END

As I prepare this petition, working in full view of our neighbourhood cell tower, the matters being discussed on the C4ST web site are puzzling and disturbing. Is one side right, is the other or is it something in between and if it is in between then shouldn’t Health Canada change their position? My question to Health Canada is:

Can Health Canada refute with specific, unbiased and conflict-of-interest free scientific evidence the statements made by C4ST?

June 1, 2015

Office of the Auditor General of Canada
Commissioner of the Environment and Sustainable Development
Attention: Petitions
240 Sparks Street
Ottawa, Ontario K1A 0G6

Attention, Petitions, please accept the following petition under section 22 of the Auditor General Act.

On January 28th of this year I contacted the Mayor of Norfolk County, Ontario concerning a potential health issue for Norfolk County Employees. Currently in the Town of Simcoe a recently erected building on the corner of Queen St. and Robertson St. is scheduled to house municipal employees. The plate glass window of the 3rd floor office at the Southeast corner of this building is less than 30 steps from 2 antennae of a cell tower. The adjacent building is the former Canadian Cannery plant. Atop this 4 story building is a cell tower on the Southwest corner of the roof. Upon noticing the proximity of the antennae to the future municipal offices I was concerned for the health of the occupants.

The Mayor took my concern to the Norfolk County Manager, Organizational Health and Safety Wellness Program. On March 12th of this year I received a reply from the Manager who referenced the Radiation Institute of Canada and Health Canada as resources. He concluded from his studies that "there is no recognized hazard."

On March 18th of this year I took my concern to the President of CUPE 4700 who passed my worry on to a National Representative. At the time of writing this petition no action has been taken to my knowledge.

Health Canada is the final arbitrator of health issues with electromagnetic radiation such as those generated by cell towers. They use a document, Safety Code 6 to address such concerns.

My petition: Does Health Canada's Safety Code 6 offer protection from the effects of electromagnetic radiation for people working in close proximity to a cell tower antennae?

Yours.

Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

OCT 13 2015



Dear I

This is in response to your environmental petition no. 378 of June 1, 2015, addressed to Ms. Julie Gelfand, Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised concerns regarding protection from the effects of electromagnetic radiation.

I am pleased to provide you with the enclosed Health Canada response to your petition.

Thank you for your interest in this important matter.

Yours sincerely,

The Hon. Rona Ambrose, P.C., M.P.

Enclosure

c.c. Ms. Julie Gelfand, CESD

Canada

Health Canada response to Petition #378

Question: Does Health Canada's Safety Code 6 offer protection from the effects of electromagnetic radiation for people working in close proximity to a cell tower antenna?

Response:

Health Canada's mandate regarding human exposure to radiofrequency (RF) electromagnetic energy from wireless devices is to carry out research into possible health effects, monitor the scientific literature related to such effects, and develop exposure guidelines such as the *Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz - Safety Code 6 (2015)*.

Industry Canada is the federal agency responsible for regulating wireless communications equipment (e.g. cell phones, cell towers, smart meters, Wi-Fi) in Canada. To ensure that public exposures fall within acceptable guidelines, Industry Canada has developed regulatory standards that require compliance with the human exposure limits outlined in Safety Code 6.

The Safety Code 6 limits for human exposure to RF fields are designed to provide protection against all known adverse health effects for all age groups, including children, on a continuous (24 hours a day/seven days a week) basis. Large safety margins have been incorporated into these limits to provide a significant level of protection for the general public and personnel working near RF sources.

It is Health Canada's position that the health of Canadians is protected from RF energy when the human exposure limits recommended in Safety Code 6 are respected.

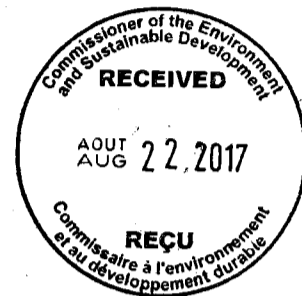
Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

AUG 16 2017



Dear

This is in response to your environmental petition no. 398 of April 3, 2017, addressed to Ms. Julie Gelfand, Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised concerns regarding appropriate warnings on common personal and household wireless devices. I am pleased to provide you with the enclosed responses to questions 1, 2, 3, 6, 7, 8, 9 and 10 of your petition. I understand that the Minister of Innovation, Science and Economic Development will be responding separately to questions that come under the purview of his department.

I appreciate your interest in this important matter.

Yours sincerely,

The Honourable Jane Philpott, P.C., M.P.

Enclosure

c.c. Ms. Julie Gelfand, CESD
The Honourable Navdeep Bains, P.C., M.P.

Canada

Minister of Health's response to Petition #398

Question 1: Given the proof that the way Canadians are using their cell phones (against their bodies) is exceeding the Safety Code 6 guidelines, is Health Canada considering increasing the 50 times uncertainty margin and reducing the level of radiation that is permitted?

Response 1:

When establishing Safety Code 6, Health Canada incorporated several tiers of precaution into the human exposure limits. These included conservative thresholds for the occurrence of adverse effects, extreme worst-case situations for body size and orientation in relation to the radiofrequency (RF) fields, and additional safety margins. Since these conservative approaches are cumulative, i.e., stacked upon each other, Safety Code 6 provides very large margins of safety against the occurrence of all established adverse health effects associated with RF field exposure. Therefore, Health Canada will not be changing the uncertainty margin at this time.

Question 2: What science based evidence does the Government of Canada have to make the above statement "cell phones are still safe when carried directly against the body"?

Question 3: What is the precise level (with confidence intervals) in W/kg per 1 gram of tissue at which harm from radiofrequency/microwave radiation has been established? Where can the calculations for this be found? On which scientific publications was this level based?

Response 2 and 3:

The peak spatially-averaged specific absorption rate (pk-SAR) limit in Safety Code 6 (SC6) applies to the head, neck and trunk. This limit is 1.6 W/kg, as averaged over any 1 g and for any 6 minute exposure period (reference period). This limit is based upon avoiding cataract formation in the eye, which has been conservatively estimated to occur at sustained pk-SAR levels of 100-150 W/kg to the eye (as reviewed in Elder, 2003 and IEEE C95.1 (2005)).

The recommended pk-SAR limit of 1.6 W/kg is not the threshold for the occurrence of adverse health effects. In fact, as a precautionary measure, the pk-SAR limit was set more than 50x below the level where excessive tissue heating could occur in the eye. This means that the pk-SAR limits in Safety Code 6 would need to be exceeded by more than 50x in the eye before the occurrence of any thermally-related adverse health effects would be expected. Exposures to the body (skin and underlying tissue) at the SC6 pk-SAR limit of 1.6 W/kg would result in a localized temperature increase of less than 1 degree Celsius (Anderson et al., 2010; Moore et al., 2017).

In the event of exposures that marginally exceed the pk-SAR limits in SC6 (in the head, neck or trunk), the only scientifically established health impact would be a warming of the skin and underlying tissue. This degree of heating is no different from the type of skin warming that

occurs every day from sources like a hot water bottle, warm bath, or warm clothes. The human body can efficiently dissipate small increases in local body temperature, resulting in no adverse impacts on health.

For these reasons, exposures that marginally exceed the pk-SAR limits in SC6 is not considered to represent a risk to health due to the precautionary safety margins already incorporated within SC6. Despite this, Health Canada recommends that the pk-SAR limits in SC6 for the head, neck and trunk should be respected.

References:

Elder JA. Ocular effects of radiofrequency energy. *Bioelectromagnetics Suppl.* 6:S148-161 (2003).

Institute of Electrical and Electronics Engineers. *Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields C95.1, 3 kHz to 300 GHz.* New York, USA (2005).

Anderson V, Croft R, McIntosh RL. SAR versus S(inc): What is the appropriate RF exposure metric in the range 1-10 GHz? Part I: Using planar body models. *Bioelectromagnetics.* 2010 Sep;31(6):454-66.

Moore SM, McIntosh RL, Iskra S, Lajevardipour A, Wood AW. Effect of adverse environmental conditions and protective clothing on temperature rise in a human body exposed to radiofrequency electromagnetic fields. *Bioelectromagnetics.* 2017 Mar 24. <http://onlinelibrary.wiley.com/doi/10.1002/bem.22048/epdf> [E-pub ahead of print]

For further information on the scientific rationale for the basic restrictions and reference levels within the Safety Code 6, please consult the Safety Code 6 Rationale document (attached).

Questions 4 and 5 will be responded to by the Minister of Innovation, Science and Economic Development and will be sent under separate cover.

Question 6: Will the Government of Canada provide advisories or other appropriate notifications to inform Canadians that allowing wireless transmitting devices to come in direct contact with their bodies can exceed Safety Code 6 (2015) limits? Which Ministry and Department would be responsible to provide such warnings?

Question 7: Will the Government of Canada run an education and awareness campaign to inform all Canadians how to use wireless devices more safely?

Question 8: Precedents exist where information on “situations where the use of—or exposure to—a product could pose a risk” has been published by Health Canada for other public health concerns. Will Health Canada provide precautionary messaging e.g. advisories or campaigns such as the BabySafe project, to inform pregnant women (and their physicians) to avoid having wireless transmitting devices touch their bodies to minimize risk to the fetus?

Question 9: Will Health Canada provide precautionary messaging e.g. advisories or campaigns, to inform pediatricians, parents, teachers and other school authorities to avoid having wireless transmitting devices touch their children's bodies to minimize the risk to them?

Response 6, 7, 8, and 9:

Health Canada already undertakes many of these activities. Health Canada maintains messaging on its website that reminds cell phone users that they can take practical measures to reduce their radiofrequency (RF) exposure by limiting the length of cell phone calls, using "hands-free" devices and replacing cell phone calls with text messages. This messaging also encourages parents to take these measures to reduce their children's RF exposure from cell phones in acknowledgement that children are typically more sensitive to a variety of environmental agents. More information is available at: <https://www.canada.ca/en/health-canada/services/consumer-radiation/safety-cell-phones-cell-phone-towers.html>

Health Canada and other leading health agencies, including the World Health Organization, have concluded that, to date, there is no convincing scientific evidence linking adverse health effects to levels below existing RF exposure limits. Health Canada does not have any immediate plans to expand existing messaging.

With respect to the federal role, Health Canada administers the *Radiation Emitting Devices Act* (REDA) and the *Canada Consumer Product Safety Act* (CCPSA). Under the REDA, Health Canada has the authority to take regulatory and compliance and enforcement actions in the event that a radiation emitting device creates, under particular circumstances, a risk to any person of genetic or personal injury, impairment of health or death. Under the CCPSA, it is prohibited to advertise a consumer product, including consumer products that are radiation emitting devices, if the advertisement in question may reasonably be expected to create an erroneous impression regarding the fact that the consumer product is not a danger to human health or safety, or if the product itself is a danger to human health or safety.

Under the *Radiocommunication Act*, the Minister of Innovation, Science and Economic Development Canada (ISED), has the power to manage the use of radio spectrum and regulate radio apparatus through technical standards and conditions of authorization. ISED requires compliance with Safety Code 6 as part of its technical standards for radio apparatus. ISED requires that all portable and hand-held radiocommunication devices sold in Canada, including cell phones, comply with the regulatory specific absorption rate (SAR) limits.

Question 10: In North America, devices such as baby monitors and portable home phones send out a constant signal (emitting radiofrequency/microwave radiation) at all times. In Europe, these devices have been modified for safety so that they only emit radiation when the baby makes a noise or someone speaks into the handset (on demand). Why are these devices not available in Canada? What will the Government of Canada do to facilitate the access of Canadians to these reduced risk products?

Response 10:

Health Canada cannot comment on the business decisions of companies to market products in certain regions, but not in others. For products currently marketed in Canada, they must comply with the applicable laws and regulations. The exposure limits of Safety Code 6, however, have always been established at levels far below the threshold of potential adverse effects.

Minister of
Innovation, Science and
Economic Development



Ministre de
l'Innovation, des Sciences et du
Développement économique

Ottawa, Canada K1A 0H5

JUL 28 2017



COPIE

Dear

I am writing with respect to your Environmental Petition no. 398, submitted to the Auditor General of Canada under Section 22 of the *Auditor General Act*, on “Failure of the Government of Canada to provide appropriate warnings so Canadians can take actions to protect themselves from excessive exposures to radiofrequency/microwave radiation from common personal and household wireless devices such as cell phones, baby monitors, cordless phones and Wi-Fi internet routers through normal, everyday use.”

The Office of the Auditor General of Canada forwarded your questions to the Honourable Jane Philpott, Minister of Health, and to me. I am writing in response to questions 2, 4, 5, and 10, which fall under Innovation, Science and Economic Development Canada’s (ISED) mandate and responsibility. Minister Philpott will be providing you with a separate response addressing the remaining questions that fall under her department’s mandate and areas of responsibility.

Question 2: What science based evidence does the Government of Canada have to make the above statement “cell phones are still safe when carried directly against the body”?

ISED requires that all manufacturers of wireless products, including cell phones, meet the regulatory requirements set forth in its technical standards, which are based on recognized international testing procedures that have been adopted by most countries around the world.

When cell phones are tested for compliance, they are tested at full power for the duration of the test. In reality, cell phones operate at much lower power levels, to preserve battery life, maximize call time, and avoid network interference. As such, under normal operating conditions, a cell phone yields much lower radiofrequency (RF) exposure levels than those measured during compliance testing performed in laboratory settings.

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Canada

Furthermore, ISED has adopted Health Canada's Safety Code 6 limits for the RF exposure compliance of wireless devices. In turn, Health Canada's scientific evidence indicates that the recommended peak specific absorption rate (SAR) limit of 1.6 W/kg for cell phones is not the threshold for the occurrence of adverse health effects. As a precautionary measure, the peak SAR limit in Safety Code 6 was set to more than 50 times below the level at which excessive tissue heating could occur in the most sensitive tissue (the eye). This means that the peak SAR limits in Safety Code 6 would need to be exceeded by a factor of more than 50 before one would see any thermally related adverse health effects.

Canada's approach to cell phone safety testing is among the most stringent in the world. As such, ISED strongly believes that all products evaluated following the test procedures set forth in Canadian regulatory standards that comply with Health Canada's Safety Code 6 limits are safe.

Question 4: How do the Ministries of the Government of Canada plan to address the fact that instructions require users to keep cell phones at 5 mm to 15 mm from the body and the reality that 67% of Canadians said they hold their devices against their body, in terms of: 1) the lack of awareness (81% of Canadians are unaware that instructions exist); and 2) the practicalities that cell phones can only be used in a manner complying with Safety Code 6 when used on speakerphone or with ear buds?

To comply with applicable domestic regulations, equipment manufacturers are required to provide clear information to end users on the subject of proper intended use in the user manual of their products. For instance, cell phone manufacturers shall provide the minimum separation distance to maintain compliance to applicable body-worn exposure limits.

In response to your point regarding the lack of public awareness, ISED will continue to work with Health Canada, international standards bodies, other regulators, manufacturers, and other stakeholders on improving communication with users.

Concerning the second part of your question, please be informed that cell phones can, in fact, be held against your head without requiring the use of speaker phones or ear buds while remaining in compliance with Safety Code 6 limits since, as previously mentioned, SAR head compliance testing is performed at a zero millimetre distance.

The assessment process to verify if a cell phone complies with all applicable Health Canada limits requires two types of evaluations:

- 1) SAR – Head compliance testing
- 2) SAR – Body-worn compliance testing

...3

ISED requires that head compliance testing be performed directly against a simulated head at a zero millimetre separation distance.

It also requires that body-worn compliance testing be performed with the use of a simulated body at a maximum separation distance of 15 millimeters or less.

Further information on compliance testing can be found online at www.ic.gc.ca/eic/site/ceb-bhst.nsf/eng/h_tt00084.html.

Question 5: Do current legislation and regulations enable the Government of Canada to require manufacturers to place their existing warnings on the packaging of wireless devices in a more readable font size and location, and/or at the point of sale? If this cannot be accomplished under current legislation and regulations, what changes would need to be made in order to require this of manufacturers? What Department(s) and Ministry are responsible for such regulation?

Under the *Radiocommunication Act*, I have the power to establish standards, rules, policies, and procedures relating to radiocommunication. The Governor in Council may make regulations with respect to spectrum management pursuant to section 6 of the *Radiocommunication Act*; these regulations have been prescribed under the *Radiocommunication Regulations*.

As per the technical standard developed, pursuant to the *Radiocommunication Act*, ISED requires manufacturers to provide information on the proper usage of wireless devices in their user manuals, including the minimum separation distance at which a product shall be kept from the body to be in compliance with RF exposure limits.

Under subsection 25(4) of the *Radiocommunication Regulations*, “no person shall mark, label or otherwise indicate that Category I¹ or Category II² equipment complies with applicable standards, unless that equipment complies with those standards.” This label is the certification number or a statement that the device complies with specific technical standards.

¹ Category I equipment, which comprises radio apparatus equipment for which a technical acceptance certificate (TAC) is required pursuant to subsections 4(2) of the *Radiocommunication Act* and 21(1) of the *Radiocommunication Regulations*. A TAC may be issued by the Certification and Engineering Bureau of ISED (the Bureau) or a certificate may be issued by a recognized certification body (CB).

² Category II equipment comprises radio apparatus for which standards have been prescribed. Category II equipment is certification-exempt. Therefore, no TAC from ISED or certificate from a CB is required, pursuant to subsection 4(3) of the *Radiocommunication Act*. The manufacturer and/or importer shall ensure compliance with all applicable procedures and standards for Category II equipment. Note that certification application for Category II equipment is not necessary and will not be accepted.

Your questions regarding what changes to legislation and regulations would need to be made in order to require this of manufacturers, and what Department(s) and Ministry are responsible for such regulation, essentially ask for a legal opinion. In other words, those questions ask which legislative or regulatory changes would be needed to require this and what Department or Ministry would have authority to make such amendments.

Unfortunately, as noted in the guide to the environmental petitions process, the Department of Justice Canada cannot provide legal opinions to Canadians.

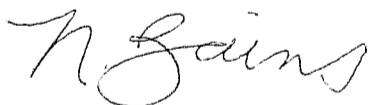
Question 10: In North America, devices such as baby monitors and portable home phones send out a constant signal (emitting radiofrequency/microwave radiation) at all times. In Europe, these devices have been modified for safety so that they only emit radiation when the baby makes a noise or someone speaks into the handset (on demand). Why are these devices not available in Canada? What will the Government of Canada do to facilitate the access of Canadians to these reduced risk products?

ISED requires that all manufacturers of wireless products, including baby monitors and portable home phones, meet the technical and RF exposure regulatory requirements set forth in its technical standards.

The Canadian standards currently in place do not prevent equipment manufacturers from introducing such products on the Canadian market as long as all applicable regulatory requirements are met. ISED cannot comment on any business decisions taken by private industry not to introduce specific products in Canada. We recommend that you contact equipment manufacturers directly for enquiries pertaining to product-specific Canadian market availability.

I appreciate this opportunity to respond to your petition, and I trust that this information is of assistance.

Sincerely,



The Honourable Navdeep Bains, P.C., M.P.

c.c.: The Honourable Jane Philpott, P.C., M.P.
Minister of Health

Ms. Julie Gelfand
Commissioner of the Environment and Sustainable Development

Environmental Petition
Name of petitioner(s):
Address of petitioner(s):



Name of the group:

I hereby submit this petition to the Auditor General of Canada under section 32 of the Auditor General Act.

Signature of the petitioner:

Date: April 3, 2017

Title of the Petition: Failure of the Government of Canada to provide appropriate warnings so Canadians can take actions to protect themselves from excessive exposures to radiofrequency/microwave radiation from common personal and household wireless devices such as cell phones, baby monitors, cordless phones and Wi-Fi internet routers through normal, everyday use.

We request responses from Health Canada, and Innovation, Science and Economic Development Canada, Environment and Climate Change Canada, Public Safety Canada and other relevant Departments/Agencies.

Possibly Relevant Acts: Canada Consumer Product Safety Act, Canadian Environmental Protection Act, Canadian Human Rights Act, Clean Air Act, Department of Health Act, Department of Industry Act, Hazardous Products Act, Measurements Canada, Health Canada Act, Radiation Emitting Devices Act, Radiocommunications Act and the Standards Council of Canada.

Background: In protecting the health of Canadians, Health Canada's mandate includes development of exposure guidelines for radiofrequency/microwave electromagnetic energy. These guidelines, published as "Safety Code 6", establish the "safety limits for human exposure to radiofrequency in the 3 kHz to 300 GHz." ¹ The questions for this petition apply only to the radiofrequency/microwaves in the range of 100 MHz² to 300 GHz; these frequencies are used for many common wireless devices such as cell phones, computer tablets, baby monitors and Wi-Fi internet routers, as well as emissions from telecommunications infrastructure such as smart meters and antennae on homes, apartment buildings, utility poles and towers.

1 Safety Code 6 (2015)-Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz. Safety Code 6. http://www.Health Canada-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct/index-eng.php

2 A biological effect of peripheral nerve stimulation, in addition to heating, is recognized by Health Canada as occurring above Safety Code 6 guidelines below frequencies of 10 MHz. Heating is considered by Health Canada to be the only established effect between 10 MHz and 300 GHz when levels are exceeded. The questions in this petition apply only to the 100 MHz to 300 GHz range.

Canadians are increasingly exposed to wireless radiation in the radiofrequency/microwave radiation range from the devices they, and those around them, use. Wireless device manufacturer Cisco projects there will be 50 billion devices connected to the internet by 2020³; that is about 6.5 devices for every man, woman and child. This assumes the devices are distributed equally among all countries, but it is likely that Canada's average will be higher.

Safety Code 6 applies to "all individuals working at, or visiting, federally regulated sites." Safety Code 6 also has been adopted by Innovation, Science and Economic Development Canada for "equipment certification and in radiofrequency exposure compliance certification... that govern the use of wireless devices in Canada such as cell phones, cell towers (base stations) and broadcast antennas".⁴

A substantial number of peer-reviewed, published research papers about human, animal and cellular (tissue) studies show that serious health consequences can occur at daily levels from exposure to personal wireless devices and wireless infrastructure i.e. at levels considered to be "safe" according to Safety Code 6.⁵ All new commercially available wireless devices contain difficult to find warnings in the packaging that explain how we can use these devices more safely.

The CBC Marketplace program "The Secret inside Your Phone, aired March 24th, 2017⁶, reported that "81% of Canadians have never seen the message in their phone or manual about carrying their cell phone 5-15mm away from their body". The same survey found that "67% of Canadians say they carry their phones in their pocket or directly against their body".⁷

The failure to communicate appropriate precautionary messaging based on current and historic scientific evidence contributes to Canadians' inability to make informed decisions to protect themselves from an elevated risk of diseases, such as brain cancer (glioblastoma), and reproductive damage (infertility), associated with exposure to radiation from wireless devices such as cell phones and Wi-Fi routers.

In Canada, we have an embarrassing history of serious health consequences as a result of exceedingly slow regulation of harmful exposures e.g. asbestos, cigarette smoking, thalidomide and urea formaldehyde insulation. The growing scientific evidence indicates that wireless exposure is becoming another of these public health catastrophes.

Wireless device manufacturers warn in each device's manual that the improper use, such as holding a device next to the body, could lead to exceeding Safety Code 6 guidelines⁸. Safety Code 6 (2015) clearly states several times, including in the last sentence of the introduction: "These [maximum exposure levels] shall not be exceeded."⁹

The following are examples of safety warnings in the hard copy user manuals or hidden several prompts from the initial home screen on the devices:

3 http://www.cisco.com/c/dam/en_us/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf

4 http://www.hc-sc.gc.ca/ewh-semt/consult/_2014/safety_code_6-code_securite_6/final_finale-eng.php

5 <https://www.scribd.com/document/339243060/References-and-Extracts-of-Over-60-Scientific-Studies-Published-in-2015-and-Up-to-April-2016-Reporting-Potential-Harm-at-Levels-at-or-Below-Safety-Cod>

6 https://www.youtube.com/watch?v=Wm69ik_Qdb8&t=1s&list=PLeyJPHbRnGaZmzkCwy3-8ykUZm_8B9kKM&index=1 time 1:13

7 Ibid time 14:24

8 These warnings often reference the FCC, USA Federal Communications Commission

9 http://www.hc-sc.gc.ca/ewh-semt/consult/_2014/safety_code_6-code_securite_6/final_finale-eng.php#s1

Failure of the Government of Canada to adequately warn Canadians about the harmful effects of radiofrequency/microwave radiation

Keep the iPhone device at least 25mm (.98 inches) from your body, including the abdomen of pregnant women and the lower abdomen of teenagers, when the ... device is turned on and connected to the wireless network....Go to Settings > General > About > Legal > RF Exposure

Keep the BlackBerry device at least 0.98 in. (25 mm) from your body (including the abdomen of pregnant women and the lower abdomen of teenagers) (Torch 9800) > User Manual > Page 21

Samsung - "For body-worn operation, this phone has been tested and meets FCC RF exposure guidelines¹⁰ when used with an accessory that contains no metal and that positions the mobile device a minimum of 1.5cm from the body." (Galaxy II) > User Manual > Page 164

CBC Marketplace tested three popular cell phones¹¹ for radiation levels and found that all three phones emitted more radiation when held against the body than Health Canada's Safety Code 6 guidelines state. The separation distances recommended in the manuals for these phones ranged from 5 mm to 1.5 cm.¹²

In response to the CBC Marketplace program "The Secret inside Your Phone", Innovation, Science and Economic Development Canada states: "...Health Canada's Safety Code 6 sets limits for exposure to wireless radiofrequency energy at 50 times lower than the threshold for potentially adverse health effects. Therefore, cell phones are still safe when carried directly against the body."¹³

Health Canada's limit of "50 times lower" is among the least stringent in its category. The uncertainty factor for Atrazine in water is 1,000.¹⁴ The safety margin for pesticides can be 1,000 times in certain scenarios¹⁵. The City of Toronto Prudent Avoidance Policy for new telecommunications towers recommends that exposure to RFs for the general public be kept 100 times below Safety Code 6 levels.¹⁶

Manufacturers' safety warnings come with every commercially available radiofrequency/microwave emitting device that we and our children use. The distance for i-Pads and other tablets is 20 cm (8 inches).¹⁷

There are precedents for providing wireless device precautionary messaging:

- In March, 2013 Australia's Radiation Protection and Nuclear Safety Agency published a Fact Sheet¹⁸ that advised parents to limit children's use of mobile and cordless phones and to keep monitors at least a meter away from babies' beds in order to minimize their exposure to EMR [electromagnetic radiation].¹⁹

10 The USA FCC Specific Absorption Rate (SAR) level standard is the same as Canada's Safety Code 6 (2015)

11 Samsung Galaxy S7, LG 5 and I-phone 7.

12 https://www.youtube.com/watch?v=Wm69ik_Qdb8&t=1s&list=PLcyJPHbRnGaZmzkCwy3-8ykUZm_8B9kKM&index=1 time 15:45

13 <http://www.cbc.ca/marketplace/blog/company-responses-cellphones>

14 <https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-atrazine.html> Classification and Assessment section.

15 <http://www.hc-sc.gc.ca/cps-spc/pubs/pest/pol-guide/spn2008-01/index-eng.php> Base 10X, plus database 10X factor, plus 10X factor "the new PCPA provisions require the application of an additional 10-fold factor in the risk assessment for certain scenarios (i.e. dietary, use in and around homes or schools) to take into account, in part, potential prenatal and postnatal toxicity."

16 <http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=88c87443e9481410VgnVCM10000071d60f89RCRD&vgnextchannel=05e0ebfc2bb31410VgnVCM10000071d60f89RCRD>

17 <http://showthefineprint.org/>

18 http://www.arpansa.gov.au/pubs/factsheets/ReduceExposure_wirelessDevices.pdf

19 <http://www.news.com.au/technology/gadgets/parents-urged-to-limit-childrens-use-of-mobiles-cordless-phone->

Failure of the Government of Canada to adequately warn Canadians about the harmful effects of radiofrequency/microwave radiation 3/5

- On May 12th, 2015, the City of Berkeley, California council adopted the cell phone “right to know” ordinance²⁰ requiring a notice be placed at the point of sale of cell phones. The notice reads, in part, “If you carry or use your phone in a pants or shirt pocket or tucked into a bra when the phone is ON and connected to a wireless network, you may exceed the federal guidelines for exposure to RF radiation.”
- In February, 2017 Orange, a Telecommunications company prominent in Europe and Africa offered advice on the safe use of cell phones. The notice includes “recommendations for use to reduce your exposure to radio waves.”²¹
- Ronald L Melnick, PhD, led the design of the \$25m US National Toxicology Program/National Institute of Environmental Health Science Rodent Study. Dr. Melnick states: “In my view, a pediatrician would be acting irresponsibly if he or she knew and understood the implications of the human and animal cancer data on cell phone radiation and did not offer precautionary advice to the parents of his or her patients.”²²

Precautionary messaging also has been considered by health authorities. In March 2017, the State of California Health Protection Branch released, after court order, its public warning that increased brain cancer risk is associated with heavy cell phone use. The guidelines advise cell phone users to keep the devices away from their bodies, keep calls short and to use the speaker phone on lengthy calls.²³

Questions:

- 1) Given the proof that the way Canadians are using their cell phones (against their bodies) is exceeding the Safety Code 6 guidelines, is Health Canada considering increasing the 50 times uncertainty margin and reducing the level of radiation that is permitted?
- 2) What science based evidence does the Government of Canada have to make the above statement “cell phones are still safe when carried directly against the body”?
- 3) What is the precise level (with confidence intervals) in W/kg per 1 gram of tissue at which harm from radiofrequency/microwave radiation has been established? Where can the calculations for this be found? On which scientific publications was this level based?
- 4) How do the Ministries of the Government of Canada plan to address the fact that instructions require users to keep cell phones at 5 mm to 15 mm from the body and the reality that 67% of Canadians said they hold their devices against their body, in terms of: 1) the lack of awareness (81% of Canadians are unaware that instructions exist); and 2) the practicalities that cell phones can only be used in a manner complying with Safety Code 6 when used on speakerphone or with ear buds?
- 5) Do current legislation and regulations enable the Government of Canada to require manufacturers to place their existing warnings on the packaging of wireless devices in a more readable font size and location, and/or at the point of sale? If this cannot be accomplished under current legislation and regulations, what changes would need to be made in order to require this of manufacturers? What Department(s) and Ministry are responsible for such regulation?
- 6) Will the Government of Canada provide advisories or other appropriate notifications to inform Canadians that allowing wireless transmitting devices to come in direct contact with their bodies

under-new-health-warnings/news-story/c33ff83e5fd2a2b0f6333182d23e824a

20 <http://www.saferemr.com/2014/11/berkeley-cell-phone-right-to-know.html>

21 <http://radio-waves.orange.com/en/your-mobile/best-practice>

22 <http://microwavenews.com/news-center/ntp-nyt>

23 <https://drive.google.com/file/d/0B14R6QNkmaXuX2Y3QVg0TjZaUTA/view>

can exceed Safety Code 6 (2015) limits? Which Ministry and Department would be responsible to provide such warnings?

- 7) Will the Government of Canada run an education and awareness campaign to inform all Canadians how to use wireless devices more safely?
- 8) Precedents exist where information on "situations where the use of -or exposure to - a product could pose a risk" has been published by Health Canada for other public health concerns.²⁴ Will Health Canada provide precautionary messaging e.g. advisories or campaigns such as the BabySafe project,²⁵ to inform pregnant women (and their physicians) to avoid having wireless transmitting devices touch their bodies to minimize risk to the fetus?
- 9) Will Health Canada provide precautionary messaging e.g. advisories or campaigns, to inform pediatricians, parents, teachers and other school authorities to avoid having wireless transmitting devices touch children's bodies to minimize risk to them?
- 10) In North America, devices such as baby monitors and portable home phones send out a constant signal (emitting radiofrequency/microwave radiation) at all times. In Europe, these devices have been modified for safety so that they only emit radiation when the baby makes a noise or someone speaks into the handset (on demand). Why are these devices not available in Canada? What will the Government of Canada do to facilitate the access of Canadians to these reduced risk products?"

24 <http://www.Health Canada-sc.gc.ca/aHealth Canada-asc/media/advisories-avis/index-eng.php> [accessed 8 October 2016]

25 <http://www.babysafeproject.org/>

Office of the Auditor General of Canada
240 Sparks Street
Ottawa, Ontario
K1A 0G6

Via email: petitions@oag-bvg.gc.ca

April 3, 2017

Attention: Petitions

Dear Commissioner,

I am hereby submitting the petition regarding radiofrequency/microwave radiation exposure and the health of Canadians.

Sincerely,

Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9



APR 12 2018

Dear

This is in response to your environmental petition No. 398-B of December 8, 2017, addressed to Ms. Julie Gelfand, Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised concerns regarding the safety of radiofrequency devices.

I am pleased to provide you with the enclosed response to your questions. I understand that the Minister of Innovation, Science and Economic Development will be responding separately to the questions that fall within his purview.

I appreciate your interest in this important matter.

Yours sincerely,

The Honourable Ginette Petitpas Taylor, P.C., M.P.

Enclosure

c.c. The Honourable Navdeep Bains, P.C., M.P.
Ms. Julie Gelfand, CESD

Canada

MINISTER OF HEALTH RESPONSE TO ENVIRONMENTAL PETITION NO.398-B

3.

In its response to the original petition, Health Canada states *“Safety Code 6 provides very large margins of safety against the occurrence of all established adverse health effects associated with RF (radiofrequency) field exposure”*, which is a factor of 50 times for the general public. Given that the uncertainty factor for Atrazine in water is 1,000, the safety margin for pesticides can be 1,000 times in certain scenarios and the City of Toronto’s Prudent Avoidance Policy for new telecommunications towers recommends that exposure to radiofrequency/microwave radiation for the general public be kept 100 times below Safety Code 6 levels, can Health Canada’s limit of “50 times lower” be considered consistent with other precautionary safety margins?

Safety Code 6 specifies science-based recommended human exposure limits that are based upon the avoidance of established adverse health effects. While a few jurisdictions have applied more restrictive limits for RF field exposures within their individual public policy contexts, scientific evidence does not support the need for limits that are more restrictive than those currently specified in Safety Code 6.

A precautionary approach to decision-making emphasizes the need to take timely and appropriate preventative action, even in the absence of a full scientific demonstration of cause and effect. However, the precautionary principle is not a tool for risk assessment. Risk assessments consider all data available in the scientific literature and focus on effects which scientists consider most relevant for human health. Based on such an evaluation, the Department will take action as required. In the case of RF exposures, Health Canada does not consider additional precautionary measures are warranted.

4.

Given that in its response (to no. 398) Health Canada provided four references that are all out of date and that C4ST provided references and extracts of over 60 scientific peer-reviewed, research papers published in 2015 and up to April 2016 reporting potential harm at or below Safety Code 6 (2015) limits for the general public, would Health Canada provide a list of what it considers to be the ten (10) most credible primary (original) research publications with science based evidence published after 2011 to support its claim that *“the only scientifically established health impact [if SAR limits were marginally exceeded] would be warming of the skin and underlying tissue”*?

5.

- A. If Health Canada has a weight of evidence analysis, would it provide it now?
- B. If a full and complete weight of evidence analysis is not available as requested in 5A, would Health Canada provide 10 primary (original) studies that support Health Canada’s position that there is no harm from RE radiation at non-thermal levels below Safety Code 6 limits?
- C. Can Health Canada provide a weight of evidence analysis for the studies in Question 5B above?
- D. If a full and complete weight of evidence analysis is not available as requested in 5A, would Health Canada provide one for the 10 peer-reviewed studies listed in Appendix A, published from 2012 to 2017 which provide evidence of harm from RE radiation such as brain tumours, breast cancer, sperm and DNA damage at exposures at non-thermal levels below Safety Code 6 limits?

Health Canada monitors the scientific literature related to RF fields on an ongoing basis and stands by its position that the recommended exposure limits in Safety Code 6 are protective of health.

Safety Code 6 is based upon credible scientific evidence and analysis. When conducting an evaluation of the scientific literature, the Department gathers, assesses, and integrates multiple sources of peer reviewed scientific evidence into an overall conclusion; an approach that is consistent with international practices.

The weight of evidence analysis conducted by Health Canada considers all the available peer reviewed literature within scope, as opposed to only a small number of studies which would inherently bias the outcome. Such a practice would not be considered rigorous or scientifically sound.

While Safety Code 6 (2015) references a number of large international reviews of the scientific literature, the Code is intended as an exposure guideline and not a scientific review article and accordingly, most individual scientific studies are not referenced in the Code. However, this does not mean that Health Canada does not consider all relevant scientific information when deriving the science-based exposure limits in Safety Code 6.

Health Canada has been taking part in the International EMF Project, coordinated by the World Health Organization (WHO). The goals of this project are to assess scientific evidence of possible health effects from exposure to EMFs and to characterize any associated health risks to humans. The WHO is coordinating an updated monograph on the potential health effects from RF field exposure. Health Canada is participating in this exercise, allowing the Department to leverage this large-scale and highly resourced international effort. Updates on the development of the WHO monograph will be made available on the WHO EMF Project website: <http://www.who.int/peh-emf/project/en/>.

If new scientific evidence were to demonstrate that exposure to RF energy below levels found in Safety Code 6 is a health concern, Health Canada would take appropriate action to help protect the health and safety of Canadians.

6.

What “weight” considerations for potential bias, as examined in Huss, A., et al. 2007, “Source of Funding and Results of Studies of Health Effects of Mobile Phone Use: Systematic Review of Experimental Studies” published in *Environmental Health Perspectives*, 115(1), 1–4, have been applied to the weight of evidence analyses by Health Canada?

Health Canada assesses the merit of individual research studies based upon a variety of quality factors, including but not limited to: inclusion of proper controls, dosimetry, temperature monitoring/control, statistical approaches, blinding of samples during analysis.

Health Canada’s approach takes into account both the quantity of studies on a particular endpoint (whether adverse or no effect), and more importantly, the quality of those studies. Poorly conducted studies (e.g., an inadequate exposure evaluation, a lack of appropriate control samples or an inadequate statistical analysis) receive relatively little weight, while properly conducted studies (e.g., with all controls included, appropriate statistics and a complete exposure evaluation) receive more weight.

Health Canada also takes note of the funding source for individual research studies.

7.

How does Health Canada reconcile its position that the studies that have reported biological effects of radiofrequency radiation that are below the limits in Safety Code 6, at non-thermal levels *“are in the minority, are very far from conclusive, and do not represent the prevailing line of scientific evidence in this area”* with the viewpoints of reputable scientists from respected institutions such as the universities of Toronto, Harvard, Washington and Yale as well as the 230 scientists from 41 nations who are specialists in the biological effects of radiofrequency radiation at non-thermal levels and who signed the International EMF Scientist Appeal stating that *“guidelines and regulatory standards [need to] be strengthened”*?

8.

- A. What was the evidence that proved conclusively that cigarette smoking causes lung cancer?
- B. What peer-reviewed studies provided the ‘tipping point’ for Health Canada to insist on precautionary warnings e.g. for labeling on cigarette packages, about the potential harm of smoking tobacco?
- C. How is that threshold different from the peer reviewed scientific evidence available regarding the harm from RF wireless radiation today?

As in many areas of science, it is possible to find differing scientific results and/or opinions. It is important to note that a biological response (as reported in some studies) does not necessarily translate to an adverse health outcome in humans. Health Canada’s recommended human exposure limits are based upon the avoidance of established adverse health outcomes in humans. Canada's limits are consistent with the science-based standards used in other parts of the world (e.g., the United States, the European Union, Japan, Australia and New Zealand) and provide protection against all known adverse health effects from RF energy.

The International Agency for Research on Cancer (IARC) has classified tobacco smoke and smoking as “carcinogenic to humans” (Class 1), as there is sufficient evidence in humans and animals of a causal relationship between smoking and cancer. Radiofrequency fields are classified by IARC as “possibly carcinogenic to humans” (Class 2B), based upon limited evidence in humans of an increased risk for glioma and acoustic neuroma among users of wireless telephones but chance, bias or confounding could not be ruled out with reasonable confidence.

10.

- A. Given that neither the *“Safety Code 6”* document, nor the *“Safety Code 6 (2015) — Rationale”* document provide a complete and transparent analyses or summary of the scientific evidence on non-thermal effects below Safety Code 6 limits as outlined in Q4, on what basis is Health Canada making the statement the process it used to revise Safety Code 6 was *“comprehensive, inclusive and transparent”*?
- B. Why is the *“Safety Code 6 (2015) - Rationale”* document only available on request, and not readily available on Health Canada’s website?
- C. When will Health Canada follow the international best practices of the scientific review process and be truly transparent by making this information available to the public, on line or in peer-reviewed journals?

Health Canada's latest process to revise Safety Code 6 was the most comprehensive, inclusive and transparent process to date. The proposed Safety Code 6 underwent an extensive independent peer review by an Expert Panel of the Royal Society of Canada; a process which further considered stakeholder feedback and resulted in changes to the Code. Health Canada furthermore published its proposed 2014 revisions to Safety Code 6 for public consultation between May 16 and July 15, 2014 and welcomed feedback from interested Canadians and stakeholders. The revised Safety Code 6, which was published in 2015, as well as the summary of consultation feedback is available on Health Canada's website:

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/consultations/2015-revisions-safety-code-6-summary-consultation-feedback.html>

The rationale document is an internal Health Canada document written to support proposed changes to Safety Code 6. This document was shared with the Expert Panel of the RSC in 2013, revised before the consultative version of Safety Code 6 was released in 2014, and subsequently revised upon final publication of Safety Code 6 (2015). The document is available to all Canadians upon request. Due to the highly technical nature of the rationale document, the decision was made to continue offering the document upon request; a practice consistent with current policy to streamline and consolidate the amount of web content to focus on information of the greatest interest to Canadians. Please note that Health Canada has distributed this document in response to several correspondences, as well as a previous environmental petition (no.365).

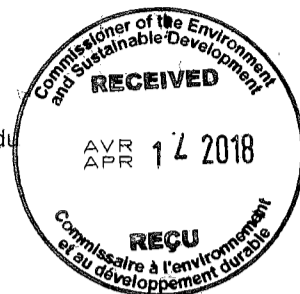
There has been significant ongoing international work on RF EMF and its potential impact on health. Among these, the WHO has convened a working group to conduct a thorough review of all of the latest scientific literature on this topic and will publish an authoritative review on this issue. As stated earlier, Safety Code 6 specifies recommended human exposure limits and was not intended to be a scientific review article, thus Safety Code 6 references a number of large international reviews of the scientific literature, which themselves have been subject to peer review procedures.

Minister of
Innovation, Science and
Economic Development



Ministre de
l'Innovation, des Sciences et du
Développement économique

Ottawa, Canada K1A 0H5



APR 10 2018

Dear

I am writing with respect to Environmental Petition no. 398-B, submitted to the Auditor General of Canada under Section 22 of the *Auditor General Act*, on “Failure of the Government of Canada to provide appropriate warnings so Canadians can take actions to protect themselves from excessive exposures to radiofrequency/microwave radiation from common personal and household wireless devices such as cell phones, baby monitors, cordless phones and Wi-Fi internet routers through normal, everyday use.”

The Office of the Auditor General of Canada forwarded your questions to the Honourable Ginette Petitpas Taylor, Minister of Health, and to me. I am writing in response to questions 1A, 1B, 2A, 2B, and 9, which fall under the mandate and responsibility of Innovation, Science and Economic Development Canada (ISED). Minister Petitpas Taylor will be providing you with a separate response addressing the remaining questions that fall under her department’s mandate and areas of responsibility.

Question 1: Given that Health Canada’s Safety Code 6 (2015) clearly states that “These [maximum exposure] levels shall not be exceeded” and that Innovation, Science and Economic Development Canada (ISED) has adopted these levels as its standard, and that the CBC TV “Marketplace” program tests showed when held at zero separation distance against the simulated head used for certification of cell phones, that some cell phone models emit radiation three to four times above Safety Code 6 limits for the general public, i.e. in clear non-compliance of Safety Code 6 limits,

- A. Why are these federal departments allowing breaches of the standard?**
- B. What enforcement measures can be taken, and are being taken to ensure compliance with these standards?**

Question 2: Will Innovation, Science and Economic Development (ISED) confirm that some cell phone models currently on the Canadian retail market,

- A. When tested “against the SAM phantom” i.e. at zero separation distance from the head, exceed (breach) the Safety Code 6 Specific Absorption Rate (SAR) limit of 1.6 W/kg, averaged over 1 gram of tissue?**

...2

Canada

B. When tested against the flat phantom at a “separation distance of 15 mm or less” exceed (breach) the Safety Code 6 Specific Absorption Rate (SAR) limit of 0.08 W/kg, averaged over 1 gram of tissue?

Response 1A, 1B, 2A and 2B:

ISED’s current regulatory framework, including market surveillance, auditing, and enforcement procedures, provides safeguards to protect Canadians against overexposure to wireless devices.

ISED requires that head-compliance testing be performed directly against a simulated head at a zero millimetre separation distance. Furthermore, it requires that body-worn compliance testing be performed with the use of a simulated body at a maximum separation distance of 15 millimetres or less. Both assessments have an applicable Safety Code 6 limit of 1.6 watts per kilogram, averaged over 1 gram of tissue.

At the time of certification, manufacturers of cell phones are required to meet the radiofrequency (RF) exposure regulatory requirements if they wish to introduce their products to the Canadian market. Compliance is an ongoing obligation for anyone who manufactures, imports, distributes, offers for sale, sells, or leases equipment in Canada.

ISED conducts regular audits as part of its market surveillance program to ensure that wireless devices in Canada are compliant. Should the Department become aware of a device exceeding the exposure levels set in the regulatory standards, it will take immediate action to protect Canadians.

In cases where ISED’s technical standards, such as RF exposure regulatory requirements, are not being met through voluntary compliance, several different enforcement measures may be taken under the *Radiocommunication Act*. These include but are not limited to:

- issuance of an order to immediately cease to manufacture, import, lease, distribute, offer for sale, or sell the device in Canada;
- imposition of an administrative monetary penalty; and
- prosecution.

Further information on compliance and enforcement measures can be found online at www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf10951.html.

Question 9: In its response, Innovation, Science and Economic Development (ISED) states that “To comply with applicable regulations, equipment manufacturers are required to provide clear information to users on the subject of intended use in the user manual of the products.” As the CBC TV “Marketplace” program polls showed, “81% of Canadians had never seen the message in their phone or manual...”

...3

A. As demonstrated above, why is ISED going against its own compliance requirements by not requiring manufacturers to ensure users are made aware of these warnings by having the warnings shown on the phone or packaging (as for cigarettes) as well as at the point of sale as in the City of Berkeley, California, where making such proper use warnings prominently visible at point of sale, is mandatory?

Response 9A:

As per the technical standard developed, pursuant to the *Radiocommunication Act*, ISED requires manufacturers to provide information on the proper usage of wireless devices in their user manuals, including the minimum separation distance at which a product shall be kept from the body to be in compliance with RF exposure limits. These user manual requirements are in line with other countries, such as the United States (US).

ISED continues to work with Health Canada, other regulators such as the US Federal Communications Commission, international standards bodies, manufacturers, and other stakeholders on improving communication with users.

I appreciate this opportunity to respond to your petition, and I trust that this information is of assistance.

Sincerely,



The Honourable Navdeep Bains, P.C., M.P.

c.c.: The Honourable Ginette Petitpas Taylor, P.C., M.P.
Health Canada

Ms. Julie Gelfand
Commissioner of the Environment and Sustainable Development

Environmental Petition
Name of petitioner(s):
Address of petitioner(s):



Name of the group:

Signature of the petitioner:

This petition is being submitted as a follow-up to environmental petition #398 in accordance with the *Auditor General Act*. Responses from Health Canada, and Innovation, Science and Economic Development Canada are requested.

Date: Dec. 8, 2017

Title of the Original Petition: Failure of the Government of Canada to provide appropriate warnings so Canadians can take actions to protect themselves from excessive exposures to radiofrequency/microwave radiation from common personal and household wireless devices such as cell phones, baby monitors, cordless phones and Wi-Fi internet routers through normal, everyday use.

Question 1: Given that Health Canada's Safety Code 6 (2015) clearly states that "*These [maximum exposure] levels shall not be exceeded*"¹ and that Innovation, Science and Economic Development Canada (ISED) has adopted these levels as its standard, and that the CBC TV "*Marketplace*" program tests showed when held at zero separation distance against the simulated head used for certification of cell phones, that some cell phone models emit radiation three to four times above Safety Code 6 limits for the general public², i.e. in clear non-compliance of Safety Code 6 limits,

- A. Why are these federal departments allowing breaches of the standard?
- B. What enforcement measures can be taken, and are being taken to ensure compliance with these standards?

Question 2: Will Innovation, Science and Economic Development (ISED) confirm that some cell phone models currently on the Canadian retail market,

A. when tested³ "*against the SAM phantom*" i.e. at zero separation distance from the head, exceed (breach) the Safety Code 6 Specific Absorption Rate (SAR) limit of 1.6 W/kg, averaged over 1 gram of tissue?

B. when tested³ "*against the flat phantom*" at a "separation distance of 15 mm or less" exceed (breach) the Safety Code 6 Specific Absorption Rate (SAR) limit of 0.08 W/kg, averaged over 1 gram of tissue?

1 http://www.hc-sc.gc.ca/ewh-semt/consult/_2014/safety_code_6-code_securite_6/final_finale-eng.php#s1

2 https://www.youtube.com/watch?v=Wm69ik_Qdb8&t=1s&list=PLeyJPHbRnGaZmzkCwy3-8ykUZm_8B9kKM&index=1 time 15:45

3 RSS-102 — Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) <http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01904.html>. Section 3.1

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Question 3: In its response to the original petition, Health Canada states “*Safety Code 6 provides very large margins of safety against the occurrence of all established adverse health effects associated with RF [radiofrequency] field exposure*”⁴, which is a factor of 50 times for the general public.

Given that the uncertainty factor for Atrazine in water is 1,000,⁵ the safety margin for pesticides can be 1,000 times in certain scenarios⁶ and the City of Toronto's Prudent Avoidance Policy for new telecommunications towers recommends that exposure to radiofrequency/microwave radiation for the general public be kept 100 times below Safety Code 6 levels,⁷ how can Health Canada's limit of “50 times lower” be considered consistent with other precautionary safety margins?

Question 4: When asked “*What science based evidence does the Government of Canada have to make the statement ‘cell phones are still safe when carried directly against the body’*”, Health Canada cited four references. Only one was dated post the 2011 World Health Organization-International Agency of Research on Cancer 2B possible human classification, and that 2017 study had to do with protective clothing of workers and was not relevant to the general public. Health Canada also provided a document called “*Safety Code 6 (2015) Rationale*”. This undated document with no names of authors and without a Health Canada logo, cites no primary references regarding non-thermal effects but does refer to four sources as being “*authoritative scientific reviews*”. All four are out of date. The three non-draft sources are reviews and have no references for 2014 or later. The WHO draft monograph missed over 300 studies (that it itself acknowledges⁸), and has only 6 from 2014 or later. In addition, the lack of a summary and recommendations in the WHO draft document, and that it is only a draft, disqualifies it as an authoritative review to support heating (upon which Safety Code 6 limits are based) as being the only established adverse effect of radiofrequency radiation⁹.

- A. Given that in its response Health Canada provided four references that are all out of date and that C4ST provided references and extracts of over 60 scientific peer-reviewed, research papers published in 2015 and up to April 2016 reporting potential harm at or below Safety Code 6 (2015) limits for the general public,¹⁰ would Health Canada provide a list of what it considers to be the ten (10) most credible primary (original) research publications with science based evidence published after 2011 to support its claim that “*the only scientifically established health impact [if SAR limits were marginally exceeded] would be warming of the skin and underlying tissue*”?

Question 5: In its response, Health Canada states “*Health Canada and other leading health agencies, including the World Health Organization, have concluded that, to date, there is no convincing scientific evidence linking adverse health effects to levels below existing RF [radiofrequency] exposure limits.*” As noted in Question 3, the reports are all out of date. In other correspondence, Health Canada has referenced its “*weight of evidence*” approach¹¹ in evaluating the most recent scientific evidence that

4 Situations such as outlined in Question 1 notwithstanding

5 <https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-atrazine.html> Classification and Assessment section.

6 http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_pol-guide/spn2008-01/index-eng.php Base 10X, plus database 10X factor, plus 10X factor “the new PCPA provisions require the application of an additional 10-fold factor in the risk assessment for certain scenarios (i.e. dietary, use in and around homes or schools) to take into account, in part, potential prenatal and postnatal toxicity.”

7 <http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=88c87443e9481410VgnVCM10000071d60f89RCRD&vgnextchannel=05e0ebfc2bb31410VgnVCM10000071d60f89RCRD>

8 <https://vimeo.com/170983540>

9 In the frequency range used for common communication devices.

10 <https://www.scribd.com/document/339243060/References-and-Extracts-of-Over-60-Scientific-Studies-Published-in-2015-and-Up-to-April-2016-Reporting-Potential-Harm-at-Levels-at-or-Below-Safety-Cod>

11 The World Health Organization-International EMF Project's 2006 document, “*Framework for developing health-based EMF standards. World Health Organization, #42*” that is referenced on the Health Canada website does not follow-up of Petition 398 -*Failure of the Government of Canada to adequately warn Canadians about the harmful effects of radiofrequency/microwave radiation*

would provide a rationale for why the evidence in the 60 studies mentioned in Question 4 do not have sufficient "weight" to warrant changes in Safety Code 6. As Health Canada says, this approach takes into account both the number and quality of studies, and gives more weight to studies that have been reproduced and that meet the highest standards of rigor and control.

- A. If Health Canada has a weight of evidence analysis, would it provide it now? The weight of evidence analysis can be in any format, although one consistent with international best practices is preferred. As noted by Weed (2005)¹² of the US National Cancer Institute, "the WOE [weight of evidence] concept and its fully associated methods should be fully described when used"¹³.
- B. If a full and complete weight of evidence analysis is not available as requested in 5A, would Health Canada provide 10 primary (original)¹⁴ studies that support Health Canada's position that there is no harm from RF radiation at non-thermal levels below Safety Code 6 limits?
- C. Can Health Canada provide a weight of evidence analysis for the studies in Question 5B above?
- D. If a full and complete weight of evidence analysis is not available as requested in 5A, would Health Canada provide one for the 10 peer-reviewed studies listed in Appendix A, published from 2012 to 2017 which provide evidence of harm from RF radiation such as brain tumours, breast cancer, sperm and DNA damage at exposures at non-thermal levels below Safety Code 6 limits?

Question 6.

- A. What "weight" considerations for potential bias, as examined in Huss, A., et al. 2007, "Source of Funding and Results of Studies of Health Effects of Mobile Phone Use: Systematic Review of Experimental Studies" published in *Environmental Health Perspectives*, 115(1), 1–4¹⁵, have been applied to the weight of evidence analyses by Health Canada?

Question 7: Health Canada acknowledges that there are scientific studies that have reported biological effects of radiofrequency radiation that are below the limits in Safety Code 6, at non-thermal levels¹⁶.

- A. How does Health Canada reconcile its position that the studies that have reported biological effects of radiofrequency radiation that are below the limits in Safety Code 6, at non-thermal levels¹⁷ "are in the minority, are very far from conclusive, and do not represent the prevailing line of scientific evidence in this area" with the viewpoints of reputable scientists from respected institutions such as the universities of Toronto, Harvard, Washington and Yale as well as the 230 scientists from 41 nations who are specialists in the biological effects of radiofrequency radiation at non-thermal levels and who signed the International EMF Scientist Appeal (Appendix B) stating that "guidelines and regulatory standards [need to] be strengthened"¹⁸ ?

provide a systematic review nor a weight of evidence analysis. <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/radiation/consumer-radiation/equipment/frequently-asked-questions-about-radiation.html>

12 Weed, D. L. (2005). Weight of evidence: a review of concept and methods. *Risk Analysis: An Official Publication of the Society for Risk Analysis*, 25(6), 1545–1557. <https://www.ncbi.nlm.nih.gov/pubmed/16506981>

13 One recent example of a systematic review would be Golbach et al. (2016): Calcium homeostasis and low-frequency magnetic and electric field exposure: A systematic review and meta-analysis of in vitro studies. *Environment International*, 92–93, 695–706. <https://www.ncbi.nlm.nih.gov/pubmed/26872872>

14 Not links to studies

15 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1797826/>

16 In the frequency range used for common communication devices.

17 In the frequency range used for common communication devices.

18 <https://www.emfscientist.org/>

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- B. What further evidence and quantity and quality of experts are required in order for Health Canada to modify Safety Code 6?

Question 8. Health Canada claims there is no convincing or conclusive evidence of harm from low levels of radiofrequency radiation exposure below Safety Code 6 limits.

- A. What was the evidence that proved conclusively that cigarette smoking causes lung cancer?
B. What peer-reviewed studies provided the "tipping point" for Health Canada to insist on precautionary warnings e.g. for labeling on cigarette packages, about the potential harm of smoking tobacco?
C. How is that threshold different from the peer reviewed scientific evidence available regarding the harm from RF wireless radiation today?

Question 9. In its response, Innovation, Science and Economic Development (ISED) states that "*To comply with applicable regulations, equipment manufacturers are required to provide clear information to users on the subject of intended use in the user manual of the products*". As the CBC TV "Marketplace" program polls showed, "*81% of Canadians had never seen the message in their phone or manual...*"

- A. As demonstrated above, why is ISED going against its own compliance requirements by not requiring manufacturers to ensure users are made aware of these warnings by having the warnings shown on the phone or packaging (as for cigarettes) as well as at the point of sale as in the City of Berkeley, California, where making such proper use warnings prominently visible at point of sale, is mandatory?

Question 10. In other correspondence, Health Canada states "*Health Canada's latest process to revise Safety Code 6 was the most comprehensive, inclusive and transparent process to date.*"

- A. Given that neither the "Safety Code 6" document, nor the "Safety Code 6 (2015) – Rationale" document provide a complete and transparent analyses or summary of the scientific evidence on non-thermal effects below Safety Code 6 limits as outlined in Q4, on what basis is Health Canada making the statement the process it used to revise Safety Code 6 was "*comprehensive, inclusive and transparent*"?
B. Why is the "Safety Code 6 (2015) – Rationale" document only available on request, and not readily available on Health Canada's website?
C. When will Health Canada follow the international best practices (Appendix C) of the scientific review process,^{19,20} and be truly transparent by making this information available to the public, on line or in peer-reviewed journals?

Appendix A. Ten (10) studies for Health Canada's weight of evidence analysis.

1. Avendaño, C., Mata, A., Sanchez Sarmiento, C. A., & Doncel, G. F. (2012). Use of laptop computers connected to internet through Wi-Fi decreases human sperm motility and increases sperm DNA fragmentation. *Fertility and Sterility*, 97(1), 39–45.e2.
<https://doi.org/10.1016/j.fertnstert.2011.10.012>
2. Carlberg, M., & Hardell, L. (2014). Decreased survival of glioma patients with astrocytoma grade IV (glioblastoma multiforme) associated with long-term use of mobile and cordless phones.

19 <http://ehp.niehs.nih.gov/1307972>

20 <http://www.ncbi.nlm.nih.gov/pubmed/16506981>

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International Journal of Environmental Research and Public Health, 11(10), 10790–10805.
<https://doi.org/10.3390/ijerph111010790>

3. Carlberg, M., & Hardell, L. (2017). Evaluation of Mobile Phone and Cordless Phone Use and Glioma Risk Using the Bradford Hill Viewpoints from 1965 on Association or Causation. *BioMed Research International*, 2017, e9218486. <https://doi.org/10.1155/2017/9218486>
4. Coureau, G., Bouvier, G., Lebailly, P., Fabbro-Peray, P., Gruber, A., Leffondre, K., ... Baldi, I. (2014). Mobile phone use and brain tumours in the CERENAT case-control study. *Occupational and Environmental Medicine*, 71(7), 514–522. <https://doi.org/10.1136/oemed-2013-101754>
5. Davis, D. L., Kesari, S., Soskolne, C. L., Miller, A. B., & Stein, Y. (2013). Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. *Pathophysiology: The Official Journal of the International Society for Pathophysiology / ISP*, 20(2), 123–129. <https://doi.org/10.1016/j.pathophys.2013.03.001>
6. Divan, H. A., Kheifets, L., Obel, C., & Olsen, J. (2012). Cell phone use and behavioural problems in young children. *Journal of Epidemiology and Community Health*, 66(6), 524–529. <https://doi.org/10.1136/jech.2010.115402>
7. Momoli, F., Siemiatycki, J., McBride, M. L., Parent, M.-É., Richardson, L., Bedard, D., ... Krewski, D. (2017). Probabilistic multiple-bias modelling applied to the Canadian data from the INTERPHONE study of mobile phone use and risk of glioma, meningioma, acoustic neuroma, and parotid gland tumors. *American Journal of Epidemiology*. <https://doi.org/10.1093/aje/kwx157>
8. Özgür, A., Tümkaya, L., Terzi, S., Kalkan, Y., Erdivanlı, Ö. Ç., & Dursun, E. (2015). Effects of chronic exposure to electromagnetic waves on the auditory system. *Acta Oto-Laryngologica*, 1–6. <https://doi.org/10.3109/00016489.2015.1032434>
9. Prasad, M., Kathuria, P., Nair, P., Kumar, A., & Prasad, K. (2017). Mobile phone use and risk of brain tumours: a systematic review of association between study quality, source of funding, and research outcomes. *Neurological Sciences: Official Journal of the Italian Neurological Society and of the Italian Society of Clinical Neurophysiology*. <https://doi.org/10.1007/s10072-017-2850-8>
10. West, J. G., Kapoor, N. S., Liao, S.-Y., Chen, J. W., Bailey, L., & Nagourney, R. A. (2013). Multifocal breast cancer in young women with prolonged contact between their breasts and their cellular phones. *Case Reports in Medicine*, 2013, 1–5. <https://doi.org/10.1155/2013/354682>

Appendix B: International Appeal: Scientists call for Protection from Non-ionizing Electromagnetic Field Exposure²¹

To: His Excellency Antonio Guterres, Secretary-General of the United Nations; Honorable Dr. Tedros Adhanom, Director-General of the World Health Organization; Honorable Erik Solheim, Executive Director of the U.N. Environment Programme; U.N. Member Nations

²¹ <https://www.emfscientist.org/>

Follow-up of Petition 398 - Failure of the Government of Canada to adequately warn Canadians about the harmful effects of radiofrequency/microwave radiation

**International Appeal:
Scientists call for Protection from Non-ionizing Electromagnetic Field Exposure**

We are scientists engaged in the study of biological and health effects of non-ionizing electromagnetic fields (EMF). Based upon peer-reviewed, published research, we have serious concerns regarding the ubiquitous and increasing exposure to EMF generated by electric and wireless devices. These include— but are not limited to—radiofrequency radiation (RFR) emitting devices, such as cellular and cordless phones and their base stations, Wi-Fi, broadcast antennas, smart meters, and baby monitors as well as electric devices and infra-structures used in the delivery of electricity that generate extremely-low frequency electromagnetic field (ELF EMF).

Scientific basis for our common concerns

Numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans. Damage goes well beyond the human race, as there is growing evidence of harmful effects to both plant and animal life. These findings justify our appeal to the United Nations (UN) and, all member States in the world, to encourage the World Health Organization (WHO) to exert strong leadership in fostering the development of more protective EMF guidelines, encouraging precautionary measures, and educating the public about health risks, particularly risk to children and fetal development. By not taking action, the WHO is failing to fulfill its role as the preeminent international public health agency.

Inadequate non-ionizing EMF international guidelines

The various agencies setting safety standards have failed to impose sufficient guidelines to protect the general public, particularly children who are more vulnerable to the effects of EMF. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) established in 1998 the “Guidelines For Limiting Exposure To Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)”¹. These guidelines are accepted by the WHO and numerous countries around the world. The WHO is calling for all nations to adopt the ICNIRP guidelines to encourage international harmonization of standards. In 2009, the ICNIRP released a statement saying that it was reaffirming its 1998 guidelines, as in their opinion, the scientific literature published since that time “has provided no evidence of any adverse effects below the basic restrictions and does not necessitate an immediate revision of its guidance on limiting exposure to high frequency electromagnetic fields”². ICNIRP continues to the present day to make these assertions, in spite of growing scientific evidence to the contrary. It is our opinion that, because the ICNIRP guidelines do not cover long-term exposure and low-intensity effects, they are insufficient to protect public health.

The WHO adopted the International Agency for Research on Cancer (IARC) classification of extremely low frequency electromagnetic field (ELF EMF) in 2002³ and radiofrequency radiation (RFR) in 2011⁴. This classification states that EMF is a possible human carcinogen (Group 2B). Despite both IARC findings, the WHO continues to maintain that there is insufficient evidence to justify lowering these quantitative exposure limits.

Since there is controversy about a rationale for setting standards to avoid adverse health effects, we recommend that the United Nations Environmental Programme (UNEP) convene and fund an independent multidisciplinary committee to explore the pros and cons of alternatives to current practices that could substantially lower human exposures to RF and ELF fields. The deliberations of this group should be conducted in a transparent and impartial way. Although it is essential that industry be involved and cooperate in this process, industry should not be allowed to bias its processes or conclusions. This group should provide their analysis to the UN and the WHO to guide precautionary action.

Collectively we also request that:

1. children and pregnant women be protected;
2. guidelines and regulatory standards be strengthened;
3. manufacturers be encouraged to develop safer technology;
4. utilities responsible for the generation, transmission, distribution, and monitoring of electricity maintain adequate power quality and ensure proper electrical wiring to minimize harmful ground current;
5. the public be fully informed about the potential health risks from electromagnetic energy and taught harm reduction strategies;
6. medical professionals be educated about the biological effects of electromagnetic energy and be provided training on treatment of patients with electromagnetic sensitivity;
7. governments fund training and research on electromagnetic fields and health that is independent of industry and mandate industry cooperation with researchers;
8. media disclose experts' financial relationships with industry when citing their opinions regarding health and safety aspects of EMF-emitting technologies; and
9. white-zones (radiation-free areas) be established.

1. <http://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf>
2. <http://www.icnirp.org/cms/upload/publications/ICNIRPStatementEMF.pdf>
3. <http://monographs.iarc.fr/ENG/Monographs/vol80>
4. <http://monographs.iarc.fr/ENG/Monographs/vol102/>

Initial release date: May 11, 2015

Date of this version: November 9, 2017

Inquiries, including those from qualified scientists who request that their name be added to the Appeal, may be made by contacting Elizabeth Kelley, M.A., Director, EMFscientist.org, at info@EMFscientist.org.

Note: the signatories to this appeal have signed as individuals, giving their professional affiliations, but this does not necessarily mean that this represents the views of their employers or the professional organizations they are affiliated with.

Appendix C. International best practices of systematic reviews according to:

Rooney, A. A., Boyles, A. L., Wolfe, M. S., Bucher, J. R., & Thayer, K. A. (2014b). Systematic Review and Evidence Integration for Literature-Based Environmental Health Science Assessments. *Environmental Health Perspectives*, 122(7), 711–718.²²

²² <https://ehp.niehs.nih.gov/1307972/>

Follow-up of Petition 398 -Failure of the Government of Canada to adequately warn Canadians about the harmful effects of radiofrequency/microwave radiation

Step 1: Problem Formulation and Protocol Development

Step 2: Search for and Select Studies for Inclusion

Step 3: Extract Data from Studies

Step 4: Assess the Quality or Risk of Bias of Individual Studies

Step 5: Rate the Confidence in the Body of Evidence

Step 6: Translate the Confidence Ratings into Level of Evidence for Health Effect

Step 7: Integrate the information from different evidence streams (human, animal, and “other relevant data” including mechanistic or *in vitro* studies) to develop hazard identification conclusions.



Government
of Canada

Gouvernement
du Canada

OCT 27 2017



Dear

We are writing with respect to your Environmental Petition No. 407, submitted to the Auditor General of Canada under Section 22 of the *Auditor General Act*, on the “Scientific Review Processes to Determine Limits on Exposure to Radiofrequency Radiation according to *Safety Code 6 - Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz (2015)*.”

The Office of the Auditor General of Canada forwarded your questions to the Minister of Health; the Minister of the Environment and Climate Change; and to us. We are writing in response to questions 3, 4, 5, 6, 11, 13 and 14. Our colleagues will be providing you with separate responses addressing questions that fall under their departments’ mandates and areas of responsibility.

Question 3: With potentially severe and costly individual and public health implications, what modeling and surveillance programs are tracking RFR exposures in the workplace, schools, public places and private spaces?

Response 3:

To help ensure the protection of the general public, Innovation, Science and Economic Development Canada (ISED) adopted Safety Code 6. ISED requires that all wireless equipment and new antenna installations meet the Code upfront. For equipment, this means complying with the regulatory requirements set forth in the technical standard *Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)* before certification can proceed. For antenna towers, it means following the process established in our antenna siting procedures, *Radiocommunication and Broadcasting Antenna Systems (CPC-2-0-03)*, before an installation can proceed.

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Canada

Compliance with Safety Code 6 must be maintained at all times. When Health Canada recently revised the Code's limits, Canadian wireless carriers and broadcast operators attested their compliance with these new limits.

ISED has in place an annual audit program of RF exposure levels on equipment and antenna installations to ensure that antenna installations and wireless devices on the Canadian market are compliant with Safety Code 6. For example, our audits show that, for cell phone tower installations, the RF levels are at a small fraction of the Safety Code 6 limits.

As part of its ongoing monitoring of wireless devices for compliance with regulatory specifications, ISED conducted an extensive series of tests in 2011 to measure RF exposure from the use of Wi-Fi devices in a simulated classroom setting. The goal was to obtain measurements of the levels of aggregated RF exposure from multiple Wi-Fi access points and Wi-Fi-enabled devices in an indoor environment. The study confirmed that, in environments such as schools, workplaces and public and private spaces, the RF exposure from wireless devices is significantly below the Safety Code 6 limits. You may consult this study online at www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf10383.html.

Question 4: How can the public request investigations and access modeling, survey or surveillance data? For example, what are the average and peak exposures at various frequencies and modulations, of children in close proximity to one another streaming wireless data?

Response 4:

Any member of the general public may contact a tower owner directly for Safety Code 6 information related to an antenna tower. Additionally, as per the process outlined in CPC-2-0-03, any tower owner seeking to install or modify an antenna system must undertake a public notification of the proposed installation, which will include Safety Code 6 information.

You may also consult ISED's study noted above under Response 3 on RF levels emitted from Wi-Fi devices in a simulated classroom setting that was conducted to ensure compliance with regulatory specifications. The findings of this case study confirmed that the aggregated RF exposure of multiple Wi-Fi access points and Wi-Fi-enabled devices in this indoor location was well below the Safety Code 6 limits. It demonstrated that, in a typical environment in which a person is located several metres from the Wi-Fi access point and surrounded by other users, the level of RF exposure is considerably below the Safety Code 6 limits. It was also concluded that the RF exposure levels found in this study are likely higher than typical equivalent set-ups in public and private environments, such as homes, schools, and businesses.

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Question 5: What initiatives are planned and in place, to ensure that Canadians understand the “fine print” in their devices, and that they respect the manufacturers’ distance requirements?

Question 6: What encouragement and incentives are directed at the industry from the government, to design and market information technology products that incorporates best practices to eliminate or minimize RFR exposures—both to protect the health of Canadians, and to position Canadian technological solutions at the global forefront as the safest possible technology?

Question 13: Given authoritative reports that cell phones as they are currently used do not comply with SC6 guidelines, what validation and verification does the Government of Canada conduct to ensure that Canadians are not exposed to RFR levels exceeding SC6 guidelines, and what measures are taken to rectify circumstances resulting in over-exposures?

Response 5, 6, and 13:

ISED requires that all manufacturers of wireless products meet the regulatory requirements set forth in its technical standards. ISED’s technical standards are based on recognized international testing procedures that have been adopted by most countries around the world.

When wireless devices are tested for compliance, they are tested at full power for the duration of the test. In reality, most portable wireless devices operate at much lower power levels to preserve battery life and avoid network interference. Therefore, under normal operating conditions, a wireless device yields much lower RF exposure levels than levels measured during compliance testing performed in laboratory settings.

Furthermore, ISED adopted Safety Code 6 limits for the RF exposure compliance of wireless devices. Health Canada’s scientific evidence indicates that the recommended peak specific absorption rate (SAR) limit of 1.6 W/kg for cell phones and tablets is not the threshold for the occurrence of adverse health effects. As a precautionary measure, the peak SAR limit in Safety Code 6 was set to more than 50 times below the level at which excessive tissue heating could occur in the most sensitive tissue (the eye). This means that the peak SAR limits in Safety Code 6 would need to be exceeded by a factor of more than 50 before one would see any thermally related adverse health effects.

Canada’s approach to wireless device safety testing is among the most stringent in the world. Given this, ISED strongly believes that all products evaluated following the test procedures set forth in Canadian regulatory standards that comply with Health Canada’s

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Safety Code 6 limits are safe. Market surveillance is also conducted to promote and ensure continued compliance to ISED regulatory standards.

In response to your enquiry regarding initiatives to ensure that Canadians understand the “fine print” in their devices, equipment manufacturers are required to provide clear information to end-users on the subject of proper intended use in the user manual of their products to comply with applicable domestic regulations. For instance, cell phone manufacturers provide the minimum separation distance to maintain compliance with applicable body-worn exposure limits. ISED will, however, continue to work with Health Canada, international standards bodies, other regulators, manufacturers, and other stakeholders on improving communication with users.

Question 11: Is it the role of the Office of the Minister of Science to ensure rigorous scientific review according to international best practices, of potentially adverse exposures of Canadian residents such as to RFR? If not, which bod(ies) is/are the arbiter of the conduct of science (methodologies) in toxicology, epidemiology and public health?

Response 11:

The Government of Canada has made a commitment to prioritize science in its decision making. This involves ensuring that government science is fully available to the public, that scientists are able to speak freely about their work, and that scientific analyses are considered in policy development. The Minister of Science has been given an overarching mandate to support science and research and to ensure that science is considered in the government’s policy-making and investment choices.

A key element of this mandate was to create the position of Chief Science Advisor (CSA) to champion the principles of open science and evidence-based decision making. Fulfilling this commitment on September 26, 2017, the Minister of Science announced the appointment of Dr. Mona Nemer to the position of CSA. Dr. Nemer will serve primarily in an advisory and coordinating capacity and will directly advise the Prime Minister, the Minister of Science, and members of Cabinet on government-wide scientific matters.

Dr. Nemer is highly respected in the scientific community and has credentials and experience in the academic and public policy domains. Furthermore, the office of the CSA is supported by a team of scientists and policy experts. The government is proposing \$2 million annually (through Budget 2017) to support the work of the CSA and related secretariat.

Despite the Minister of Science’s overarching mandate for science, it remains the responsibility of individual ministers to ensure that the science conducted within their purview meets accepted standards of scientific inquiry. Therefore, the scientific rigour of

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research on toxicology, epidemiology, and the public health impacts of RF radiation would be the responsibility of the Minister of Health.

Question 14: What identification of data requirements, research, outreach and exposure assessment activities are Health Canada, Innovation, Science and Economic Development Canada and the Public Health Agency of Canada engaged in, with respect to 5G deployment?

Response 14:

Current exposure limits found in Safety Code 6 cover the frequency range that will be used by 5G technology. ISED, through its approval processes and conditions of authorization, as well as through certification standards, ensures that all radiocommunication installations and devices are installed and operated in a manner that complies with the Code, regardless of the wireless technology.

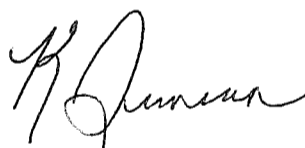
ISED engages with manufacturers and operators on the need to meet all regulatory requirements, including Safety Code 6, on an ongoing basis.

We appreciate this opportunity to respond to your petition, and we trust that this information is of assistance.

Sincerely,



The Honourable Navdeep Bains, P.C., M.P.
Minister of Innovation, Science
and Economic Development



The Honourable Kirsty Duncan, P.C., M.P.
Minister of Science

c.c.: The Honourable Catherine McKenna, P.C., M.P.
Minister of Environment and Climate Change

The Honourable Ginette Petitpas Taylor, P.C., M.P.
Minister of Health

Ms. Julie Gelfand ✓
Commissioner of the Environment and Sustainable Development

Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

OCT 25 2017



Dear

This is in response to your environmental petition No. 407 of June 21, 2017, addressed to Ms. Julie Gelfand, Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised concerns regarding the scientific review process used to determine the recommended human exposure limits to radiofrequency radiation contained in Safety Code 6. I am pleased to provide you with the enclosed response to your questions from both Health Canada and the Public Health Agency of Canada.

I understand that the Minister of Innovation, Science and Economic Development, the Minister of Science, and the Minister of Environment and Climate Change will be responding separately to questions within their respective purviews.

I appreciate your interest in this important matter.

Yours sincerely,

The Honourable Ginette Petitpas Taylor, P.C., M.P.

Enclosure

- c.c. Ms. Julie Gelfand, CESD
The Honourable Navdeep Bains, P.C., M.P., Minister of Innovation, Science and Economic Development
The Honourable Kirsty Duncan, P.C., M.P., Minister of Science
The Honourable Catherine McKenna, P.C., M.P., Minister of Environment and Climate Change

Canada

Health Canada and Public Health Agency response to Petition #407

Health Canada administers the *Radiation Emitting Devices Act* (REDA) which governs the sale (including re-sale), lease and importation of radiation emitting devices in Canada. In addition to administering the REDA authorities that pertain to devices that emit radiofrequency (RF) electromagnetic energy, the Department's mandate regarding human exposure to RF electromagnetic energy from wireless devices is to carry out research into possible health effects, monitor the scientific literature related to such effects on an ongoing basis and develop RF exposure guidelines, commonly referred to as Safety Code 6. Safety Code 6 sets recommended limits for safe human exposure to electromagnetic fields (EMF) in federally regulated industries and workplaces in the frequency range from 3 kHz to 300 GHz.

Question 1

What is the process, and factors considered, when Health Canada assesses primary science regarding whether non-thermal effects are established (even if not adverse)? In this context, has Health Canada examined catalysis, decreased activation energy and electron-transfer as mechanisms of non-thermal effects of RFR?

In the establishment of recommended human exposure limits for Safety Code 6, departmental scientists consider all relevant peer-reviewed scientific studies, and employ a weight-of-evidence approach when evaluating possible health risks from exposure to RF energy. The weight-of-evidence approach takes into account both the quantity of studies on a particular endpoint (whether adverse or no effect), and more importantly, the quality of those studies. Poorly conducted studies (e.g., inadequate exposure evaluation, a lack of appropriate control samples or an inadequate statistical analysis) receive relatively little weight, while properly conducted studies (e.g., with all controls included, appropriate statistics and a complete exposure evaluation) receive more weight.

Health Canada scientists consider all potential adverse health effects, including those that may be influenced by factors raised by the petitioner (i.e., catalysis, decreased activation energy and electron-transfer) when evaluating the possible health risks from exposure to RF energy, whether they are the result of heating or not. At frequencies below 10 megahertz (MHz), the first adverse effect to be experienced is nerve stimulation (a tingling sensation that is not caused by heating) and therefore becomes the basis for the exposure limits in this frequency range. The recommended exposure limits in Safety Code 6 are set below the level at which this effect occurs. At frequencies above 10 MHz, the first scientifically-established adverse health effect to occur (as exposure levels increase) is tissue heating. The recommended exposure limits in Safety Code 6, for frequencies above 10 MHz, are therefore set well below the threshold where tissue heating would occur.

As with most scientific conclusions, it is possible to find differing scientific opinions. It is important to note that when thousands of research studies are conducted on any test agent (e.g. RF fields), statistical chance dictates that a small number of studies (even if conducted properly) will demonstrate a "false positive" or "false negative" result. Furthermore, studies

with inappropriate study design or methodology can lead to erroneous results that are scientifically meaningless. It is for these reasons that the scientific literature on a given test agent must be evaluated both for the quality of the studies conducted but also for the strength of the evidence. Such analysis must consider all relevant properly conducted studies on the test agent. While some studies have reported biological effects or adverse health effects of RF fields at levels below the limits in Safety Code 6, these studies only form part of the dataset and do not represent the prevailing line of scientific evidence in these respective areas.

Question 2

Given that the combined uncertainty factors in Safety Code 6 is significantly less than for other adverse exposures (pesticides for example), what is the biological origin and justification for the 5-fold extrapolation factor from a healthy adult worker to the most vulnerable individuals?

Within Safety Code 6, a conservative approach has been used when establishing the thresholds for established adverse health effects (whether nerve stimulation or tissue heating). At the threshold for the occurrence of these effects, only mild alterations from homeostasis would occur that do not result in any known long-term or cumulative adverse health consequences. Thus, the threshold effects to be avoided are of minimal health significance and are of a conservative nature. When the basic restrictions are applied to provide safety margins from the occurrence of these effects, additional conservative measures are also applied. A 10-fold reduction is applied for the avoidance of nerve stimulation, while a 50-fold reduction is applied for the avoidance of thermal effects in the uncontrolled environment. Furthermore, when the reference levels are derived for ensuring that external RF field levels do not exceed the basic restrictions within the body, worst-case exposure scenarios have also been applied. Factors such as worst-case body size relative to a given frequency (including adult and child body sizes), orientation of the fields to the body, body posture and prolonged exposure in the same position have been applied for deriving the reference levels. These exposure scenarios are considered to be extremely unlikely to occur under any circumstance in either controlled or uncontrolled environments for either adults or children.

It is Health Canada's position that current measures on RF EMF protect our most vulnerable populations. Safety Code 6 human exposure limits, established by Health Canada, are designed to provide protection for all age groups, including infants and children, on a continuous basis (24 hours a day/seven days a week). This means that if someone, including a small child, were to be exposed to RF energy, within the Safety Code 6 limits, from multiple sources for 24 hours a day, 365 days a year there would be no adverse health effects. Based on a thorough review of all available data, it is Health Canada's position that there are no established adverse health effects at levels below the limits outlined in Safety Code 6.

Question 3:

With potentially severe and costly individual and public health implications, what modeling and surveillance programs are tracking RFR exposures in the workplace, schools, public places and private spaces?

Question 4:

How can the public request investigations and access modelling, survey or surveillance data? For example, what are the average and peak exposures at various frequencies and modulations, of children in close proximity to one another streaming wireless data?

Under the *Radiocommunication Act*, the Minister of Innovation, Science and Economic Development Canada (ISED), has the power to manage the use of radio spectrum and regulate radio apparatus through technical standards and conditions of authorization. Under this authority, ISED has adopted Health Canada's RF EMF exposure guideline for the purpose of protecting the general public from RF over-exposure. ISED requires that all radiocommunication and broadcasting antennas and all apparatus, such as cell phones, base stations and Wi-Fi routers, comply with the relevant limits outlined in Safety Code 6 at all times. Safety Code 6 exposure limits take into account the total exposure from all sources of RF energy, providing protection from the cumulative effects of RF energy when Safety Code 6 is respected.

Provinces and territories, through the legislation they have enacted, work alongside municipal governments to make decisions in relation to schools and implementation measures for wireless technologies, including those related to surveillance. Given this and Health Canada's position that the health of Canadians is protected when the recommended exposure limits in Safety Code 6 are respected, Health Canada has no plans to undertake surveillance activity at this time.

The modelling and surveillance activities related to RFR exposures fall outside the mandate of the Public Health Agency of Canada (PHAC). PHAC does not gather data on RFR exposure in the workplace, schools, public places and private spaces.

Question 7

What are some of the details of Health Canada's systematic reviewing of health effects of RFR, including:

- **Software and features used by Health Canada to maintain a database and to review systematically potentially relevant RFR exposure scientific literature;**
- **Search strategies, updating and notification services to stay up to date**
- **Timeframe covered by the database, and number of records (papers) contained therein;**
- **Topics identified for ongoing attention, and number of studies presently included for each topic;**
- **Access for citizens to the bibliographic search strategies and results on key topics or specific outcomes (e.g. sperm damage, cancers, etc.), with reasons for study exclusions, and data extracted from included studies;**

- Health Canada capacity (staff, skills and competencies, and information technology) to catch up and keep up with the relevant scientific literature for today's common RFR exposures?

Question 8

In the Health Canada determination of the 36 studies that are in scope and meet quality criteria during the HESA hearing, studies using a cell phone or other wireless device as the source of exposure were excluded. Studies using realistic emissions from commercial devices also appear to have been excluded from the SC6 review, even when emissions were quantified. How does Health Canada integrate the large body of evidence from research using "status quo" exposures from commercial devices, in ongoing SC6 review?

Question 9

In the absence of Health Canada systematic reviews on key outcomes, will Health Canada take action on the basis of up-to-date independent systematic reviews by academic experts, published in the peer-reviewed literature? If Health Canada will not take action, what are the reasons for not doing so?

Question 10

Does Health Canada maintain and update a comprehensive list of relevant studies and database of results (extracted data), for RFR? If so, from the comprehensive list of potentially relevant studies, what numbers of bibliographic records are presently included and excluded in the Safety Code 6 literature compilation regarding RFR/MW effects on chemical/biochemical reactions and catalysis (*in vitro* and *in vivo*), addressing whether non-thermal RFR effects are *established*?

Safety Code 6 is based upon credible scientific evidence and analysis. When conducting an evaluation of the scientific literature, the Department gathers, assesses, and integrates multiple sources of scientific evidence into an overall conclusion; an approach that is consistent with international practices. Safety Code 6 references a number of large international reviews of the scientific literature, and the Code is intended as an exposure guideline and not a scientific review article. Accordingly, most individual scientific studies are not referenced in the Code.

There is ongoing significant international work on RF EMF and its impact on our health. Comprehensive reviews of the scientific literature relating to RF fields have been carried out by scientists and expert panels under the auspices of highly recognized international bodies including the European Union's Scientific Committee on Emerging and Newly Identified Health Risks and the International Committee on Non-Ionizing Radiation Protection. The approach, commonly referred to as a scientific monograph or a systematic review, is generally conducted by international bodies requiring the participation of many scientific experts (40+) and many years of effort. Recent similar efforts have taken place by the International Agency for Research on Cancer, part of the World Health Organization (WHO), as well as the WHO itself. Health Canada has been taking part in the International EMF Project, coordinated by the WHO. The

goals of this project are to verify reported biological effects from exposure to EMFs and to characterize any associated health risks to humans.

The collective expertise of the international scientific community working for these bodies, which include Health Canada scientists, is a valuable world-class resource. Health Canada's participation on these bodies allows the Department to leverage these large-scale and highly resourced international efforts which are widely recognized as more comprehensive and detailed than any review from a single jurisdiction could be.

In addition to participating in the international monograph exercises, Health Canada scientists carry out an ongoing review of emerging scientific studies in this area. As mentioned previously, Health Canada scientists employ a weight-of-evidence approach when evaluating possible health risks from exposure to RF energy. Health Canada did consider all studies that were deemed to be both in scope and of sufficient quality for inclusion in its risk assessment. Consistent with scientific best practice, the 36 studies that you mention were considered in the context of the full body of available literature pertaining to possible health effects of radiofrequency electromagnetic energy in the 3 kHz to 300 GHz frequency range.

Safety Code 6 exposure limits are not device-specific, but the limits do take into account the total exposure from all sources of RF energy. Please rest assured that there was no deliberate exclusion of studies that used cellular phones or other wireless devices as the source of exposure. It should be noted that studies with inappropriate study design or methodology can lead to erroneous results that are scientifically meaningless. Studies were considered not to be of sufficient quality to inform the 2015 update of Safety Code 6 if it was not possible to determine the dosage studied, if the study lacked an appropriate control, if experiments within the study were not repeated a sufficient number of times, if no statistical analysis of the results was conducted, or if other improper scientific techniques were used.

Health Canada continues to monitor and analyze ongoing scientific research on this issue. Should new scientific evidence arise demonstrating that exposure to RF fields poses a health risk to Canadians, Health Canada would take the appropriate action to safeguard the health of Canadians.

Question 11

Is it the role of the Office of the Minister of Science to ensure rigorous scientific review according to international best practices, of potentially adverse exposures of Canadian residents such as to RFR? If not, which bodies is/are the arbiter of the conduct of science (methodologies) in toxicology, epidemiology and public health?

Canada is recognized worldwide for the rigour with which it gathers, assesses, and incorporates scientific information into its decision making and standards. In the case of electromagnetic radiation Health Canada carefully tracks developments in the scientific literature, in particular studies in relation to adverse health impacts. Health Canada has implemented policies and

codes of conduct for the management of science, which include research governance frameworks and the *Health Canada Scientific Integrity Policy*.

Question 12

How does Health Canada reconcile and incorporate precautionary approaches alongside the extraordinary stated evidentiary requirements for consensus on established, adverse effects of RFR radiation based on the “totality of the evidence”?

The limits within Safety Code 6 are designed to provide protection for all age groups, including infants and children, on a continuous basis. When establishing Safety Code 6, Health Canada incorporated several tiers of precaution into the human exposure limits. These included conservative thresholds for the occurrence of adverse effects, extreme worst-case situations for body size and orientation in relation to the RF fields, and additional safety margins. Since these conservative approaches are cumulative, i.e., stacked upon each other, Safety Code 6 provides very large margins of safety against the occurrence of all established adverse health effects associated with RF field exposure.

Question 14

What identification of data requirements, research, outreach and exposure assessment activities are Health Canada, Innovation, Science and Economic Development Canada and the Public Health Agency of Canada engaged in, with respect to 5G deployment?

Question 15

If Health Canada is not currently collecting and reviewing all relevant scientific data with respect to higher frequency 5G, are there any plans to do so and if not, why not?

Current exposure limits found in Safety Code 6 cover the frequency range used by devices employing 5G technology. Innovation, Science and Economic Development Canada is the regulator of wireless communication technology, which includes the roll-out of 5G wireless cellular networks.

As previously stated, Health Canada continues to monitor the scientific research in this area. If new scientific evidence were to demonstrate that exposure to RF energy below levels found in Safety Code 6 from wireless technologies is a concern, Health Canada would take appropriate action to help protect the health and safety of Canadians.

Consumer complaints concerning products, such as cell phones, can be directed to Health Canada using the web-based system developed under the *Canada Consumer Product Safety Act* and accessible through the Canada.ca website:

<https://www.canada.ca/en/services/health/report-health-safety-concern.html>

The system identifies hazards that can then be addressed by appropriate experts within Health Canada and Innovation, Science and Economic Development Canada.

Ministre de l'Environnement et
du Changement climatique



Minister of Environment
and Climate Change

Ottawa, Canada K1A 0H3

AUG 03 2017



Dear

I am writing in response to your Environmental Petition No. 407, pursuant to section 22 of the *Auditor General Act*, regarding scientific review processes to determine limits on exposure to radiofrequency radiation. Your petition was received in Environment and Climate Change Canada on June 29, 2017.

As the issues you raise in your petition fall outside of Environment and Climate Change Canada's mandate, my colleagues, the Minister of Health, the Honourable Dr. Jane Philpott; the Minister of Innovation, Science and Economic Development, the Honourable Navdeep Singh Bains; and the Minister of Science, the Honourable Kirsty Duncan, will be responding to your questions.

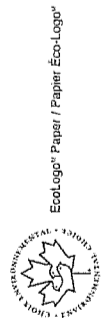
Please accept my best wishes.

Sincerely,

The Honourable Catherine McKenna, P.C., M.P.

c.c.: The Honourable Dr. Jane Philpott, P.C., M.P.
The Honourable Navdeep Singh Bains, P.C., M.P.
The Honourable Kirsty Duncan, P.C., M.P.
Ms. Julie Gelfand, Commissioner of the Environment
and Sustainable Development

Canada



Environmental Petition

Name of petitioner(s): Frank Clegg

Address of petitioner(s):



Telephone number(s): [Redacted]

Email address: frank@c4st.org

Name of the group: Canadians for Safe Technology (C4ST)

I hereby submit this petition to the Auditor General of Canada under section 32 of the Auditor General Act.

Signature of the petitioner:



Date: April 3, 2017

Title of the Petition: Failure of the Government of Canada to provide appropriate warnings so Canadians can take actions to protect themselves from excessive exposures to radiofrequency/microwave radiation from common personal and household wireless devices such as cell phones, baby monitors, cordless phones and Wi-Fi internet routers through normal, everyday use.

We request responses from Health Canada, and Innovation, Science and Economic Development Canada, Environment and Climate Change Canada, Public Safety Canada and other relevant Departments/Agencies.

Possibly Relevant Acts: Canada Consumer Product Safety Act, Canadian Environmental Protection Act, Canadian Human Rights Act, Clean Air Act, Department of Health Act, Department of Industry Act, Hazardous Products Act, Measurements Canada, Health Canada Act, Radiation Emitting Devices Act, Radiocommunications Act and the Standards Council of Canada.

Background: In protecting the health of Canadians, Health Canada's mandate includes development of exposure guidelines for radiofrequency/microwave electromagnetic energy. These guidelines, published as "Safety Code 6", establish the "safety limits for human exposure to radiofrequency in the 3 kHz to 300 GHz." ¹ The questions for this petition apply only to the radiofrequency/microwaves in the range of 100 MHz² to 300 GHz; these frequencies are used for many common wireless devices such as cell phones, computer tablets, baby monitors and Wi-Fi internet routers, as well as emissions from telecommunications infrastructure such as smart meters and antennae on homes, apartment buildings, utility poles and towers.

1 Safety Code 6 (2015)-Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz. Safety Code 6. http://www.Health Canada-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct/index-eng.php

2 A biological effect of peripheral nerve stimulation, in addition to heating, is recognized by Health Canada as occurring above Safety Code 6 guidelines below frequencies of 10 MHz. Heating is considered by Health Canada to be the only established effect between 10 MHz and 300 GHz when levels are exceeded. The questions in this petition apply only to the 100 MHz to 300 GHz range.

Canadians are increasingly exposed to wireless radiation in the radiofrequency/microwave radiation range from the devices they, and those around them, use. Wireless device manufacturer Cisco projects there will be 50 billion devices connected to the internet by 2020³; that is about 6.5 devices for every man, woman and child. This assumes the devices are distributed equally among all countries, but it is likely that Canada's average will be higher.

Safety Code 6 applies to *"all individuals working at, or visiting, federally regulated sites."* Safety Code 6 also has been adopted by Innovation, Science and Economic Development Canada for *"equipment certification and in radiofrequency exposure compliance certification... that govern the use of wireless devices in Canada such as cell phones, cell towers (base stations) and broadcast antennas"*.⁴

A substantial number of peer-reviewed, published research papers about human, animal and cellular (tissue) studies show that serious health consequences can occur at daily levels from exposure to personal wireless devices and wireless infrastructure i.e. at levels considered to be "safe" according to Safety Code 6.⁵ All new commercially available wireless devices contain difficult to find warnings in the packaging that explain how we can use these devices more safely.

The CBC Marketplace program "The Secret inside Your Phone, aired March 24th, 2017⁶, reported that "81% of Canadians have never seen the message in their phone or manual about carrying their cell phone 5-15mm away from their body". The same survey found that "67% of Canadians say they carry their phones in their pocket or directly against their body".⁷

The failure to communicate appropriate precautionary messaging based on current and historic scientific evidence contributes to Canadians' inability to make informed decisions to protect themselves from an elevated risk of diseases, such as brain cancer (glioblastoma), and reproductive damage (infertility), associated with exposure to radiation from wireless devices such as cell phones and Wi-Fi routers.

In Canada, we have an embarrassing history of serious health consequences as a result of exceedingly slow regulation of harmful exposures e.g. asbestos, cigarette smoking, thalidomide and urea formaldehyde insulation. The growing scientific evidence indicates that wireless exposure is becoming another of these public health catastrophes.

Wireless device manufacturers warn in each device's manual that the improper use, such as holding a device next to the body, could lead to exceeding Safety Code 6 guidelines⁸. Safety Code 6 (2015) clearly states several times, including in the last sentence of the introduction: *"These [maximum exposure levels] shall not be exceeded."*⁹

The following are examples of safety warnings in the hard copy user manuals or hidden several prompts from the initial home screen on the devices:

3 http://www.cisco.com/c/dam/en_us/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf

4 http://www.hc-sc.gc.ca/ewh-semt/consult/_2014/safety_code_6-code_securite_6/final_finale-eng.php

5 <https://www.scribd.com/document/339243060/References-and-Extracts-of-Over-60-Scientific-Studies-Published-in-2015-and-Up-to-April-2016-Reporting-Potential-Harm-at-Levels-at-or-Below-Safety-Code>

6 https://www.youtube.com/watch?v=Wm69ik_Qdb8&t=1s&list=PLeyJPHbRnGaZmzkCwy3-8ykUZm_8B9kKM&index=1 time 1:13

7 Ibid time 14:24

8 These warnings often reference the FCC, USA Federal Communications Commission

9 http://www.hc-sc.gc.ca/ewh-semt/consult/_2014/safety_code_6-code_securite_6/final_finale-eng.php#s1

Keep the iPhone device at least 25mm (.98 inches) from your body, including the abdomen of pregnant women and the lower abdomen of teenagers, when the ... device is turned on and connected to the wireless network....Go to Settings > General > About > Legal > RF Exposure

Keep the BlackBerry device at least 0.98 in. (25 mm) from your body (including the abdomen of pregnant women and the lower abdomen of teenagers) (Torch 9800) > User Manual > Page 21

Samsung - "For body-worn operation, this phone has been tested and meets FCC RF exposure guidelines¹⁰ when used with an accessory that contains no metal and that positions the mobile device a minimum of 1.5cm from the body." (Galaxy II) > User Manual > Page 164

CBC Marketplace tested three popular cell phones¹¹ for radiation levels and found that all three phones emitted more radiation when held against the body than Health Canada's Safety Code 6 guidelines state. The separation distances recommended in the manuals for these phones ranged from 5 mm to 1.5 cm.¹²

In response to the CBC Marketplace program "The Secret inside Your Phone", Innovation, Science and Economic Development Canada states: "...Health Canada's Safety Code 6 sets limits for exposure to wireless radiofrequency energy at 50 times lower than the threshold for potentially adverse health effects. Therefore, cell phones are still safe when carried directly against the body."¹³

Health Canada's limit of "50 times lower" is among the least stringent in its category. The uncertainty factor for Atrazine in water is 1,000.¹⁴ The safety margin for pesticides can be 1,000 times in certain scenarios¹⁵. The City of Toronto Prudent Avoidance Policy for new telecommunications towers recommends that exposure to RFs for the general public be kept 100 times below Safety Code 6 levels.¹⁶

Manufacturers' safety warnings come with every commercially available radiofrequency/microwave emitting device that we and our children use. The distance for iPads and other tablets is 20 cm (8 inches).¹⁷

There are precedents for providing wireless device precautionary messaging:

- In March, 2013 Australia's Radiation Protection and Nuclear Safety Agency published a Fact Sheet¹⁸ that advised parents to limit children's use of mobile and cordless phones and to keep monitors at least a meter away from babies' beds in order to minimize their exposure to EMR [electromagnetic radiation].¹⁹

10 The USA FCC Specific Absorption Rate (SAR) level standard is the same as Canada's Safety Code 6 (2015)

11 Samsung Galaxy S7, LG 5 and I-phone 7.

12 https://www.youtube.com/watch?v=Wm69ik_Qdb8&t=1s&list=PLeyJPHbRnGaZmzkCwy3-8ykUZm_8B9kKM&index=1 time 15:45

13 <http://www.cbc.ca/marketplace/blog/company-responses-cellphones>

14 <https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-atrazine.html> Classification and Assessment section.

15 http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_pol-guide/spn2008-01/index-eng.php Base 10X, plus database 10X factor, plus 10X factor "the new PCPA provisions require the application of an additional 10-fold factor in the risk assessment for certain scenarios (i.e. dietary, use in and around homes or schools) to take into account, in part, potential prenatal and postnatal toxicity."

16 <http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=88c87443e9481410VgnVCM10000071d60f89RCRD&vgnextchannel=05e0ebfc2bb31410VgnVCM10000071d60f89RCRD>

17 <http://showthefineprint.org/>

18 http://www.arpana.gov.au/pubs/factsheets/ReduceExposure_wirelessDevices.pdf

19 <http://www.news.com.au/technology/gadgets/parents-urged-to-limit-childrens-use-of-mobiles-cordless-phone->

- On May 12th, 2015, the City of Berkeley, California council adopted the cell phone “right to know” ordinance²⁰ requiring a notice be placed at the point of sale of cell phones. The notice reads, in part, “If you carry or use your phone in a pants or shirt pocket or tucked into a bra when the phone is ON and connected to a wireless network, you may exceed the federal guidelines for exposure to RF radiation.”
- In February, 2017 Orange, a Telecommunications company prominent in Europe and Africa offered advice on the safe use of cell phones. The notice includes “recommendations for use to reduce your exposure to radio waves.”²¹
- Ronald L Melnick, PhD, led the design of the \$25m US National Toxicology Program/National Institute of Environmental Health Science Rodent Study. Dr. Melnick states: “In my view, a pediatrician would be acting irresponsibly if he or she knew and understood the implications of the human and animal cancer data on cell phone radiation and did not offer precautionary advice to the parents of his or her patients.”²²

Precautionary messaging also has been considered by health authorities. In March 2017, the State of California Health Protection Branch released, after court order, its public warning that increased brain cancer risk is associated with heavy cell phone use. The guidelines advise cell phone users to keep the devices away from their bodies, keep calls short and to use the speaker phone on lengthy calls.²³

Questions:

- 1) Given the proof that the way Canadians are using their cell phones (against their bodies) is exceeding the Safety Code 6 guidelines, is Health Canada considering increasing the 50 times uncertainty margin and reducing the level of radiation that is permitted?
- 2) What science based evidence does the Government of Canada have to make the above statement “cell phones are still safe when carried directly against the body”?
- 3) What is the precise level (with confidence intervals) in W/kg per 1 gram of tissue at which harm from radiofrequency/microwave radiation has been established? Where can the calculations for this be found? On which scientific publications was this level based?
- 4) How do the Ministries of the Government of Canada plan to address the fact that instructions require users to keep cell phones at 5 mm to 15 mm from the body and the reality that 67% of Canadians said they hold their devices against their body, in terms of: 1) the lack of awareness (81% of Canadians are unaware that instructions exist); and 2) the practicalities that cell phones can only be used in a manner complying with Safety Code 6 when used on speakerphone or with ear buds?
- 5) Do current legislation and regulations enable the Government of Canada to require manufacturers to place their existing warnings on the packaging of wireless devices in a more readable font size and location, and/or at the point of sale? If this cannot be accomplished under current legislation and regulations, what changes would need to be made in order to require this of manufacturers? What Department(s) and Ministry are responsible for such regulation?
- 6) Will the Government of Canada provide advisories or other appropriate notifications to inform Canadians that allowing wireless transmitting devices to come in direct contact with their bodies

under-new-health-warnings/news-story/c33ff83e5fd2a2b0f6333182d23e824a

20 <http://www.saferemr.com/2014/11/berkeley-cell-phone-right-to-know.html>

21 <http://radio-waves.orange.com/en/your-mobile/best-practice>

22 <http://microwavenews.com/news-center/ntp-nyt>

23 <https://drive.google.com/file/d/0B14R6QNkmaXuX2Y3QVg0TjZaUTA/view>

can exceed Safety Code 6 (2015) limits? Which Ministry and Department would be responsible to provide such warnings?

- 7) Will the Government of Canada run an education and awareness campaign to inform all Canadians how to use wireless devices more safely?
- 8) Precedents exist where information on "situations where the use of -or exposure to - a product could pose a risk" has been published by Health Canada for other public health concerns.²⁴ Will Health Canada provide precautionary messaging e.g. advisories or campaigns such as the BabySafe project,²⁵ to inform pregnant women (and their physicians) to avoid having wireless transmitting devices touch their bodies to minimize risk to the fetus?
- 9) Will Health Canada provide precautionary messaging e.g. advisories or campaigns, to inform pediatricians, parents, teachers and other school authorities to avoid having wireless transmitting devices touch children's bodies to minimize risk to them?
- 10) In North America, devices such as baby monitors and portable home phones send out a constant signal (emitting radiofrequency/microwave radiation) at all times. In Europe, these devices have been modified for safety so that they only emit radiation when the baby makes a noise or someone speaks into the handset (on demand). Why are these devices not available in Canada? What will the Government of Canada do to facilitate the access of Canadians to these reduced risk products?"

24 <http://www.HealthCanada-sc.gc.ca/aHealthCanada-asc/media/advisories-avis/index-eng.php> [accessed 8October2016]

25 <http://www.babysafeproject.org/>



Ottawa, Canada K1A 0H5

JUL 28 2017

Mr. Frank Clegg
Canadians for Safe Technology

Dear Mr. Clegg:

I am writing with respect to your Environmental Petition no. 398, submitted to the Auditor General of Canada under Section 22 of the *Auditor General Act*, on “Failure of the Government of Canada to provide appropriate warnings so Canadians can take actions to protect themselves from excessive exposures to radiofrequency/microwave radiation from common personal and household wireless devices such as cell phones, baby monitors, cordless phones and Wi-Fi internet routers through normal, everyday use.”

The Office of the Auditor General of Canada forwarded your questions to the Honourable Jane Philpott, Minister of Health, and to me. I am writing in response to questions 2, 4, 5, and 10, which fall under Innovation, Science and Economic Development Canada’s (ISED) mandate and responsibility. Minister Philpott will be providing you with a separate response addressing the remaining questions that fall under her department’s mandate and areas of responsibility.

Question 2: What science based evidence does the Government of Canada have to make the above statement “cell phones are still safe when carried directly against the body”?

ISED requires that all manufacturers of wireless products, including cell phones, meet the regulatory requirements set forth in its technical standards, which are based on recognized international testing procedures that have been adopted by most countries around the world.

When cell phones are tested for compliance, they are tested at full power for the duration of the test. In reality, cell phones operate at much lower power levels, to preserve battery life, maximize call time, and avoid network interference. As such, under normal operating conditions, a cell phone yields much lower radiofrequency (RF) exposure levels than those measured during compliance testing performed in laboratory settings.

...2

Furthermore, ISED has adopted Health Canada's Safety Code 6 limits for the RF exposure compliance of wireless devices. In turn, Health Canada's scientific evidence indicates that the recommended peak specific absorption rate (SAR) limit of 1.6 W/kg for cell phones is not the threshold for the occurrence of adverse health effects. As a precautionary measure, the peak SAR limit in Safety Code 6 was set to more than 50 times below the level at which excessive tissue heating could occur in the most sensitive tissue (the eye). This means that the peak SAR limits in Safety Code 6 would need to be exceeded by a factor of more than 50 before one would see any thermally related adverse health effects.

Canada's approach to cell phone safety testing is among the most stringent in the world. As such, ISED strongly believes that all products evaluated following the test procedures set forth in Canadian regulatory standards that comply with Health Canada's Safety Code 6 limits are safe.

Question 4: How do the Ministries of the Government of Canada plan to address the fact that instructions require users to keep cell phones at 5 mm to 15 mm from the body and the reality that 67% of Canadians said they hold their devices against their body, in terms of: 1) the lack of awareness (81% of Canadians are unaware that instructions exist); and 2) the practicalities that cell phones can only be used in a manner complying with Safety Code 6 when used on speakerphone or with ear buds?

To comply with applicable domestic regulations, equipment manufacturers are required to provide clear information to end users on the subject of proper intended use in the user manual of their products. For instance, cell phone manufacturers shall provide the minimum separation distance to maintain compliance to applicable body-worn exposure limits.

In response to your point regarding the lack of public awareness, ISED will continue to work with Health Canada, international standards bodies, other regulators, manufacturers, and other stakeholders on improving communication with users.

Concerning the second part of your question, please be informed that cell phones can, in fact, be held against your head without requiring the use of speaker phones or ear buds while remaining in compliance with Safety Code 6 limits since, as previously mentioned, SAR head compliance testing is performed at a zero millimetre distance.

The assessment process to verify if a cell phone complies with all applicable Health Canada limits requires two types of evaluations:

- 1) SAR – Head compliance testing
- 2) SAR – Body-worn compliance testing

ISED requires that head compliance testing be performed directly against a simulated head at a zero millimetre separation distance.

It also requires that body-worn compliance testing be performed with the use of a simulated body at a maximum separation distance of 15 millimeters or less.

Further information on compliance testing can be found online at www.ic.gc.ca/eic/site/ceb-bhst.nsf/eng/h_tt00084.html.

Question 5: Do current legislation and regulations enable the Government of Canada to require manufacturers to place their existing warnings on the packaging of wireless devices in a more readable font size and location, and/or at the point of sale? If this cannot be accomplished under current legislation and regulations, what changes would need to be made in order to require this of manufacturers? What Department(s) and Ministry are responsible for such regulation?

Under the *Radiocommunication Act*, I have the power to establish standards, rules, policies, and procedures relating to radiocommunication. The Governor in Council may make regulations with respect to spectrum management pursuant to section 6 of the *Radiocommunication Act*; these regulations have been prescribed under the *Radiocommunication Regulations*.

As per the technical standard developed, pursuant to the *Radiocommunication Act*, ISED requires manufacturers to provide information on the proper usage of wireless devices in their user manuals, including the minimum separation distance at which a product shall be kept from the body to be in compliance with RF exposure limits.

Under subsection 25(4) of the *Radiocommunication Regulations*, “no person shall mark, label or otherwise indicate that Category I¹ or Category II² equipment complies with applicable standards, unless that equipment complies with those standards.” This label is the certification number or a statement that the device complies with specific technical standards.

¹ Category I equipment, which comprises radio apparatus equipment for which a technical acceptance certificate (TAC) is required pursuant to subsections 4(2) of the *Radiocommunication Act* and 21(1) of the *Radiocommunication Regulations*. A TAC may be issued by the Certification and Engineering Bureau of ISED (the Bureau) or a certificate may be issued by a recognized certification body (CB).

² Category II equipment comprises radio apparatus for which standards have been prescribed. Category II equipment is certification-exempt. Therefore, no TAC from ISED or certificate from a CB is required, pursuant to subsection 4(3) of the *Radiocommunication Act*. The manufacturer and/or importer shall ensure compliance with all applicable procedures and standards for Category II equipment. Note that certification application for Category II equipment is not necessary and will not be accepted.

Your questions regarding what changes to legislation and regulations would need to be made in order to require this of manufacturers, and what Department(s) and Ministry are responsible for such regulation, essentially ask for a legal opinion. In other words, those questions ask which legislative or regulatory changes would be needed to require this and what Department or Ministry would have authority to make such amendments.

Unfortunately, as noted in the guide to the environmental petitions process, the Department of Justice Canada cannot provide legal opinions to Canadians.

Question 10: In North America, devices such as baby monitors and portable home phones send out a constant signal (emitting radiofrequency/microwave radiation) at all times. In Europe, these devices have been modified for safety so that they only emit radiation when the baby makes a noise or someone speaks into the handset (on demand). Why are these devices not available in Canada? What will the Government of Canada do to facilitate the access of Canadians to these reduced risk products?

ISED requires that all manufacturers of wireless products, including baby monitors and portable home phones, meet the technical and RF exposure regulatory requirements set forth in its technical standards.

The Canadian standards currently in place do not prevent equipment manufacturers from introducing such products on the Canadian market as long as all applicable regulatory requirements are met. ISED cannot comment on any business decisions taken by private industry not to introduce specific products in Canada. We recommend that you contact equipment manufacturers directly for enquiries pertaining to product-specific Canadian market availability.

I appreciate this opportunity to respond to your petition, and I trust that this information is of assistance.

Sincerely,



The Honourable Navdeep Bains, P.C., M.P.

c.c.: The Honourable Jane Philpott, P.C., M.P.
Minister of Health

Ms. Julie Gelfand
Commissioner of the Environment and Sustainable Development

Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

AUG 16 2017

Mr. Frank Clegg
Canadians for Safe Technology

Dear Mr. Clegg:

This is in response to your environmental petition no. 398 of April 3, 2017, addressed to Ms. Julie Gelfand, Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised concerns regarding appropriate warnings on common personal and household wireless devices. I am pleased to provide you with the enclosed responses to questions 1, 2, 3, 6, 7, 8, 9 and 10 of your petition. I understand that the Minister of Innovation, Science and Economic Development will be responding separately to questions that come under the purview of his department.

I appreciate your interest in this important matter.

Yours sincerely,

A handwritten signature in blue ink that reads "Jane Philpott".

The Honourable Jane Philpott, P.C., M.P.

Enclosure

c.c. Ms. Julie Gelfand, CESD
The Honourable Navdeep Bains, P.C., M.P.

Canada The word "Canada" in a bold, sans-serif font, with a small Canadian flag icon to the right of the letter 'a'.

Minister of Health's response to Petition #398

Question 1: Given the proof that the way Canadians are using their cell phones (against their bodies) is exceeding the Safety Code 6 guidelines, is Health Canada considering increasing the 50 times uncertainty margin and reducing the level of radiation that is permitted?

Response 1:

When establishing Safety Code 6, Health Canada incorporated several tiers of precaution into the human exposure limits. These included conservative thresholds for the occurrence of adverse effects, extreme worst-case situations for body size and orientation in relation to the radiofrequency (RF) fields, and additional safety margins. Since these conservative approaches are cumulative, i.e., stacked upon each other, Safety Code 6 provides very large margins of safety against the occurrence of all established adverse health effects associated with RF field exposure. Therefore, Health Canada will not be changing the uncertainty margin at this time.

Question 2: What science based evidence does the Government of Canada have to make the above statement "cell phones are still safe when carried directly against the body"?

Question 3: What is the precise level (with confidence intervals) in W/kg per 1 gram of tissue at which harm from radiofrequency/microwave radiation has been established? Where can the calculations for this be found? On which scientific publications was this level based?

Response 2 and 3:

The peak spatially-averaged specific absorption rate (pk-SAR) limit in Safety Code 6 (SC6) applies to the head, neck and trunk. This limit is 1.6 W/kg, as averaged over any 1 g and for any 6 minute exposure period (reference period). This limit is based upon avoiding cataract formation in the eye, which has been conservatively estimated to occur at sustained pk-SAR levels of 100-150 W/kg to the eye (as reviewed in Elder, 2003 and IEEE C95.1 (2005)).

The recommended pk-SAR limit of 1.6 W/kg is not the threshold for the occurrence of adverse health effects. In fact, as a precautionary measure, the pk-SAR limit was set more than 50x below the level where excessive tissue heating could occur in the eye. This means that the pk-SAR limits in Safety Code 6 would need to be exceeded by more than 50x in the eye before the occurrence of any thermally-related adverse health effects would be expected. Exposures to the body (skin and underlying tissue) at the SC6 pk-SAR limit of 1.6 W/kg would result in a localized temperature increase of less than 1 degree Celsius (Anderson et al., 2010; Moore et al., 2017).

In the event of exposures that marginally exceed the pk-SAR limits in SC6 (in the head, neck or trunk), the only scientifically established health impact would be a warming of the skin and underlying tissue. This degree of heating is no different from the type of skin warming that

occurs every day from sources like a hot water bottle, warm bath, or warm clothes. The human body can efficiently dissipate small increases in local body temperature, resulting in no adverse impacts on health.

For these reasons, exposures that marginally exceed the pk-SAR limits in SC6 is not considered to represent a risk to health due to the precautionary safety margins already incorporated within SC6. Despite this, Health Canada recommends that the pk-SAR limits in SC6 for the head, neck and trunk should be respected.

References:

Elder JA. Ocular effects of radiofrequency energy. *Bioelectromagnetics Suppl.* 6:S148-161 (2003).

Institute of Electrical and Electronics Engineers. *Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields C95.1, 3 kHz to 300 GHz.* New York, USA (2005).

Anderson V, Croft R, McIntosh RL. SAR versus S(inc): What is the appropriate RF exposure metric in the range 1-10 GHz? Part I: Using planar body models. *Bioelectromagnetics.* 2010 Sep;31(6):454-66.

Moore SM, McIntosh RL, Iskra S, Lajevardipour A, Wood AW. Effect of adverse environmental conditions and protective clothing on temperature rise in a human body exposed to radiofrequency electromagnetic fields. *Bioelectromagnetics.* 2017 Mar 24.
<http://onlinelibrary.wiley.com/doi/10.1002/bem.22048/epdf> [E-pub ahead of print]

For further information on the scientific rationale for the basic restrictions and reference levels within the Safety Code 6, please consult the Safety Code 6 Rationale document (attached).

Questions 4 and 5 will be responded to by the Minister of Innovation, Science and Economic Development and will be sent under separate cover.

Question 6: Will the Government of Canada provide advisories or other appropriate notifications to inform Canadians that allowing wireless transmitting devices to come in direct contact with their bodies can exceed Safety Code 6 (2015) limits? Which Ministry and Department would be responsible to provide such warnings?

Question 7: Will the Government of Canada run an education and awareness campaign to inform all Canadians how to use wireless devices more safely?

Question 8: Precedents exist where information on “situations where the use of—or exposure to—a product could pose a risk” has been published by Health Canada for other public health concerns. Will Health Canada provide precautionary messaging e.g. advisories or campaigns such as the BabySafe project, to inform pregnant women (and their physicians) to avoid having wireless transmitting devices touch their bodies to minimize risk to the fetus?

Question 9: Will Health Canada provide precautionary messaging e.g. advisories or campaigns, to inform pediatricians, parents, teachers and other school authorities to avoid having wireless transmitting devices touch their children's bodies to minimize the risk to them?

Response 6, 7, 8, and 9:

Health Canada already undertakes many of these activities. Health Canada maintains messaging on its website that reminds cell phone users that they can take practical measures to reduce their radiofrequency (RF) exposure by limiting the length of cell phone calls, using "hands-free" devices and replacing cell phone calls with text messages. This messaging also encourages parents to take these measures to reduce their children's RF exposure from cell phones in acknowledgement that children are typically more sensitive to a variety of environmental agents. More information is available at:

<https://www.canada.ca/en/health-canada/services/consumer-radiation/safety-cell-phones-cell-phone-towers.html>

Health Canada and other leading health agencies, including the World Health Organization, have concluded that, to date, there is no convincing scientific evidence linking adverse health effects to levels below existing RF exposure limits. Health Canada does not have any immediate plans to expand existing messaging.

With respect to the federal role, Health Canada administers the *Radiation Emitting Devices Act* (REDA) and the *Canada Consumer Product Safety Act* (CCPSA). Under the REDA, Health Canada has the authority to take regulatory and compliance and enforcement actions in the event that a radiation emitting device creates, under particular circumstances, a risk to any person of genetic or personal injury, impairment of health or death. Under the CCPSA, it is prohibited to advertise a consumer product, including consumer products that are radiation emitting devices, if the advertisement in question may reasonably be expected to create an erroneous impression regarding the fact that the consumer product is not a danger to human health or safety, or if the product itself is a danger to human health or safety.

Under the *Radiocommunication Act*, the Minister of Innovation, Science and Economic Development Canada (ISED), has the power to manage the use of radio spectrum and regulate radio apparatus through technical standards and conditions of authorization. ISED requires compliance with Safety Code 6 as part of its technical standards for radio apparatus. ISED requires that all portable and hand-held radiocommunication devices sold in Canada, including cell phones, comply with the regulatory specific absorption rate (SAR) limits.

Question 10: In North America, devices such as baby monitors and portable home phones send out a constant signal (emitting radiofrequency/microwave radiation) at all times. In Europe, these devices have been modified for safety so that they only emit radiation when the baby makes a noise or someone speaks into the handset (on demand). Why are these devices not available in Canada? What will the Government of Canada do to facilitate the access of Canadians to these reduced risk products?

Response 10:

Health Canada cannot comment on the business decisions of companies to market products in certain regions, but not in others. For products currently marketed in Canada, they must comply with the applicable laws and regulations. The exposure limits of Safety Code 6, however, have always been established at levels far below the threshold of potential adverse effects.

GET FROM AUDITOR PETITION PACKAGE

16	398 B (Follow-up) Canadians for Safe Technology (C4ST)	Follow-up petition on adequate warnings to Canadians about the effects of radiofrequency and microwave radiation from personal and household wireless devices (follow-up)	3 April 2017	00429 (cover letter)
	REPLY: Minister of Health – Ginette Petitpas Taylor		12 April 2017	00431
	RESPONSE: Health Canada		With letter 12 April 2017	432-435
	Industry, Science and Economic Development (ISED) - Minister Navdeep Bains		10 April 2017	436-438

Frank Woodcock



The Auditor General of Canada
Commissioner of the Environment and Sustainable Development
240 Sparks St.
Ottawa, ON
K1A 0G6

Attention, Petitions, please accept the following petition under the Auditor General Act.

After Minister Philpott responded to the chair of HESA, Bill Casey, MP, “The Government of Canada carefully considered the Thirteenth Report of the Standing Committee on Health entitled *Radiofrequency Electromagnetic Radiation and the Health of Canadians.*” she declared, “As can be seen in the attached Government Response, the Government is committed to using the best available science to inform its decision making...”

At or about the same time on the opposite side of the continent The Berkeley City Council voted unanimously a "right to know" ordinance to requiring retailers to warn customers of possible radiation exposure when purchasing cell phones. The best available science the Berkeley City Council used to make their decision seems at odds with Minister Philpott's science.

At or about the same time a study of conflict of interest was published with findings that may indicate Health Canada is not using the best available science when it comes to the EMR health of Canadians.

Findings from 190 published studies across a range of medical fields were published in *BMJ* (British Medical Journal), the same day as a paper on industry ties in clinical guidelines was published by *JAMA Internal Medicine* (Journal of American Medical Association). Of the 397 principal investigators in the cohort, 58% were found to have financial ties—nearly 40% of these being advisor/consultancy payments followed by speaker's fees (20%), honoraria (13%), employee relationships (13%), travel fees (13%), and stock ownership (10%), among other types of payments. Having some kind of financial relationship was associated with a threefold higher likelihood of a positive randomized clinical trial result.

Minister Philpott's report to HESA continues to assure Canadians, "Health Canada uses a "weight of evidence" approach in evaluating scientific studies, which takes into account both the quantity and quality of studies, and gives more weight to studies which have been reproduced and which meet the highest standards of rigor and control... Through CIHR, the Government of Canada is also working with... CIHR has partnered with the Canadian Wireless Telecommunications Association to fund Canadian participation in the MOBI-Kids study... It is Health Canada's position, and that of the Expert Panel of the Royal Society of Canada, that current measures on RF EMF protect our most vulnerable... Based on a thorough review of all available data, it is Health Canada's position that there are no established adverse health effects at levels below the limits outlined in Safety Code 6..."

In a letter of response to the Minister of Health, Frank Clegg CEO - C4ST (Canadians for Safe Technology) reported, "Unfortunately, it appears that the Minister did not investigate the issue directly herself, but accepted the response from Health Canada at face value. We continue to believe that Health Canada is not supporting the direction from the Liberal government to base its policies on evidence-based decision making. The response contained the same non-transparent, incomplete and outdated science based responses we have heard for years. Health Canada continues to dismiss current, published, evidence-based science that shows harm below current Safety Code 6 levels."

In response to my e-mail concerning Minister Philpott's response to HESA's report I received an email from Tim Singer, Director General, Environmental and Radiation Health. He offers, "In 2015, Health Canada updated Safety Code 6 to take into account recent scientific data from studies carried out worldwide. In the establishment of acceptable limits, departmental scientists considered all peer-reviewed scientific studies, and employed a weight-of-evidence approach when evaluating possible health risks from exposure to RF energy. It is Health Canada's position, and that of the Expert Panel of the Royal Society of Canada ... that current measures on RF EMFs protect our most vulnerable..."

Minister Philpott's and Mr. Singer's arguments revolve around the single phrase "weight-of-evidence" and it is this phrase that needs examination.

For years Health Canada's "weight-of-evidence" has never been produced. An iota of this "weight" has been offered but the studies selected were criticized for conflict of interest.

Minister Philpott's reference to any partnership with the Canadian Wireless Telecommunications Association is by title alone compromised by conflict of interest.

Minister Philpott's reference to the Royal Society of Canada's panel to assess the safety of radiowave-emitting devices was likewise compromised by conflict of interest. From C4ST, "Allegations of conflict of interest surround a member appointed to a federal expert panel, which was convened to impartially study health and safety effects of wireless radiation." According to reports, the panel's chair failed to disclose a six-figure federal government

contract he received to provide “communications advice” on how to relieve Canadians’ concerns with respect to cellphone antennas.

Prime Minister Trudeau’s mandate letter to Minister Philpott says in part, “We have promised Canadians a government that will bring real change... As Minister, you must ensure that you are aware of and fully compliant with the *Conflict of Interest Act* and Treasury Board policies and guidelines. You will be provided with a copy of *Open and Accountable Government* to assist you as you undertake your responsibilities.” It is clear from the words of the Prime Minister that conflict of interest has no part in the work of Health Canada protecting the health of Canadians.

What do Canadians know of Health Canada’s EMR “weight-of-evidence”? At Canada’s open data site: http://open.canada.ca/en?_ga=1.67708497.1949065385.1483706339, there is no mention of Health Canada’s “weight-of-evidence”.

Health Canada bases their argument that Canada’s Safety Code 6 protects Canadians from EMR based on a “weight-of-evidence”. The last four Ministers have given Health Canada’s scientific answer to the harms of EMR as “weight-of-evidence”, a term which is not a scientific, has no parameters, no quantifiable substance, no graphs, no data that can be plotted, is untestable, is problematic, in fact it lacks any weight. If “weight-of-evidence” was a scientific term we could examine the evidence, test the evidence and test for “conflict of interest”. Health Canada uses “weight-of-evidence” as some type of explanation but the elephant in this “weight” room is conflict of interest. I am not the only one that contends Health Canada cannot produce a scientific “weight-of-evidence” free of conflict of interest.

When Health Canada uses the “weight-of-evidence” defense it is modified with “peer reviewed”. The folly of this is self-evident; when a paper funded by Industry is circulated for peer review and Industry sponsored peers are supportive, I say, please follow the funding, follow the money.

Question 1: It is 2017, a time for openness and transparency, will the Minister of Health produce the scientific “weight-of-evidence” used to support Safety Code 6 and will the Minister guarantee the studies produced follow conflict of interest guidelines?

Question 2: Has the Minister of Health considered that there may be individuals providing her with EMR advice that have a conflict of interest?

Regards,

Frank Woodcock

Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

AUG 18 2017

Mr. Frank Woodcock

Dear Mr. Woodcock:

This is in response to your environmental petition no. 399 of April 7, 2017, addressed to Ms. Julie Gelfand, Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised concerns regarding the use of the best available science related to electromagnetic radiation. I am pleased to provide you with the enclosed response.

I appreciate your interest in this important matter.

Yours sincerely,

A handwritten signature in blue ink that reads "Jane Philpott".

The Honourable Jane Philpott, P.C., M.P.

Enclosure

c.c. Ms. Julie Gelfand, CESD

Health Canada response to Petition #399

Question 1:

It is 2017, a time for openness and transparency, will the Minister of Health produce the scientific “weight of evidence” used to support Safety Code 6 and will the Minister guarantee the studies produced follow conflict of interest guidelines?

Response:

Regarding “weight of evidence”, please see the response Health Canada provided to a similar question in petition No. 365:

http://www.oag-bvg.gc.ca/internet/English/pet_365_e_39688.html

In addition, for further background, attached is the *Safety Code 6 (2015) - Rationale* document.

It is in the best interest of the scientific community, as well as the general public, to address conflict of interest in order to avoid jeopardizing the integrity of the research findings. Federal public servants are subject to the conflict of interest guidelines contained within the *Values and Ethics Code for the Public Sector* and organizational policies, such as the *Health Canada Scientific Integrity Policy*, while undertaking their assessment of the scientific studies used in developing the Safety Code 6 guidelines. As for the studies written by researchers external to the federal government, most research/academic institutions have their own conflict of interest guidelines.

An accepted method to support bias-free analysis and quality research results is to subject scientific conclusions to external study and peer-review. Further to the Standing Committee on Health recommendations published in December 2010, Health Canada contracted the Royal Society of Canada (RSC) to convene an Expert Panel to provide assurance that the results of emerging research relating to the safety of radiofrequency (RF) energy on human health were accurately reflected in the revised Safety Code 6. The Expert Panel of the RSC released their review in March 2014, concluding that, in the view of the Panel, there were no established adverse health effects at exposure levels below the proposed limits. Feedback received from the RSC as a result of their Expert Panel review was incorporated into the published Safety Code 6.

Consistent with Health Canada’s commitments in relation to transparency and openness in its decision-making, and in recognition of public interest in issues related to RF energy, Health Canada undertook a public consultation on the proposed revisions to Safety Code 6 in 2014. Health Canada welcomed feedback from interested Canadians and stakeholders; however, given the scientific basis of Safety Code 6 guidelines, only feedback of a technical/scientific nature was considered in the development of the final revised Safety Code 6.

The revised Safety Code 6, which was published in 2015, as well as the summary of consultation feedback is available on Health Canada's website at the following location: http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct/index-eng.php.

Question 2:

Has the Minister of Health considered that there may be individuals providing her with EMR advice that have a conflict of interest?

Response:

Federal public servants are subject to the *Values and Ethics Code for the Public Sector* and directed to complete declarations if they believe they may be in a 'potential', 'real' or 'perceived' conflict of interest. They must also respect organizational policies, as mentioned above. Acceptance of these values and adherence to the expected behaviours is a condition of employment for every public servant. More information on the Values and Ethics Code is available here:

<https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=25049>

Concerns were raised in 2013 with the RSC's Expert Panel selection process regarding an undisclosed conflict of interest from the original chairperson. The RSC has detailed conflict of interest guidelines to support decision-making respecting individuals' participation on expert panels. Since the composition of the Expert Panel remained under the responsibility of the RSC, they took the appropriate steps at the time to rectify the situation.

Name of petitioner(s) - [REDACTED]
Address of petitioner(s): [REDACTED]
Telephone number(s): [REDACTED]
Email address: peelparentspetition@gmail.com

Name of the group: Peel Parents For Safe Use of Technology In Schools

I hereby submit this petition to the Auditor General of Canada under section 22 of the Auditor General Act.

Signature of the petitioner: [REDACTED]

Date: May 25, 2017

Title of the Petition: Need for Health Canada to provide appropriate precautionary messaging and advisories in schools for safer use of wireless devices such as cell phones and tablets, especially when connected through Wi-Fi, to protect children and others from radiofrequency/microwave radiation – above and below Safety Code 6 (2015) guidelines.

We request responses from Health Canada, and Innovation, Science and Economic Development Canada, – Families, Children and Social Development, Employment Workforce Development and Labour – and other relevant Departments/Agencies.

Background:

The environments of schools across Canada are being permeated with increasing levels of radiofrequency/microwave (RF/MW) radiation being emitted from wireless devices such as cell phones, smart boards and tablets. Emissions are often even higher when connected through Wi-Fi technology. Health Canada’s Safety Code 6, which applies to federal workplaces and federal employees, sets out limits for safe exposure to RF/MW radiation. These guidelines have been adopted by school boards, Provinces and Territories¹. In many cases, reliance on Safety Code 6 by these authorities has been presented as an excuse not to exercise caution by reducing exposures that may protect children, teachers and others in the school environment e.g. by turning Wi-Fi routers in classrooms off when not in use.

**1. Above, i.e. exceeding (=unsafe) Safety Code 6 emission exposure levels:
Breach of guidelines – having devices too close to the body may create health hazards**

Safety Code 6 (2015)² states: that “at frequencies between 100 kHz and 6 GHz³, the SAR [Specific Absorption Rate] limits shall not be exceeded. The SAR should be determined for

1 Schools boards, etc. are free to set their own safer RF/MW radiation guidelines.
2 http://www.hc-sc.gc.ca/ewh-semt/consult/_2014/safety_code_6-code_securite_6/final_finale-eng.php
3 Devices used by students and teachers would fall within this range, as does Wi-Fi frequency.

situations where exposures occur at 0.2m or less from the source. In all cases, the values in Table 2 “shall not be exceeded.” The value in “Table 2” that would apply is 1.6 W/kg.

On March 24th, 2017, the CBC aired a TV program called “*The Secret Inside Your Phone*.”⁴ In this program, three popular cell phones were tested by a company that provides testing services for USA Federal Communications Commission (FCC) certification for cell phones. FCC standards and Safety Code 6, SAR guidelines are the same. All of the RF/MW radiation emissions of these phones exceeded (unsafe) the FCC standard when tested as though they were being held right next to the body. The distance that a device must be held from the body to meet requirements is at least 5 mm for cell phones and 200 mm for tablets, yet students and teachers often keep these devices closer than this to their bodies.

Children in schools can be exposed to multiple devices for extended periods (their own as well as second hand exposure from others’ devices) which, if not used according to the instructions which come with the devices, could expose them to levels that exceed Health Canada’s Safety Code 6 safety guidelines and put them at particular risk.

2. Below Safety Code 6 emission exposure levels:

There is also historic and recent evidence that Safety Code 6 (2015) is not protective enough at many times below its guidelines.^{5,6}

The first public reports of Canadian children becoming ill from newly installed Wi-Fi in their school occurred in the fall of 2010 and were documented in a Global News television program called *Wi-Fi Safety in Schools*. The affected students reported headaches, nausea and lack of ability to concentrate as well as heart problems. In that program, a Health Canada representative stated that there was “no scientific evidence” of harm⁷ from Wi-Fi frequency exposure as would be found in schools and provided a list of 16 studies (Appendix 1) as supporting Health Canada’s assertions that Wi-Fi was not dangerous; only one of those studies was conducted on real people and it was not specifically on Wi-Fi and children.

In 2015, Canadians for Safe Technology (C4ST) prepared a report documenting 50 studies showing adverse biological effects at below Safety Code 6 levels. Seventeen (17) were published before Health Canada made their statement of “no scientific evidence” of harm and 33 were published after 2010.

Potentially harmful effects described in the C4ST report included DNA (genetic) damage and oxidative stress on body systems e.g. brain, cardiovascular, immune, testes.⁸ DNA damage

4 Marketplace with Wendy Mesley - <http://www.cbc.ca/marketplace/episodes/2015-2016/the-secret-inside-your-phone>

5 Canadians for Safe Technology web page: <http://c4st.org/news/category/wifi-in-schools/>

6 Environmental Health Trust - <https://ehtrust.org/key-issues/cell-phoneswireless/wifi-in-schools/>

7 Wi-Fi Safety in Schools - 16:9. The Bigger Picture (about 14 minutes): October 2010

<http://www.youtube.com/watch?v=KN7VetsCR2I>

8 <http://c4st.org/images/documents/cell-tower-situations/Limestone-DSB/50-Recent-Studies-Showing-Harm-Below->

can lead to various adverse reproductive and other health effects – not only cancer. Chronic or excessive oxidative stress can lead to chronic inflammation, which in turn has been associated with illnesses such as cancer, and cardiovascular and neurological diseases (Alzheimer's and Parkinson's).^{9, 10}

Although Health Canada has stated: "*while Health Canada is aware of concerns related to WIFI in schools, decisions on this matter are outside the department's mandate,*"¹¹ it has provided published information on "*situations where the use of –or exposure to – a product could pose a risk*" for other public health concerns.¹²

We maintain that the following factors and scientific evidence must be considered in setting standards to protect children and teachers in the school environment:

CANADA

- a) The Specific Absorption Rate can exceed (=unsafe) Safety Code 6 guidelines when devices are held next to the body, as is commonly done by many students, teachers and others.
- b) Power Density readings can exceed (= unsafe) Safety Code 6 guidelines in schools as demonstrated in a 2011 report by the Simcoe County District School Board in Ontario.¹³
- c) The Ontario English Catholic Teachers Association (OECTA) state in "*A position regarding the use of Non-Ionizing Electromagnetic Radiation, including WiFi, in the workplace: "Controls for Wi-Fi would best be guided by the ALARA principle (As Low As Reasonably Achievable), as well as by applying the concept of prudent avoidance."*¹⁴
- d) The Canadian Teachers' Federation has expressed concern for students and their exposure to Wi-Fi.^{15, 16} "*That an education program regarding the relative safety of Wi-Fi exposure be implemented and that appropriate resources be developed to educate the public regarding ways to avoid potential exposure risks of Wi-Fi access points and devices.*"¹⁷
- e) There are reports of more children being made ill from exposure to wireless radiation.¹⁸

SC6.pdf

9 Reuter et al. (2010). Oxidative stress, inflammation and cancer: How are they linked? *Free Radic Biol. Med.* 49 (11):1603-1616.

10 Dasdag, S., & Akdag, M. Z. (2015). The link between radiofrequencies emitted from wireless technologies and oxidative stress. *Journal of Chemical Neuroanatomy*. doi:10.1016/j.jchemneu.2015.09.001;

11 Health Canada letter to a Canadian resident.

12 <http://www.HealthCanada-sc.gc.ca/aHealthCanada-asc/media/advisories-avis/index-eng.php> [accessed 8October2016]

13 <http://www.magdahavas.com/wordpress/wp-content/uploads/2011/06/SCDSB-Feb-9-2011-B-F-Use-of-Wi-fi.pdf>

Table 1. Power Densities, MountainView ED (Elementary School); Whereas 1.0 = SC6 Threshold. The fifth measurement is 1.32. = 32% above SC6 limits

14 [http://www.oecta.on.ca/wps/portal/!](http://www.oecta.on.ca/wps/portal/) <http://www.safeschool.ca/uploads/WiFipositionpaper2.pdf>

15 Canadian Teacher Magazine. CTF [Canadian Teachers' Federation] sounds the alarm on Wi-Fi (page 46).

http://www.canadianteachermagazine.com/issues/2015/CTM_JanFeb15/index.html

16 Canadian Teachers' Federation- The Use of Wi-Fi in Schools - Briefing document.

<http://www.ctf-fce.ca/en/Pages/Issues/Wi-Fi-Briefing-Document.aspx>

17 <http://www.ctf-fce.ca/en/Pages/Issues/Wi-Fi-Briefing-Document.aspx>

18 Presentation to Royal Society of Canada, October 28, 2013. <https://www.youtube.com/watch?v=A6yUpX9Ved8>

f) *"Brain tumours are now the leading cancer in American adolescents, and incidence is rising in young adults according to the largest most comprehensive analysis¹⁹ of these age groups to date. Dr. Jacob Easaw, from the Tom Baker Cancer Centre in Calgary: 'The astounding increases reported in this study, especially in young people; mirror what I am seeing in my clinic. Canada is in the process of establishing a comparable brain tumour registry, so these analyses will not be available here for 15 or 20 years. I am increasingly convinced that mobile phones are a major cause and urgent action is needed.'*"²⁰

- There was recently a legal ruling in Italy: *"Landmark Case: First Court Worldwide to Recognize Causal Link Between Cellphone Use and Brain Tumor."*²¹
- Dr. Joel Moskowitz²² recently reported: *"Four reviews of the research on cell phone use and brain tumor risk have been published in peer-reviewed journals in 2017. All of these studies report finding a statistically significant relationship between cell phone use of ten or more years and brain tumor risk especially on the side of the head where the cell phone was predominantly placed during phone calls (i.e., ipsilateral use)."*²³

g) More than 50 Canadian medical doctors and a further 50 international scientists have written to Canada's Minister of Health calling for more protective wireless radiation guidelines, based on recent studies and the presence of patients seeking medical attention for relief of symptoms from exposure to microwave radiation from common wireless devices.²⁴

h) More than 60 studies have been identified in 2015 and early 2016 documenting potential adverse effects below Safety Code 6. Adverse effects and RF/MW radiation levels tested for 30 of them at SAR levels below Safety Code 6 are charted in Appendix 2.

INTERNATIONALLY

i) In 2011 the World Health Organization – International Agency for Research on Cancer (WHO-IARC) classified wireless radiation in the radiofrequency/microwave range [radiofrequency electromagnetic fields], which includes Wi-Fi, as a Class 2B, *possible* human carcinogen.²⁵ Dr. Hardell and his brain cancer research team, whose work was used, in part, to reach this determination, is now calling for a Class 1 *known* human carcinogen classification, based on newer research.^{26, 27}

19 Ostrom, Q.T., et al. (2016). American Brain Tumor Association Adolescent and Young Adult Primary Brain and Central Nervous System Tumors Diagnosed in the United States in 2008-2012.

Neuro-Oncology 18.Suppl. 1. i1-50. First Author Affiliation: Case Comprehensive Cancer Center, Case Western Reserve University School of Medicine, Cleveland, OH USA; **Central Brain Tumor Registry of the United States**, Hinsdale, IL USA.

20 <http://www.preventcancer.ca/brain-tumours-now-leading-form-of-cancer-in-adolescents>

21 <https://ehtrust.org/landmark-italian-court-ruling-recognizes-causal-link-cellphone-use-brain-tumor/>

22 Director, Center for Family and Community Health, School of Public Health, University of California, Berkeley

23 <http://www.saferemr.com/2017/02/long-term-cell-phone-use-increases.html>

24 <http://c4st.org/category/appeals-research/>

25 WHO/IARC Press Release: http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

26 Hardell, L., et al. (2013). Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. *Pathophysiology: The Official Journal of the International Society for Pathophysiology / ISP*, 20(2), 85–110.

- j) Other Class 2B agents such as lead, DDT and automobile exhaust are curtailed in most school environments because of their inclusion on this list. Yet, wireless radiation exposure (possible carcinogen) has become mandatory in close to 100% of school environments in Canada.
- k) France has legislated no Wi-Fi in daycares/nursery schools and Wi-Fi off in elementary classrooms except when being used for teaching/learning purposes.²⁸
- l) Taiwan has also legislated measures to reduce children's exposure.²⁹
- m) The Italian State Parliament of Tyrol has mandated the state government to replace existing wireless networks in schools and preschools whenever possible with safer alternatives. Hardwired solutions can be excellent alternatives to the constant exposure of a wireless network.
- n) Cyprus has banned Wi-Fi from kindergarten and from elementary school classrooms. Brazil, Ghent, Belgium and Israel have also taken strong measures to reduce students' exposure to wireless radiation.³⁰
- o) Over 224 scientists from 41 nations, who have published peer-reviewed papers on the biological or health effects of non-ionizing radiation³¹, made the following statement on May 11, 2015³²:
"These findings justify our appeal to the United Nations (UN) and, all member States in the world, to encourage the World Health Organization (WHO) to exert strong leadership in fostering the development of more protective EMF guidelines, encouraging precautionary measures, and educating the public about health risks, particularly risk to children and fetal development. By not taking action, the WHO is failing to fulfill its role as the preeminent international public health agency."
- p) Letters from medical doctors with more evidence that precautionary messaging and measures are required can be found at the Environmental Health Trust web site.³³

QUESTIONS:

1. Given that students, teachers and others are likely being exposed to levels exceeding Health Canada's (=unsafe) RF/MW radiation Safety Code 6 guidelines (e.g. by cell phones and tablets held too close to the body (exceeding SAR levels) and as reported in one case, exceeding Power Density above the Safety Code 6 threshold³⁴,

- 1) Will the Government of Canada provide regular monitoring of cumulative levels, to which children in schools are being exposed?

27 Coureau, G., et al. (2014). Mobile phone use and brain tumours in the CERENAT case-control study. *Occupational and Environmental Medicine*, 71(7), 514–522.

28 <http://www.complianceandrisks.com/france-publishes-law-on-electromagnetic-waves/>

29 <http://www.dailymail.co.uk/news/article-2929530/Does-toddler-play-iPad-Taiwan-makes-ILLEGAL-parents-let-children-two-use-electronic-gadgets-18s-limit-use-reasonable-lengths.html>

30 <https://ehtrust.org/cyprus-issues-decree-banning-wireless-kindergarten-elementary-school-classrooms/>

31 part of the EMF [electromagnetic field] spectrum that includes extremely low frequency fields (ELF) used for electricity, or radiofrequency radiation (RFR) used for wireless communications

32 As of July 25th, 2016 the appeal had 222 signatures from 41 nations.

33 <https://ehtrust.org/wp-content/uploads/Doctor-Letters-on-Wi-Fi-In-School-Full-Compilation.pdf>

34 <http://www.magdahavas.com/wordpress/wp-content/uploads/2011/06/SCDSB-Feb-9-2011-B-F-Use-of-Wi-fi.pdf>

Table 1. Power Densities, MountainView ED (Elementary School); Whereas 1.0 = SC6 Threshold. The fifth measurement is 1.32. = 32% above SC6 limits

2) Will the Government of Canada provide more precautionary messaging for wireless devices and Wi-Fi in schools and school board/industry sponsored programs such as BYOD (Bring Your Own Device)?

2. Based on evidence of harm below Safety Code 6 guidelines, the actions in other countries, and because Health Canada has been deferred to as setting authoritative thresholds on this question by school boards (who have been asked by parents to curtail wireless radiation exposure to children in school), and it has the broad responsibility for the protection of children's health across Canada:

1) Will Health Canada and Innovation, Science and Economic Development Canada issue advisories, based on a precautionary approach, to trustees, principals, teachers and parents and others who are responsible for the health of children in schools who are being exposed to Wi-Fi?

2) Will Health Canada take a precautionary approach and advise Provincial and Territorial Departments of Education, school boards and others responsible for children's health across Canada, to strive for ALARA (As Low As Reasonably Achievable) e.g. take simple, no cost measures such as turning off Wi-Fi in classrooms when Wi-Fi is not needed for teaching purposes, using hard-wired alternatives and setting devices to airplane mode with Wi-Fi turned off?

3. Given that Health Canada states on its website: *"It is true that there are no completed studies of the long term effects of Wi-Fi radiation specifically on children,"*³⁵ and *"situations where the use of -or exposure to - a product could pose a risk"* has been published by Health Canada for other public health concerns,³⁶ will Health Canada issue an advisory or warning related to use of Wi-Fi technologies in schools?

4. Based on the case presented above for a precautionary approach, will the Government of Canada run and/or provide education materials for a campaign to raise awareness of the potential harm of wireless devices and how to use them more safely, to those responsible for the health of children in schools such as trustees, principals, teachers and parents?

5. Will the Government of Canada share the best practices on methods to reduce Wi-Fi exposure in schools from countries such as France with the Provincial and Territorial Departments of Education, school boards and others responsible for children's health across Canada?

6. How have Health Canada and Innovation, Science and Economic Development Canada responded to the Canadian Teacher's Federation request for *"an education program regarding the relative safety of Wi-Fi exposure be implemented and appropriate resources be developed to educate the public regarding ways to avoid potential exposure risks of Wi-Fi"*³⁷ ?

35 <http://www.Health Canada-sc.gc.ca/ewh-semt/radiation/cons/wifi/faq-eng.php>

36 <http://www.Health Canada-sc.gc.ca/aHealth Canada-asc/media/advisories-avis/index-eng.php> [accessed 8 October 2016]

37 <http://www.ctf-fce.ca/en/Pages/Issues/Wi-Fi-Briefing-Document.aspx>

7. What response has Health Canada provided to the more than 50 Canadian medical doctors and 50 international scientists who have written to Canada's Minister of Health calling for more protective wireless radiation guidelines, especially for children?³⁸

8. Given the fact that over 33 studies on Wi-Fi frequencies and at least 60 studies on Wi-Fi and other common wireless device frequencies have been published demonstrating potential adverse effects below Safety Code 6 levels since Health Canada claimed there was "*no scientific evidence*" of harm,

– Will Health Canada provide the counter-balancing evidence in the form of a weight of evidence analysis or a list of 10 or so of the highest quality studies, from its database and from the authorities in other countries which it frequently names, that still support that there is "*no scientific evidence*" of harm?

Appendix 1.

The list of 16 studies labelled "List of studies reviewed at Health Canada that are specific to Wi-Fi" that Health Canada provided to the Global Network current affairs program 16:9 The Bigger Picture (aired October, 2010). The links have been added. Added comments are in [square brackets]. Only #10 was a biological effects study conducted on real people.

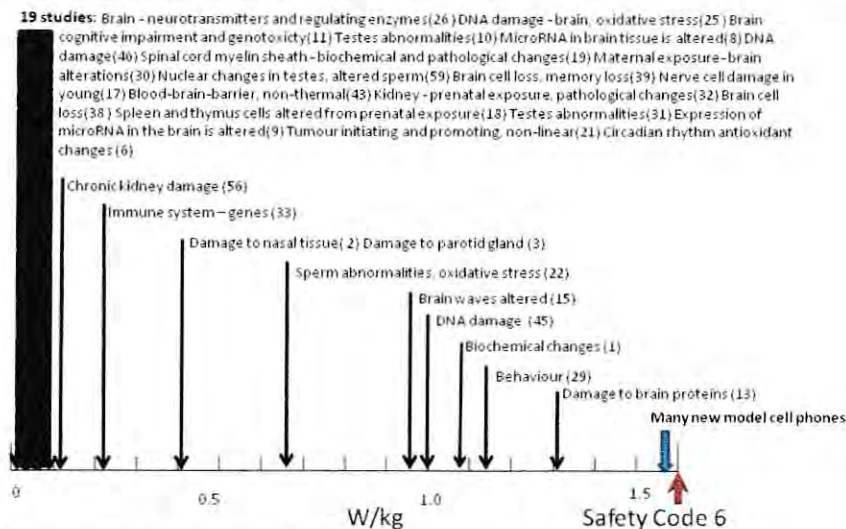
1. Andersen, J. B., et al. (2010). Power variations of wireless communication systems. *Bioelectromagnetics*, 31(4), 302-310. <http://www.ncbi.nlm.nih.gov/pubmed/20112260>
2. Fang, M., & Malone, D. (2010). Experimental verification of a radiofrequency power model for Wi-Fi technology. *Health Physics*, 98(4), 574-583. <http://www.ncbi.nlm.nih.gov/pubmed/20220364>
3. Findlay, R. P., & Dimbylow, P. J. (2010). SAR in a child voxel phantom from exposure to wireless computer networks (Wi-Fi). *Physics in Medicine and Biology*, 55(15), N405-411. <http://www.ncbi.nlm.nih.gov/pubmed/20647607>
4. Foster, K. R. (2007). Radiofrequency exposure from wireless LANs utilizing Wi-Fi technology. *Health Physics*, 92(3), 280-289. <http://www.ncbi.nlm.nih.gov/pubmed/17293700>
5. Joseph, W., et al. (2010). Comparison of personal radio frequency electromagnetic field exposure in different urban areas across Europe. *Environmental Research*, 110(7), 658-663. <http://www.ncbi.nlm.nih.gov/pubmed/20638656>
6. Joseph, W., (2008). Characterization of personal RF electromagnetic field exposure and actual absorption for the general public. *Health Physics*, 95(3), 317-330. <http://www.ncbi.nlm.nih.gov/pubmed/18695413>
7. Joseph, W., et al. (2010). Estimation of whole-body SAR from electromagnetic fields using personal exposure meters. *Bioelectromagnetics*, 31(4), 286-295. <http://www.ncbi.nlm.nih.gov/pubmed/20041435>
8. Malone, D., & Malone, L. A. (2009). Ambient radiofrequency power: the impact of the number of devices in a Wi-Fi network. *Health Physics*, 96(6), 629-635. <http://www.ncbi.nlm.nih.gov/pubmed/19430215>
9. Martínez-Búrdalo, M., (2009). FDTD assessment of human exposure to electromagnetic fields from WiFi and bluetooth devices in some operating situations. *Bioelectromagnetics*, 30(2), 142-151. <http://www.ncbi.nlm.nih.gov/pubmed/18937345>

38 <http://c4st.org/category/appeals-research/>

10. Mohler, E., Frei, P., Braun-Fahrlander, C., Fröhlich, J., Neubauer, G., Rössli, M., & Qualifex Team, (2010). Effects of everyday radiofrequency electromagnetic-field exposure on sleep quality: a cross-sectional study. *Radiation Research*, 174(3), 347-356. [study group was on men and women aged 30 to 60 years exposed to various sources, not a study specific to the school environment]
<http://www.ncbi.nlm.nih.gov/pubmed/20726726>
11. Otto, M., & von Mühlendahl, K. E. (2007). Electromagnetic fields (EMF): do they play a role in children's environmental health (CEH)? *International Journal of Hygiene and Environmental Health*, 210(5), 635-644. [supposedly a review of the literature but NONE of the studies identified in this study are referenced. Most, if not all, involve different frequencies] <http://www.ncbi.nlm.nih.gov/pubmed/17765660>
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 Old link not working: http://www.hpa.org.uk/web/HPAwebFile/HPA_C/1254510618866
 Link to archived report (have to copy and paste):
http://webarchive.nationalarchives.gov.uk/20140714084352/http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1254510618866
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Appendix 2.

Examples from the 60 peer-reviewed studies published since the HESA 2015 hearings with more compelling evidence that Safety Code 6 should be revised¹



Thirty (30) relevant scientific studies published in 2015 and up to April 2016 reporting potential harm at or below Safety Code 6 (2015). Specific Absorption Rate (SAR) for head, neck and trunk is 1.6 W/kg. Human, animal and cell culture studies. [numbers in brackets refer to the reference in the '60 studies' report]. Figure modified from the '200 studies' report.

¹ <https://www.scribd.com/document/339243060/Reference-mul-Extract-of-Dust-60-Scientific-Studies-Published-in-2015-and-Up-to-April-2016-Reporting-Potential-Harm-at-Level-at-or-Below-Safety-Code-from-embed>



Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

OCT 11 2017

[REDACTED]
Peel Parents for Safe Use of
Technology in Schools
[REDACTED]

Dear Ms. [REDACTED]

This is in response to your environmental petition no. 402 of May 25, 2017, addressed to Ms. Julie Gelfand, Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised concerns regarding Safety Code 6. I am pleased to provide you with the enclosed response to your questions. I understand that the Minister of Innovation, Science and Economic Development will be responding separately to questions that come under the purview of his department.

I appreciate your interest in this important matter.

Yours sincerely,

A handwritten signature in blue ink that reads "Ginette Petitpas Taylor".

The Honourable Ginette Petitpas Taylor, P.C., M.P.

Enclosure

c.c. Ms. Julie Gelfand, CESD
The Honourable Navdeep Bains, P.C., M.P.

Canada

Health Canada response to Petition #402

Question 1.1:

- 1. Given that students, teachers and others are likely being exposed to levels exceeding Health Canada's (=unsafe) RF/MW radiation Safety Code 6 guidelines (e.g. by cell phones and tablets held too close to the body (exceeding SAR levels) and as reported in one case, exceeding Power Density above the Safety Code 6 threshold,
1) Will the Government of Canada provide regular monitoring of cumulative levels, to which children in schools are being exposed?**

Response 1.1:

Health Canada administers the *Radiation Emitting Devices Act* (REDA) which governs the sale (including re-sale), lease and importation of radiation emitting devices in Canada. In addition to administering the REDA's authorities that pertain to devices that emit RF electromagnetic energy, the Department's mandate regarding human exposure to RF electromagnetic energy from wireless devices is to carry out research into possible health effects, monitor the scientific literature related to such effects on an ongoing basis and develop RF exposure guidelines, commonly referred to as Safety Code 6. Safety Code 6 sets recommended limits for safe human exposure to EMF in federally regulated industries and workplaces in the frequency range from 3 kHz to 300 GHz.

While the human exposure limits in Safety Code 6 were initially developed for, and applied by, federally-regulated employers, some of the exposure limits in the Code have since been referenced by other federal departments and non-federal jurisdictions. In particular, Innovation, Science and Economic Development Canada (ISED) requires compliance with Safety Code 6 as part of its technical standards for radio apparatus. With respect to matters that fall under the jurisdiction and authorities of provincial, territorial and or municipal governments, including school boards, it is the responsibility of these levels of government to determine whether and how they wish to implement measures in relation to wireless technologies, including those related to monitoring. Given this and Health Canada's position that the health of Canadians is protected when the recommended exposure limits in Safety Code 6 are respected, Health Canada has no plans to undertake such monitoring activity at this time.

Questions 1.2 through to 6

- 1.2 Will the Government of Canada provide more precautionary messaging for wireless devices and Wi-Fi in schools and school board/industry sponsored programs such as BYOD (Bring Your own device)?**
- 2. Based on evidence of harm below Safety Code 6 guidelines, the action in other countries, and because Health Canada has been deferred to as setting authoritative thresholds on this question by school boards (who have been asked by parents to curtail wireless**

radiation exposure to children in school), and it has the broad responsibility of the protection of children's health across Canada:

- 1) Will Health Canada and ISEDC issue advisories, based on a precautionary approach to trustees, principals, teachers and parents and others who are responsible for the health of children in schools who are being exposed to Wi-Fi?
- 2) Will Health Canada take a precautionary approach and advise Provincial and Territorial Departments of Education, school boards and others responsible for children's health across Canada, to strive for ALARA (As Low as Reasonably Achievable) e.g. take simple, no cost measures such as turning off Wi-Fi in classrooms when Wi-Fi is not needed for teaching purposes, using hard-wired alternatives and setting devices to airplane mode with Wi-Fi turned off?
3. Given that Health Canada states on its website *"It is true that there are no completed studies of the long term effects of Wi-Fi radiation specifically on children,"* and given that Health Canada has published warnings for other public health concerns in *"situations where the use of – or exposure to – a product could pose a risk"*, will Health Canada issue an advisory or warning related to use of Wi-Fi technology in schools?
4. Based on the case presented above for a precautionary approach, will the Government of Canada run and/or provide education materials for a campaign to raise awareness of the potential harm of wireless devices and how to use them more safely, to those responsible for the health of children in schools such as trustees, principals, teachers and parents?
5. Will the Government of Canada share the best practices on methods to reduce Wi-Fi exposure in schools from countries such as France with the provincial and territorial Departments of Education, school boards and others responsible for children's health across Canada?
6. How have Health Canada and Innovation, Science and Economic Development Canada responded to the Canadian Teacher's Federation request for *"an education program regarding the relative safety of Wi-Fi exposure be implemented and appropriate resources be developed to educate the public regarding ways to avoid potential exposure risks of Wi-Fi?"*

Response to question 1.1 through to 6:

The recommended limits within Safety Code 6 are designed to provide protection for all age groups, including infants and children, on a continuous basis. When establishing Safety Code 6, Health Canada incorporated several tiers of precaution into the human exposure limits. These included conservative thresholds for the occurrence of adverse effects, extreme worst-case situations for body size and orientation in relation to the RF fields, and additional safety margins. Since these conservative approaches are cumulative, i.e., stacked upon each other, Safety Code 6 provides very large margins of safety against the occurrence of all established adverse health effects associated with RF field exposure.

With respect to the petitioner's request for Health Canada to provide support for awareness raising measures, including advisories, warnings, best practices and education programs/materials on potential harms of wireless devices, it is Health Canada's position, based on the latest scientific evidence, that exposure to low-level RF energy, including that from Wi-Fi technology, is not dangerous to the public if the recommended exposure limits in Safety Code 6 are respected. Accordingly, no additional precautionary measures are required, since RF energy exposure levels from Wi-Fi are typically well below Canadian and international safety limits. Internationally, while a few jurisdictions (cities, provinces or countries) have applied more restrictive limits for RF field exposures from certain wireless devices/apparatus (whether it be Wi-Fi or cell towers), scientific evidence does not support the need for such restrictive limits.

Health Canada provides advice, upon request, to federal, provincial and territorial governments, on health related considerations associated with radiation emitting devices. Health Canada has previously provided timely scientific information and messaging on electromagnetic frequency (EMF) and health to federal, provincial, and territorial partners, including through the Pan Canadian Public Health Network. The Department maintains this practice and its ongoing relationship with its FPT partners in an effort to support regional efforts and decision-making in this area.

Health Canada information on Wi-Fi equipment is available at the following links:

Wi-Fi Equipment:

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/radiation/consumer-radiation/equipment.html>

Safety of Wi-Fi Equipment:

<https://www.canada.ca/en/health-canada/services/healthy-living/your-health/products/safety-equipment.html>

Frequently Asked Questions about Wi-Fi

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/radiation/consumer-radiation/equipment/frequently-asked-questions-about-radiation.html>

Finally, Health Canada is committed to safeguarding the health and safety of Canadians by actively monitoring scientific research and collaborating with various international organizations, partners, stakeholders, federal, provincial and territorial governments to protect Canadians from the adverse health effects from radiation emitting devices. The Department continues to monitor and analyze ongoing scientific research on this issue. Should new scientific evidence arise demonstrating that exposure to RF fields poses a health risk to Canadians, Health Canada would take appropriate action to safeguard the health of Canadians.

Question 7:

What response has Health Canada provided to the more than 50 Canadian medical doctors and 50 international scientists who have written to Canada's Minister of Health calling for more protective wireless radiation guidelines, especially for children?

As outlined above, the limits within Safety Code 6 are designed to provide protection for all age groups, including infants and children, on a continuous basis. Safety Code 6 has been updated periodically since it was first developed in 1979, with updates occurring in 1991, 1999, 2009 and, most recently, in 2015.

In the establishment of acceptable limits for Safety Code 6, departmental scientists considered all peer-reviewed scientific studies as well as comprehensive reviews of the scientific literature in this area undertaken by several national health agencies and organizations such as the World Health Organization, France's Agency for Food, Environmental and Occupational Health & Safety, the United Kingdom's Advisory Group on Non-Ionizing Radiation, the European Commission's Scientific Committee on Emerging Newly Identified Health Risks and the International Commission on Non-ionizing Radiation Protection.

Health Canada's latest process to revise Safety Code 6 was the most comprehensive, inclusive and transparent process to date. The 2015 update to Safety Code 6, which included more restrictive RF exposure limits than the previous version of the Code, was reviewed by an Expert Panel of the Royal Society of Canada (RSC). The RSC concluded in spring 2014 that there are no established adverse human health effects at exposure levels below the limits proposed. Overall, the Royal Society's review of Safety Code 6 was favourable and supported the science based conclusions that the basic restrictions in Safety Code 6 provided adequate protection. Based on evidence which emerged after Health Canada submitted Safety Code 6 for review, the Society did recommend slightly more restrictive reference levels in some frequency ranges to ensure larger safety margins for all Canadians, including newborn infants and children. Health Canada accepted the recommendation and adjusted Safety Code 6 accordingly.

It is Health Canada's position, and that of the Expert Panel of the Royal Society of Canada, that current measures on RF EMF protect our most vulnerable. The recommended human exposure limits in Safety Code 6, established by Health Canada, are designed to provide protection for all age groups, including infants and children, on a continuous basis (24 hours a day/seven days a week). This means that if someone, including a small child, were to be exposed to RF energy from multiple sources for 24 hours a day, 365 days a year, within the recommended limits in Safety Code 6, there would be no adverse health effects.

Question 8:

Given the fact that over 33 studies on Wi-Fi frequencies and at least 60 studies on Wi-Fi and other common wireless device frequencies have been published demonstrating potential

adverse effects below Safety Code 6 levels since Health Canada claimed there was “*no scientific evidence*” of harm,

- **Will Health Canada provide the counter-balancing evidence in the form of a weight of evidence analysis or a list of 10 or so of the highest quality studies, from its database and from the authorities in other countries which it frequently names, that still support that there is “*no scientific evidence*” of harm?**

In the establishment of acceptable limits for Safety Code 6, departmental scientists consider all peer-reviewed scientific studies, and employ a weight-of-evidence approach when evaluating possible health risks from exposure to RF energy. The weight-of-evidence approach takes into account both the quantity of studies on a particular endpoint (whether adverse or no effect), and more importantly, the quality of those studies. Poorly conducted studies (e.g., an inadequate exposure evaluation, a lack of appropriate control samples or inadequate statistical analysis) receive relatively little weight, while properly conducted studies (e.g., with all controls included, appropriate statistics and a complete exposure evaluation) receive more weight.

Safety Code 6 is based upon credible scientific evidence and analysis. When conducting an evaluation of the scientific literature, the Department gathers, assesses, and integrates multiple sources of scientific evidence into an overall conclusion; an approach that is consistent with international practices. While Safety Code 6 (2015) references a number of large international reviews of the scientific literature, the Code is intended as an exposure guideline and not a scientific review article and accordingly, most individual scientific studies are not referenced in the Code. However, this does not mean that Health Canada does not consider all relevant scientific information when deriving the science-based exposure limits in Safety Code 6.

Health Canada has been taking part in the International EMF Project, coordinated by the World Health Organization (WHO). The goals of this project are to verify reported biological effects from exposure to EMFs and to characterize any associated health risks to humans. The WHO is committed to conduct a formal risk assessment of all studied health outcomes from RF field exposure. Health Canada’s participation on these bodies allows the Department to leverage these large-scale and highly resourced international efforts which are widely recognized as comprehensive, and more detailed, than any review from a single jurisdiction could be. If new scientific evidence were to demonstrate that exposure to RF energy below levels found in Safety Code 6 from wireless technologies is a concern, Health Canada would take appropriate action to help protect the health and safety of Canadians. More information on the International EMF Project is available at the following link:

<http://www.who.int/peh-emf/project/en/>

Health Canada is aware of some studies that report biological effects or adverse health outcomes at RF field intensities below the limits in Safety Code 6 and other similar international standards. While Health Canada acknowledges that these studies exist, the Department does not consider these studies to be consistent with the prevailing line of scientific evidence in their respective areas and as such, these studies do not form a credible basis for the derivation of

science-based human exposure limits. Similar conclusions have been reported in recent reviews of the scientific evidence by national and international health authorities.

As with most scientific conclusions, it is possible to find differing scientific opinions. It is important to note that when thousands of research studies are conducted on any test agent (e.g. RF fields), statistical chance dictates that a small number of studies (even if conducted properly) will demonstrate a “false positive” or “false negative” result. Furthermore, studies with inappropriate study design or methodology can lead to erroneous results that are scientifically meaningless. It is for these reasons that the scientific literature on a given test agent must be evaluated both for the quality of the studies conducted but also for the strength of the evidence. Such analysis must consider all relevant properly conducted studies on the test agent.

More information can be found by visiting the Health Canada website at the following links:

Safety Code 6: Health Canada’s Radiofrequency Exposure Guidelines

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/safety-code-6-health-canada-radiofrequency-exposure-guidelines-environmental-workplace-health-health-canada.html>

Understanding Safety Code 6

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/understanding-safety-code-6.html>

Fact Sheet - What is Safety Code 6?

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/fact-sheet-what-safety-code-6.html>

2015 Revisions to Safety Code 6: Summary of Consultation Feedback

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/consultations/2015-revisions-safety-code-6-summary-consultation-feedback.html>



OCT 11 2017

[REDACTED]
Peel Parents for Safe Use of Technology in Schools
[REDACTED]

Dear Ms. [REDACTED]

I am writing with respect to your Environmental Petition no. 402, submitted to the Auditor General of Canada under Section 22 of the *Auditor General Act*, on the “Need for Health Canada to provide appropriate precautionary messaging and advisories in schools for safer use of wireless devices such as cell phones and tablets, especially when connected through Wi-Fi, to protect children and others from radiofrequency/microwave radiation – above and below Safety Code 6 (2015) guidelines.”

The Office of the Auditor General of Canada forwarded your questions to the Honourable Ginette Petitpas Taylor, Minister of Health, and to me. I am writing in response to questions 1(1), 2(1), and 6, which fall under Innovation, Science and Economic Development Canada’s (ISED) mandate and responsibility. Minister Petitpas Taylor will be providing you with a separate response addressing questions that fall under her department’s mandate and areas of responsibility.

Question 1: Given that students, teachers and others are likely being exposed to levels exceeding Health Canada’s (=unsafe) RF/MW radiation Safety Code 6 guidelines (e.g. by cell phones and tablets held too close to the body (exceeding SAR levels) and as reported in one case, exceeding Power Density above the Safety Code 6 threshold,

(1) Will the Government of Canada provide regular monitoring of cumulative levels, to which children in schools are being exposed?

Response 1(1):

Under the *Radiocommunication Act*, ISED requires that all manufacturers of wireless products, including Wi-Fi devices, cell phones, and tablets, meet the regulatory requirements set forth in its technical standards. ISED’s technical standards are based on recognized international testing procedures that have been adopted by most countries around the world.

...2

When cell phones and tablets are tested for compliance, they are tested at full power for the duration of the test. In reality, cell phones and tablets operate at much lower power levels, to preserve battery life, maximize call time, and avoid network interference. As such, under normal operating conditions, wireless devices yield much lower radiofrequency (RF) exposure levels than those measured during the compliance testing performed in laboratory settings.

Furthermore, ISED has adopted Health Canada's Safety Code 6 limits for the RF exposure compliance of wireless devices. In turn, Health Canada's scientific evidence indicates that the recommended peak specific absorption rate (SAR) limit of 1.6 W/kg for cell phones and tablets is not the threshold for the occurrence of adverse health effects. As a precautionary measure, the peak SAR limit in Safety Code 6 was set to more than 50 times below the level at which excessive tissue heating could occur in the most sensitive tissue (the eye). This means that the peak SAR limits in Safety Code 6 would need to be exceeded by a factor of more than 50 before one would see any thermally related adverse health effects.

Canada's approach to wireless device safety testing is among the most stringent in the world. As such, all products evaluated following the test procedures set forth in Canadian regulatory standards that auto comply with Health Canada's Safety Code 6 limits are safe.

As part of its ongoing monitoring of wireless devices for compliance with regulatory specifications, ISED conducted an extensive RF exposure technical study on the subject of Wi-Fi enabled devices in a simulated classroom setting entitled *Case Study: Measurements of Radio Frequency Exposure from Wi-Fi Devices*. This 2012 study confirmed that the cumulative levels of RF exposure from numerous Wi-Fi enabled devices were well below Health Canada's Safety Code 6 limits. The conclusion of this case study is still applicable in today's school environment. Other countries, such as New Zealand¹, have also performed RF exposure measurements in schools. Their conclusion is consistent with the results of our case study.

A copy of ISED's case study can be found online at www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf10383.html.

Question 2: Based on evidence of harm below Safety Code 6 guidelines, the actions in other countries, and because Health Canada has been deferred to as setting authoritative thresholds on this question by school boards (who have been asked by parents to curtail wireless radiation exposure to children in school), and it has the broad responsibility for the protection of children's health across Canada:

...3

¹ www.health.govt.nz/publication/snapshot-study-wifi-in-schools

(1) Will Health Canada and Innovation, Science and Economic Development Canada issue advisories, based on a precautionary approach, to trustees, principals, teachers and parents and others who are responsible for the health of children in schools who are being exposed to Wi-Fi?

Question 6: How have Health Canada and Innovation, Science and Economic Development Canada responded to the Canadian Teacher's Federation request for "an education program regarding the relative safety of Wi-Fi exposure be implemented and appropriate resources be developed to educate the public regarding ways to avoid potential exposure risks of Wi-Fi"?

Response 2(1) and 6:

Based on domestic and international studies, the cumulative levels of RF exposure from numerous Wi-Fi enabled devices in a classroom setting are well below RF exposure limits. All products evaluated following the measurement procedures set forth in Canadian regulatory standards that auto comply with Health Canada's Safety Code 6 safety limits. The ongoing measures taken by my department are effective in protecting Canadians, and advisories are not needed to reduce RF energy exposure from Wi-Fi devices.

The Government of Canada maintains web-based materials to inform the public on exposure to RF energy. The "It's Your Health" web-based series of publications created by Health Canada address issues such as the safety of cell phones and cell phone towers, electric and magnetic fields at extremely low frequencies, electromagnetic hypersensitivity, Wi-Fi equipment, and smart meters. The series' web page on the safety of Wi-Fi devices can be found online at www.canada.ca/en/health-canada/services/healthy-living/your-health/products/safety-equipment.html.

ISED also provides information on ensuring radio equipment safety in Canada, which is available at the following address: www.ic.gc.ca/eic/site/ceb-bhst.nsf/eng/h_tt00084.html.

I appreciate this opportunity to respond to your petition, and I trust that this information is of assistance.

Sincerely,



The Honourable Navdeep Bains, P.C., M.P.

c.c.: The Honourable Ginette Petitpas Taylor, P.C., M.P.
Minister of Health

Ms. Julie Gelfand
Commissioner of the Environment and Sustainable Development

Environmental Petition

Date: 12 June 2017

Name of petitioner(s) - Murray Cunningham

Address of petitioner(s): [REDACTED]

Telephone number: [REDACTED]

Email address: [REDACTED]

Name of the group: Environmental Health Association of Manitoba

I hereby submit this petition to the Auditor General of Canada under section 22 of the Auditor General Act.

Signature of the petitioner: via email to - petitions@oag-bvg.gc.ca

Title of the Petition: Scientific evidence for more substantial actions regarding the Parliamentary Standing Committee on Health (HESA) 2015 recommendations regarding children and pregnant women (vulnerable persons) exposed to wireless radiation in the microwave/radiofrequency range covered by Safety Code 6, from wireless devices such as baby monitors, tablets, cell phones, smart meters, Wi-Fi routers and 5 G technology

We request responses from Health Canada and Innovation, Science and Economic Development Canada.

Background:

Canadians have a right to be fully informed about the risks of exposure to environmental agents for which there is scientific evidence of harm. There is a considerable body of evidence published by credible scientists from respected institutions that is not being incorporated in safety guidelines with regard to the environmental agent, radiofrequency/microwave radiation. This is especially true regarding the health risks of vulnerable persons such as children and pregnant women.

The developing fetus is exquisitely sensitive to some environmental agents. Exposure of a pregnant woman or child to harmful agents can disrupt critical developmental processes that can interfere with pregnancy and normal development resulting in adverse health outcomes that may include lifelong detrimental effects. This is known from experiences with alcohol resulting in fetal alcohol syndrome (FAS), tobacco (cigarette) smoke exposure, and pharmaceutical drugs such as diethylstilbestrol (DES) and thalidomide, to name a few examples.

Radiofrequency/microwave radiation emissions occur from many common wireless devices such as baby monitors, cell phones, computer tablets, smart meters, Wi-Fi routers, as well as from telecommunications infrastructure such as antennae on homes, apartment buildings, utility poles and towers. The installation of microcells, required for 5 G technologies and the Internet of Things (IoT) will further increase exposure levels and to a wider range of radiofrequency wavelengths.

In 2015, the Parliamentary Standing Committee on Health held hearings regarding the potential adverse effects of exposure to microwave/radio frequency covered by Safety Code 6¹. Part of the range covered by this safety code is the same range used for the operation of wireless devices that children and pregnant women use or that are used in close proximity to them (second hand exposure).

On October 6th, the Honourable Jane Philpott, Minister of Health responded on behalf of the Government of Canada² to the recommendations³ (Appendix 1). Dr. Philpott's response, in part, states:

"Safety Code 6 human exposure limits, established by Health Canada, are designed to provide protection for all age groups, including infants and children, on a continuous basis (24 hours a day/seven days a week). This means that if someone, including a small child, were to be exposed to RF energy from multiple sources for 24 hours a day, 365 days a year, within the

1 Safety Code 6 (2015)- Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz. Safety Code 6. http://www.HealthCanada-sc.gc.ca/ewh-semtpubs/radiation/radio_guide-lignes_direct/index-eng.php

2 <http://www.ourcommons.ca/DocumentViewer/en/42-1/HESA/report-2/response-8512-421-78>

3 <http://www.ourcommons.ca/DocumentViewer/en/41-2/HESA/report-13>

Safety Code 6 limits, there would be no adverse health effects." The response also describes the "incorporations of several tiers of precaution", "extreme case scenarios", "very large margin of safety", etc. when designing Safety Code 6 guidelines.

Furthermore, the Minister's response states "Based on a thorough review of all available data, it is Health Canada's position that there are no established adverse health effects at levels below the limits outlined by Safety Code 6".

To clarify, the Government of Canada considers valid, only the "established" adverse health effect of heating (i.e. cooking or burning effects)⁴, in its determination of safety to radiofrequency/microwave radiation from commonly used devices. The "design" of Safety Code 6 guidelines only incorporates calculations regarding heating i.e. thermal effects. Yet there is a large body of evidence published by credible scientists from respected institutions that non-heating (non-thermal) adverse biological effects occur at below Safety Code 6 guidelines.

Justification in not implementing recommendations for children and vulnerable persons of the HESA 2015 report is based only on the heating of tissue and not on the large body of literature showing adverse biological effects below Safety Code 6 that are non-thermal.

The Minister's response continues citing the International Commission on Non-ionizing Radiation Protection (ICNIRP), the European Commission's Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) and the World Health Organization (WHO), and the panel report of the Royal Society of Canada (RSC) on Safety Code 6, as supporting, or being in line with, that position that heating is the only adverse effect that needs to be taken into account.

None of these bodies have conducted a systematic review of the relevant literature. In fact, no systematic review following best international practices exists in the published literature with "all" of the relevant published literature. Furthermore, the ICNIRP reports, the RSC report and the World Health Organization publications are not up to date. The 2015 SCENIR report is controversial and the process followed and conclusions reached are highly questionable^{5,6}.

The Minister's response also refers to the French Agency for Food, Environmental and Occupational Health and Safety (ANSES) (which is also controversial⁷) yet does not mention that France has legislated no Wi-Fi in nursery schools and reduced use of Wi-Fi in lower grade classrooms⁸.

This petition presents detailed information indicating adverse effects on the fetus, pregnant women and pre-adults from exposure to radiofrequency/microwave radiation at everyday living exposures at non-thermal, less than Safety Code 6 levels. This information is presented in four tables:

TABLE I. ADVERSE BIOLOGICAL EFFECTS AT NON-HEATING (NON-THERMAL) EXPOSURES BELOW SAFETY CODE 6 GUIDELINES: EVIDENCE FROM THE SCIENTIFIC LITERATURE

TABLE II. ACTIONS TAKEN IN OTHER COUNTRIES

TABLE III. STATEMENTS BY HEALTH CARE PROFESSIONALS

Table IV. RELATED INFORMATION.

Overall, at least 40 peer-reviewed publications showing potential adverse effects on pregnant women, the fetus and children from human, animal and cell/tissue studies are presented. There are many more showing adverse effects on adults that support the scientific evidence in these 40 studies.

4 Peripheral nerve stimulation, in addition to heating, also occurs at lower radiofrequencies not used commonly for telecommunications.

5 <http://www.iemfa.org/wp-content/pdf/Complaint-to-the-European-Commission-SCENIHR-2015-08-31.pdf>

6 <http://www.bioinitiative.org/rebuttal-emf-effects/> and <http://www.bioinitiative.org/submission-of-comments-on-final-scenihr-opinion-from-the-bioinitiative-working-group/>

7 http://www.robindestoits.org/Le-Pr-Belpomme-critique-severement-le-dernier-rapport-de-l-ANSES-sur-les-champs-electromagnetiques-Le-Republicain_a2083.html

8 http://www.lemonde.fr/planete/article/2015/01/29/une-loi-pour-encadrer-l-exposition-aux-ondes_4565339_3244.html#meter_toaster

TABLE I. ADVERSE BIOLOGICAL EFFECTS AT NON-HEATING (NON-THERMAL) EXPOSURES BELOW SAFETY CODE 6 GUIDELINES: EVIDENCE FROM THE SCIENTIFIC LITERATURE

Appendix 2 provides the references with relevant extracts to the following scientific evidence indicating potential risks.

1. PREGNANCY
 - 1.1 Women carrying to term
 - Spontaneous unexplained abortions
 - Embryo growth ceasing
 - Amniotic cells
 - 1.2 Animal
 - Implantation

2. EXPOSURE IN THE WOMB (PRENATAL) OR AS A NEWBORN (POSTNATAL)
 - 2.1 Human
 - Behaviour
 - Autism
 - 2.2 Animal
 - Hyperactivity and impaired memory
 - Kidney damage
 - Developmental abnormalities including testes
 - Memory loss
 - Abnormal brain cell development
 - Abnormal sperm quality

3. CHILDHOOD AND EARLY ADOLESCENCE
 - 3.1 Human
 - Attention Deficit Hyperactivity Disorder (ADHD)
 - Addiction, depression
 - Fatigue
 - Well-being
 - Cognitive and behavioural effects
 - Epigenetics
 - 3.2 Animal
 - Possible infertility
 - Abnormal spinal cord development
 - Poor spatial memory

- 4.0 LATE-ADOLESCENCE AND EARLY ADULTHOOD
 - 4.1 Human
 - Brain tumours/brain cancer

 - 4.2 Animal
 - Brain cell abnormalities
 - Brain cancer and schwannomas
 - Possible infertility

TABLE II. ACTIONS TAKEN IN OTHER COUNTRIES

1. France: France has legislated no Wi-Fi in nursery schools and reduced exposures in kindergarten and lower grade classrooms.⁹ The National Health and Safety Agency (ANSES) in France has recently recommended immediately reducing children's exposure to wireless devices.¹⁰
2. Belgium: As of March, 2014, it is illegal in Belgium to market cell phones to children less than seven years of age.¹¹
3. Cyprus: The National Committee for the Safety of the Environment and Children's Health (established by the Council of Ministers of Cyprus to protect the fetus and the child from health threats in the environment, created the informational video called "*Protect the children from mobile phones and Wi-Fi*"¹²
4. Italy: The state of South Tyrol, Italy, has mandated its government to take considerable precautionary measures to reduce children's exposure to wireless radiation including that schools replace wireless networks wherever possible.¹³
5. Taiwan: Taiwan has passed legislation banning parents from letting their children less than two years old from using any electronic devices such as tablets and smartphones.¹⁴

TABLE III. STATEMENTS BY HEALTH CARE PROFESSIONALS AND RELATED INFORMATION

1. Over 50 Canadian doctors signed a submission to the Minister of Health in 2014: "*Out of sincere concern for the health of Canadians at all stages of life – from the developing fetus through childhood and into adulthood – we respectfully request that: Health Canada develop and support strategies to raise awareness about microwave radiation impacts and to minimize prolonged exposure to microwave radiation in schools and other places where children are regularly exposed*"¹⁵
2. The Canadian Pediatric Association has released a position statement (posted June 1, 2017) stating that for children under 5 years old, "*children's early media experiences involves four principles*" - one of which is "*minimizing*" use of screens"¹⁶
3. A joint statement has been signed by over 100 doctors, scientists and educators expressing their concern and urging "*pregnant women to limit their exposures*."¹⁷
4. Ronald L Melnick, PhD, a (now retired) Senior Toxicologist and Director of Special Programs, led the design of the \$25m US National Toxicology Program/National Institute of Environmental Health Science (NTP/NIEHS) Rodent Study. Dr. Melnick states: "*In my view, a pediatrician would be acting irresponsibly if he or she knew and understood the implications of the human and animal cancer data on cell phone radiation and did not offer precautionary advice to the parents of his or her patients*."¹⁸
5. "*Brain tumours are now the leading cancer in American adolescents, and incidence is rising in young adults according to the largest most comprehensive analysis*¹⁹ of these age groups to date. Dr. Jacob Easaw, then from

9 http://www.lemonde.fr/planete/article/2015/01/29/une-loi-pour-encadrer-l-exposition-aux-ondes_4565339_3244.html#meter_toaster

10 ANSES Press release and report:

<https://www.anses.fr/fr/content/exposition-des-enfants-aux-radiofr%C3%A9quences-pour-un-usage-mod%C3%A9r%C3%A9-et-encadr%C3%A9-des-technologies>

<https://www.anses.fr/fr/content/exposition-des-enfants-aux-radiofr%C3%A9quences-pour-un-usage-mod%C3%A9r%C3%A9-et-encadr%C3%A9-des-technologies>

11 expatica.com/be/news/belgian-news/TMag-Mobile-phones-to-be-banned-for-children_259994.html

12 <https://www.facebook.com/1522020334715209/videos/1672938882956686/> (English subtitles)

13 <https://www.youtube.com/watch?v=996vzcCYCnE&feature=youtu.be>

14 <http://kompetenzinitiative.net/KIT/KIT/progress-in-south-tyrol-applying-the-precautionary-principle/>

15 <http://www.dailymail.co.uk/news/article-2929530/Does-toddler-play-iPad-Taiwan-makes-ILLEGAL-parents-let-children-two-use-electronic-gadgets-18s-limit-use-reasonable-lengths.html>

16 <http://c4st.org/doctors-call-protection-radio-frequency-radiation-exposure/>

17 <http://www.cps.ca/en/documents/position/screen-time-and-young-children> [accessed 3 June 2017]

18 <https://ehtrust.org/baby-safe-project-takes-off-protecting-pregnancy-from-wireless-radiation/>

19 <http://microwavenews.com/news-center/ntp-nyt>

19 Ostrom, Q.T., et al. (2016). American Brain Tumor Association Adolescent and Young Adult Primary Brain and Central Nervous System Tumors Diagnosed in the United States in 2008-2012. *Neuro-Oncology* 18.Suppl. 1. i1-50. First Author

the Tom Baker Cancer Centre in Edmonton: 'The astounding increases reported in this study, especially in young people, mirror what I am seeing in my clinic. Canada is in the process of establishing a comparable brain tumour registry, so these analyses will not be available here for 15 or 20 years. I am increasingly convinced that mobile phones are a major cause, and urgent action is needed.'²⁰ Australian brain surgeons, Dr. Vini Khurana and Dr. Charles Teo have stated they believe there is a direct causal link between brain cancers and mobile phone use.²¹

6. A research team led by Hugh S. Taylor, M.D., Chair of Obstetrics, Gynecology and Reproductive Sciences, Yale School of Medicine in a study published in 2011 concluded "We have shown that behavioral problems in mice that resemble ADHD [Attention Deficit Hyperactivity Disorder] are caused by cell phone exposure in the womb."²²

TABLE IV. RELATED INFORMATION

1. In June 2015, Canada's Parliamentary Committee on Health (HESA), after their hearings on Safety Code 6, recommended: "That the Government of Canada develop an awareness campaign relating to the safe use of wireless technologies, such as cell phones and Wi-Fi, in key environments such as the school and home to ensure that Canadian families and children are reducing risks related to radiofrequency exposure"²³ (Appendix 1).
2. In Dec., 2010, the Standing Committee on Health for the 40th Parliament, 3rd Session created a report entitled "An Examination of the Potential Health Impacts of Radiofrequency Electromagnetic Radiation". Recommendation 4 states "Health Canada and Industry Canada offer to provide information, including awareness sessions on exposure to radiofrequency electromagnetic radiation."
3. Dr. Devra Davis, co-founder and former director of the Oncology Department of the University of Pittsburgh, along with colleagues from Yale University, has founded the site Environmental Health Trust which has launched the BabySafe awareness project to educate pregnant women: *What You Need To Know About Pregnancy and Wireless Radiation*.²⁴
4. Over 200 other recent studies (some presented here), showing biological effects in human, animal and cell biology at below Safety Code 6 (2015) non-heating (non-thermal) limits and published in peer-reviewed journals further strengthen the weight of evidence of harm.²⁵
5. A faster 5th generation (5G) technology is being rolled out utilizing the radiofrequency/microwave bandwidth of over 30 GHz. The infrastructure would support the "Internet of Things" (IoT), self-driving cars, and virtual reality streaming and requires the installation of microcells (small cell tower antennae) in close proximity to homes. A recent conference "The Internet Of Things Poses Human Health Risks: Scientists Question The Safety Of Untested 5G Technology"²⁶ looked at many health related issues, not the least being that there is very little study on the effects of what will be an inundation of more wireless radiation in the environment. Some of the main concerns are outlined by Dr.Cindy Russell.²⁷

Affiliation: Case Comprehensive Cancer Center, Case Western Reserve University School of Medicine, Cleveland, OH USA; Central Brain Tumor Registry of the United States, Hinsdale, IL USA.

²⁰ <http://www.preventcancer.org/brain-tumours-now-leading-form-of-cancer-in-adolescents>

²¹ Reuter et al. (2010). Oxidative stress, inflammation and cancer: How are they linked? *Free Radic Biol. Med.* 49 (11):1603-1616.

²² Dasdag, S., & Akdag, M. Z. (2015). The link between radiofrequencies emitted from wireless technologies and oxidative stress. *Journal of Chemical Neuroanatomy*. doi:10.1016/j.jchemneu.2015.09.001;

²³ <https://www.youtube.com/watch?v=mMKwtjO73Y8>

²⁴ Aldad, T. S., Gan, G., Gao, X.-B., & Taylor, H. S. (2012). Fetal radiofrequency radiation exposure from 800-1900 mhz-rated cellular telephones affects neurodevelopment and behavior in mice. *Scientific Reports*, 2, 312. doi:10.1038/srep00312 <http://www.ncbi.nlm.nih.gov/pubmed/22428084>

²⁵ Government of Canada, Parliamentary Standing Committee on Health (HESA) Report (2015): Radiofrequency Electromagnetic Radiation and the Health of Canadians.

<http://www.parl.gc.ca/housepublications/publication.aspx?DocId=8041315>

²⁶ <http://www.babysafeproject.org/>

²⁷ <http://c4st.org/200-scientific-studies-reporting-potential-harm-non-thermal-levels/>

²⁸ <https://ehtrust.org/internet-things-poses-human-health-risks-scientists-question-safety-untested-5g-technology-international-conference/>

²⁹ https://ecfsapi.fcc.gov/file/10308361407065/5%20G%20Wireless%20Future-SCCMA%20Bulletin_FEB%202017_pdf.pdf

QUESTIONS:

1. Given the large amount of peer-reviewed, scientific evidence presented in the background information and the fact that Health Canada admits there are studies that show harm below Safety Code 6²⁸ will Health Canada acknowledge that the concept of using heating as the only established effect²⁹, and that using calculations based only on heating to set radiofrequency/microwave safe limits, are out of date? Will Health Canada begin to incorporate the new evidence, supported by older studies, of non-heating effects e.g. DNA damage, in its determination of Safety Code 6 guidelines?
2. Given that Health Canada states on its website "*It is true that there are no completed studies of the long term effects of Wi-Fi radiation specifically on children*"³⁰, will it use the information provided here (more than 40 studies showing potential harm below Safety Code 6 guidelines, children absorb more radiation than adults, etc.) to issue precautionary warnings regarding small children and pregnant women to minimize exposures?
3. What peer reviewed, published studies on radiofrequency/ microwave radiation does Health Canada rely on (itself and not from other "authorities") to indicate long term exposures are safe from non-heating (non-thermal) effects?
4. Given that epidemiological studies (CEFALO on children) and on adults (INTERPHONE (13 countries), INTERPHONE Canada (odds ratio of 2.0),³¹ the Hardell team and CERENAT) show an increased risk of brain cancer in long term avid users using regular cell phones (while meeting all current safety standards) and that children absorb more radiation than adults into the brain, will Health Canada update its archived "*Practical Advice on Safe Cell Phone Use*" issued in 2011³² and post it prominently on its website, and will the Government of Canada examine and implement protective measures and messaging regarding the sale and marketing of cell phones? If not, why not?
5. What was the decision making process that Health Canada followed to give more weight to the information in the French ANSES report as justification for inaction on the HESA 2015 recommendations when that report also made the recommendation to immediately reduce children's exposure to wireless devices³³ and that France has, in fact, legislated reduced exposure of Wi-Fi for young children?
6. What has the Government of Canada done to identify what actions and for what reasons protective measures have been taken in France³⁴ (legislation) , Belgium³⁵ (no marketing of wireless devices to children under 14 years), Taiwan,³⁶ (legislation) and Cyprus³⁷ (strong precautionary messaging)?

28 Health Canada's list of 36 studies that were in scope in response to C4ST's list of 140 omitted studies. 26 are below Safety Code 6 exposure guidelines.

http://archives.c4st.org/images/documents/hesa/Health_Canada_Response_to_C4ST_References_of_140_Missing_Studies.pdf

29 At frequencies used in common wireless devices used by children and pregnant women.

30 <http://www.hc-sc.gc.ca/ewh-semt/radiation/cons/wifi/faq-eng.php#a7> [accessed 7 June 2017]

31 Odds ratio of 2.2 (95% confidence interval; 1.3,4.1) when adjusted for selection and recall bias, over 558 lifetime hours.

32 <http://www.healthycanadians.gc.ca/recall-alert-rappel-avis/hc-sc/2011/13548a-eng.php>

33 ANSES Press release and report:

<https://www.anses.fr/fr/content/exposition-des-enfants-aux-radiofr%C3%A9quences-pour-un-usage-mod%C3%A9r%C3%A9-et-encadr%C3%A9-des-technologies>

<https://www.anses.fr/fr/content/exposition-des-enfants-aux-radiofr%C3%A9quences-pour-un-usage-mod%C3%A9r%C3%A9-et-encadr%C3%A9-des-technologies>

34 http://www.lemonde.fr/planete/article/2015/01/29/une-loi-pour-encadrer-l-exposition-aux-ondes_4565339_3244.html#meter_toaster

35 expatica.com/be/news/belgian-news/TMag-Mobile-phones-to-be-banned-for-children_259994.html

36 <http://www.dailymail.co.uk/news/article-2929530/Does-toddler-play-iPad-Taiwan-makes-ILLEGAL-parents-let-children-two-use-electronic-gadgets-18s-limit-use-reasonable-lengths.html>

37 <https://www.facebook.com/1522020334715209/videos/1672938882956686/> (English subtitles)

<https://www.youtube.com/watch?v=996vzcYCN&feature=youtu.be>

7. Given the lessons learned from not acting sooner to protect unborn children in cases such as fetal alcohol syndrome (FAS), tobacco (cigarette) smoke exposure, diethylstilbestrol (DES) and thalidomide, will the Government of Canada act immediately to the scientific evidence linking radiofrequency/microwave wireless radiation to autism and other potential adverse health outcomes, and require warnings, similar to alcohol consumption and cigarette packaging, to warn pregnant women on the potential harmful effects of wireless devices to them and their unborn child as well as update its web page "Safety of cell phones and cell phone towers"³⁸ to include the most recent science and cautionary advice from other countries such as France³⁹, Belgium⁴⁰, Taiwan,⁴¹ and Cyprus⁴²? If not, why not?
8. Will the Government of Canada conduct an educational campaign such as the "Baby Safe Project"⁴³ from the United States, led in part by researchers at Yale University, to educate pregnant women on the potential harmful effects of wireless devices to their unborn child?
9. Given that few health related studies have been conducted on 5G technology and that this technology will be pervasive because it will be used for intense connectivity e.g. for the Internet of Things, what precautionary measures will the Government of Canada take to protect the health of Canadians, particularly pregnant women and children?
10. With the new scientific evidence presented here, what specific actions will Health Canada take regarding the recommendations from both the 2010 and 2015 Parliamentary Health Committee Reports to run awareness sessions and/or campaigns to educate Canadians, especially relating to children and pregnant women, on the safer use of wireless devices?

38 <https://www.canada.ca/en/health-canada/services/consumer-radiation/safety-cell-phones-cell-phone-towers.html>

39 http://www.lemonde.fr/planete/article/2015/01/29/une-loi-pour-encadrer-l-exposition-aux-ondes_4565339_3244.html#meter_toaster

40 expatica.com/be/news/belgian-news/TMag-Mobile-phones-to-be-banned-for-children_259994.html

41 <http://www.dailymail.co.uk/news/article-2929530/Does-toddler-play-iPad-Taiwan-makes-ILLEGAL-parents-let-children-two-use-electronic-gadgets-18s-limit-use-reasonable-lengths.html>

42 <https://www.facebook.com/1522020334715209/videos/1672938882956686/> (English subtitles)

<https://www.youtube.com/watch?v=996vzcCYnE&feature=youtu.be>

43 <http://www.babysafeproject.org/>

Appendix 1. Recommendations from the 13th Report of the Standing Committee on Health (HESA), "Radiofrequency electromagnetic radiation and the Health of Canadians", June 2015, 41st Parliament⁴⁴.

Recommendations relating directly to vulnerable persons are recommendations 8, 9 and 12.

RECOMMENDATION 1

That the Government of Canada, in collaboration with the health departments of the provinces and territories, examine existing cancer data collection methods to improve the collection of information relating to wireless device use and cancer.

RECOMMENDATION 2

That Statistics Canada consider including questions related to electromagnetic hypersensitivity in the Canadian Community Health Survey.

RECOMMENDATION 3

That the Government of Canada, through the Canadian Institutes of Health Research, consider funding research into electromagnetic hypersensitivity testing, diagnosis and treatment, and its possible impacts on health in the workplace.

RECOMMENDATION 4

That the Canadian Medical Association, the Royal College of Physicians and Surgeons, the College of Family Physicians of Canada and the World Health Organization consider updating their guidelines and continuing education materials regarding the diagnosis and treatment of electromagnetic hypersensitivity to ensure they are based on the latest scientific evidence and reflect the symptoms of affected Canadians.

RECOMMENDATION 5

That the Government of Canada continue to provide reasonable accommodations for environmental sensitivities, including electromagnetic hypersensitivity, as required under the *Canadian Human Rights Act*.

RECOMMENDATION 6

That Health Canada ensure the openness and transparency of its processes for the review of Safety Code 6, so that all Canadians have an opportunity to be informed about the evidence considered or excluded in such reviews, that outside experts are provided full information when doing independent reviews, and that the scientific rationale for any change is clearly communicated.

RECOMMENDATION 7

That the Government of Canada establish a system for Canadians to report potential adverse reactions to radiofrequency fields.

RECOMMENDATION 8

That an independent scientific body recognized by Health Canada examine whether measures taken and guidelines provided in other countries, such as France and Israel, to limit the exposure of vulnerable populations, including infants, and young children in the school environment, to radiofrequencies should be adopted in Canada.

RECOMMENDATION 9

That the Government of Canada develop an awareness campaign relating to the safe use of wireless technologies, such as cell phones and Wi-Fi, in key environments such as the school and home to ensure that Canadian families and children are reducing risks related to radiofrequency exposure.

RECOMMENDATION 10

That Health Canada conduct a comprehensive review of all existing literature relating to radiofrequency fields and carcinogenicity based on international best practices.

RECOMMENDATION 11

That the Government of Canada, through the Canadian Institutes of Health Research, consider funding research into the link between radiofrequency fields and potential health effects such as cancer, genetic damage, infertility, impairment to development and behaviour, harmful effects to eyes and on the brain, cardiovascular, biological and biochemical effects.

RECOMMENDATION 12

That the Government of Canada and manufacturers consider policy measures regarding the marketing of radiation emitting devices to children under the age of 14, in order to ensure they are aware of the health risks and how they can be avoided.

44 <http://www.parl.gc.ca/content/hoc/Committee/412/HESA/Reports/RP8041315/hesarp13/hesarp13-e.pdf>

Appendix 2. Adverse health effects at radiofrequency/microwave radiation exposure levels below Health Canada's "safe" Safety Code 6 human exposure guidelines have been documented for every life stage of human development (except for the egg where only insect studies have been conducted⁴⁵).

The following are only some of the scientifically sound studies showing harm and potential harm from exposures below Safety Code 6 limits – some at many times below these limits – on pre-adult life stages. These studies include human, animal and cell/tissue studies.

In each section, human studies are listed first and are followed by animal studies which provide support for what is being reported in people, and in some studies report possible effects in humans which have not been yet identified.

1. PREGNANCY

1.1. Women carrying to term

- Spontaneous unexplained abortions: A case-control study (292 women with unexplained spontaneous abortions/308 normal pregnancies). Conclusion: Our result suggests that use of mobile phones can be related to the early spontaneous abortions." Mahmoudabadi, F. S., et al. (2015)¹
- Embryo growth ceasing: Watching TV and using mobile telephone during the first trimester of pregnancy may increase the risk of embryo growth ceasing significantly, in particular the high-risk pregnant women with embryo growth ceasing history." Han, J., et al. (2010).²
- Amniotic cells: exposure at 0.1 and 0.5 W/kg (6.3% and 31.3% of Safety Code 6).
"... we conclude that membrane receptors could be one of the main targets that RFR [radiofrequency radiation] interacts with cells, and the dose-rate threshold, in the case of EGF [epidermal growth factor] receptors, is between SAR of 0.1 and 0.5 W/kg." Sun, W., et al. (2012).³

1.2. Animal supporting studies

- Implantation: Exposure 0.023023 W/kg (1.4 % of Safety Code 6): "We observed that implantation sites were affected significantly...Our findings led us to conclude that a low level of MW [microwave] irradiation-induced oxidative stress not only suppresses implantation, but it may also lead to deformity of the embryo in case pregnancy continues. We also suggest that MW radiation-induced oxidative stress by increasing ROS [reactive oxygen species] production in the body may lead to DNA strand breakage in the brain cells and implantation failure/resorption or abnormal pregnancy in mice." Shahin, S., et al. (2013).⁴

2. EXPOSURE IN THE WOMB (PRENATAL) OR AS A NEWBORN (POSTNATAL)

2.1. Human

1. Behavioural problems:

- "The findings of the previous publication were replicated in this separate group of participants demonstrating that cell phone use was associated with behavioural problems at age 7 years in children, and this association was not limited to early users of the technology. Divan et al. (2012).⁵
- "Maternal cell phone use during pregnancy may be associated with an increased risk for behavioral problems, particularly hyperactivity/inattention, in offspring." Birks et al. (2017)⁶

- #### 2. Autism: A plausible link to exposure of wireless radiation to Attention Deficit Hyperactivity Disorder Spectrum (ADHDS) has been presented (Herbert and Sage (2013)^{7, 8} and Herbert (2015).⁹

45 Abnormal development: "All EMF [electromagnetic field] sources used created statistically significant effects regarding fecundity and cell death-apoptosis induction, even at very low intensity levels... well below ...guidelines..." Margaritis, L. H., et al. (2014). *Drosophila* oogenesis as a bio-marker responding to EMF sources. *Electromagnetic Biology and Medicine*, 33(3), 165–189 <http://www.ncbi.nlm.nih.gov/pubmed/23915130>

2.2. Animal

- Hyperactivity and impaired memory: "Neurobehavioral disorders are increasingly prevalent in children... we used a mouse model to demonstrate that in-utero radiofrequency exposure from cellular telephones does affect adult behavior. Mice exposed in-utero were hyperactive and had impaired memory... We present the first experimental evidence of neuropathology due to in-utero cellular telephone radiation." Aldad, T. S., et al. (2012)¹⁰
- Kidney damage: "[Exposure] during the prenatal period can cause pathological changes in kidney tissue in 21-day-old male rats owing to oxidative stress and decreased antioxidant enzyme levels." Odacı, E., et al. (2015).¹¹
- Developmental abnormalities including testes: "... exposure throughout embryogenesis may cause reductions in serum total T levels and in the size and weight of the testes of male rats, while causing modest increase in apoptosis." Sehitoglu, I., et al. (2015).¹²
- Memory loss: "... exposure to continuous-wave MW [microwave] radiation leads to oxidative/nitrosative stress induced p53 dependent/independent activation of hippocampal neuronal and non-neuronal apoptosis associated with spatial memory loss." Shahin, S., et al. (2015).¹³
- Abnormal brain cell development: "In conclusion, our study results show that prenatal exposure to EMF [electromagnetic fields] affects the development of Purkinje cells in the female rat cerebellum and that the consequences of this pathological effect persist after the postnatal period." Odacı, E., et al. (2015).¹⁴
- Abnormal sperm quality: "We found a higher apoptotic index, greater DNA oxidation levels and lower sperm motility and vitality in the NEMFG [new born exposed group] ... rat testes exposed to 900 MHz EMF [electromagnetic fields] exhibited altered sperm quality and biochemical characteristics." Odacı, E., et al. (2016).¹⁵

3. CHILDHOOD AND EARLY ADOLESCENCE

3.1. Human

- Attention Deficit Hyperactivity Disorder (ADHD)-mobile phones: A total of 2,422 children at 27 elementary schools in 10 Korean cities were examined and followed up 2 years later... The ADHD [Attention Deficit Hyperactivity Disorder] symptom risk [was] associated with mobile phone use for voice calls but the association was limited to children exposed to relatively high lead." Byun, Y.-H., et al. (2013).¹⁶
- Addiction, depression: "...We analyzed three-year longitudinal data from the Korean Children and Youth Panel Survey conducted by the National Youth Policy Institute in Korea. A total of 1877 valid responses from 2011 to 2013 were analyzed....We found that each mobile phone addiction and depressive symptom in earlier years was associated with increasing severity in these conditions consistently over the three years." Jun S. (2016)¹⁷
- Fatigue: "The present study indicated that there was a consistent significant association between MP [mobile phone] use and fatigue in children. Further in-depth research is needed to explore the potential health effects of MP use in children." Zheng, F., et al. (2015).¹⁸

- Well-being:
 - "... New Zealand early-adolescents' subjective well-being and self-reported use of, or exposure to, wireless telephone and internet technology... increased risk of headaches Using a wired cellphone headset was associated with tinnitus ... headache ... feeling down/depressed ... waking in the night... To safeguard young people's well-being, we suggest limiting their use of cellphones and cordless phones to less than 15 minutes daily, and employing a speaker-phone device for longer daily use..." Redmayne, M., et al. (2013).¹⁹
 - "...We recruited 619 fourth-grade students (8-11 years) from 37 schools around Melbourne and Wollongong, Australia... results for CP (cell phone) use were broadly consistent with our earlier study of older children..." Redmayne, M., et al. (2016).²⁰
- Cognitive and behavioural effects: exposure median 285.94 $\mu\text{W}/\text{m}^2$ and maximum 2,759.68 $\mu\text{W}/\text{m}^2$ - 100kHz to 6GHz (0.01% and 0.14% of Safety Code 6⁴⁶, respectively):
 - "A subsample of 123 boys belonging to the Environment and Childhood cohort from Granada (Spain), recruited at birth from 2000 through 2002, were evaluated at the age of 9–11 years...children living in higher RF exposure areas (above median SRMS [root mean-square] levels) had lower scores for verbal expression/comprehension and higher scores for internalizing and total problems, and obsessive-compulsive and post-traumatic stress disorders... Calvente, I., et al. (2016).²¹
 - "Two groups of healthy school-age children aged 11-14 (12.5 ± 1.5) years were included in the study, the one comprising those who are occasional users of a cellular phone (Group A) while the second those who do regularly use one (Group B)...CONCLUSIONS: HPA [The hypothalamic-pituitary-adrenal] axis response to cellular phone after mental stress in children and adolescents follow a different pattern in frequent users than in occasional users that seems to be influenced by the baseline thyroid hormone levels." Geronikolou, S. A., et al. (2015).²²
- Epigenetics: The subject of childhood development and epigenetics was recently reviewed by Sage and Burgio (2017).²³

3.2 Animal

- Possible infertility: "Further, these adverse reproductive effects suggest that chronic exposure to nonionizing MW [microwave] radiation may lead to infertility via free radical species-mediated pathway." Shahin, S., et al. (2014).²⁴
- Abnormal spinal cord development: Biochemistry results revealed significantly increased malondialdehyde and glutathione levels... LM [light microscopy] revealed atrophy in the spinal cord, vacuolization, myelin thickening and irregularities in the perikarya. TEM [transmission electron microscopic] revealed marked loss of myelin sheath integrity." Ikin, A., et al. (2015)²⁵
- Poor spatial memory: "... exposed rats exhibited poor spatial memory retention when tested 48 h after the final trial... Structural changes found in the hippocampus of RF-EMR [radiofrequency - electromagnetic radiation] exposed rats could be one of the possible reasons for altered cognition." Narayanan, S. N., et al. (2015)²⁶

46 Calculated using 2,000,000 $\mu\text{W}/\text{m}^2$ as the Safety Code 6 level. Safety Code 6 level at 6GHz is 10,000,000 $\mu\text{W}/\text{m}^2$.

4.0 LATE-ADOLESCENCE AND EARLY ADULTHOOD

4.1 Human

- Brain tumours/brain cancer

- Children are not little adults. Studies indicate that children absorb more radiation than adults.^{27,28} Dr. Om Gandhi of the Department of Electrical and Computer Engineering, University of Utah, has published multiple research studies indicating that children absorb radiation deeper into their brains than adults.⁴⁷
- Children absorb more radiation: “Computer simulation using MRI scans of children is the only possible way to determine the microwave radiation (MWR) absorbed in specific tissues in children. Children absorb more MWR [microwave radiation] than adults because their brain tissues are more absorbent, their skulls are thinner and their relative size is smaller... tumors induced in children may not be diagnosed until well into adulthood. The fetus is particularly vulnerable.” Morgan, L. L., et al. (2014).²⁹
- First use before the age of 20 increases risk: “... pooled analysis of two case-control studies on malignant brain tumours with patients ... aged 20-80 years and 18-75 years, respectively, at the time of diagnosis... Mobile phone use increased the risk of glioma... Use of cordless phones increased the risk ... First use of mobile or cordless phone before the age of 20 gave higher OR [Odds Ratio] for glioma than in later age groups.” Hardell, L., & Carlberg, M. (2015).³⁰
- Malignant brain tumors : A 2016 report published in the journal *Neuro-Oncology* and funded by the American Brain Tumor Association (ABTA) reports on the Central Brain Tumor Registry of the US (CBTRUS). Brain tumors are the most common cause of cancer-related deaths in adolescents and young adults aged 15-39, and the most common cancer occurring among 15-19 year olds. American Brain Tumor Association. (2016)³¹
- Canada: “The astounding increases reported in this study, especially in young people, mirror what I am seeing in my clinic,” responded Dr. Jacob Easaw, from the Tom Baker Cancer Centre in Calgary. “Canada is in the process of establishing a comparable brain tumour registry, so these analyses will not be available here for 15 or 20 years. I am increasingly convinced that mobile phones are a major cause, and urgent action is needed.” Quoted by *Prevent Cancer Now* (2016)³²
 - Recently published Canadian data for the 13-nation INTERPHONE study, used for the World Health Organization -International Agency for Research on Cancer (WHO-IARC) Class 2B *possible* human carcinogen classification, confirmed the more than doubling of risk of glioma (odds ratio of 2.2 after adjustment for selection and recall bias).³³
- Possible/probable/known human carcinogen: The 2011 WHO-IARC’s “*possible* carcinogen” designation was based primarily on the 13 country-wide INTERPHONE study⁴⁸, as well as a series of studies led by Dr. Lennart Hardell.³⁴ In 2014, the well-designed CERENAT French study supported those findings.³⁵ The international CEFALO study of children and adolescents indicated increased glioma risk with increased time of subscription, with significantly increased odds among the longest subscribers.^{36,37}
 - There is more recent evidence that the current classification of radiofrequency/microwave radiation should be upgraded to a Group 2A *probable* carcinogen or Group 1 *known* carcinogen. The 2011 classification of radiofrequency/microwave radiation as a Group 2B *possible* carcinogen was based largely on human studies. Baan, R., et al. (2011).³⁸ On May 27th, 2016, results of a US National Toxicology Program study were released showing strong evidence that cancer in rats can be caused by cell phone radiation (details below).
 - Recently Dr. Hardell co-authored a paper calling for radiofrequency/microwave radiation from wireless phones to be classified as a Group 1, *known* carcinogenic to humans.³⁹ Tobacco is in Group 1.

47 Environmental Health Trust: <http://ehtrust.org/>

48 See Appendix 2. <https://academic.oup.com/ije/article/39/3/675/631387/Brain-tumour-risk-in-relation-to-mobile-telephone>

4.2 Animal

- **Brain cell abnormalities:** "... Histopathological evaluations were also performed on these sections. Histopathological observation showed abundant cells with abnormal, black or dark blue cytoplasm and shrunken morphology among the normal pyramidal neurons. ... Stereological analyses showed that the total number of pyramidal neurons in the *cornu ammonis* of the EMF-EG [electromagnetic fields -exposed group] rats was significantly lower..." Şahin, A., et al. (2015)⁴⁰
- **Brain cancer and schwannomas:** In 2016 The US National Toxicology Program, National Institute of Environmental Health Science (NTP/NIEHS) released partial, but final, results of a major study finding a statistically significant association between cell phone radiation below USA safety standard (same as Health Canada's Safety Code 6) and cancer in male rats. "*The occurrences of two tumor types in male Harlan Sprague Dawley rats exposed to RFR [radiofrequency radiation], malignant gliomas in the brain and schwannomas of the heart, were considered of particular interest...*"⁴¹ This study found that cancer occurred at non-thermal levels, below the Safety Code 6 danger threshold. DNA damage was also observed in the NTP animal study. Wyde, M., et al. (2016).⁴²
- **Possible infertility:** "... chronic exposure to nonionizing MW [microwave] radiation may lead to infertility via free radical species-mediated pathway." Şahin, S., et al. (2014).⁴³
"...Data of the present study showed a significant increase in both excitatory and inhibitory amino acids in the cerebellum of adult and young rats and midbrain of adult animals after 1 hour of EMR [electromagnetic radiation] exposure...The present changes in amino acid concentrations may underlie the reported adverse effects of using mobile phones." Noor, N. A., et al. (2011).⁴⁴

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Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

OCT 20 2017

Mr. Murray Cunningham

Dear Mr. Cunningham:

This is in response to your environmental petition no. 403 of June 12, 2017, addressed to Ms. Julie Gelfand, Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised concerns regarding Safety Code 6. I am pleased to provide you with the enclosed response.

I appreciate your interest in this important matter.

Yours sincerely,

A handwritten signature in cursive script, reading "Ginette Petitpas Taylor".

The Honourable Ginette Petitpas Taylor, P.C., M.P.

Enclosure

c.c. Ms. Julie Gelfand, CESD

Canada

Health Canada response to Petition #403

Question 1

Given the large amount of peer-reviewed, scientific evidence presented in the background information and the fact that Health Canada admits there are studies that show harm below Safety Code 6, will Health Canada acknowledge that the concept of using heating as the only established effect, and that using calculations based only on heating to set radiofrequency/microwave safe limits, are out of date? Will Health Canada begin to incorporate the new evidence, supported by older studies, of non-heating effects e.g., DNA damage, in its determination of Safety Code 6 guidelines?

Health Canada administers the *Radiation Emitting Devices Act* (REDA) which governs the sale (including re-sale), lease and importation of radiation emitting devices in Canada. In addition to administering the REDA's authorities that pertain to devices that emit RF electromagnetic energy, the Department's mandate regarding human exposure to RF electromagnetic energy from wireless devices is to carry out research into possible health effects, monitor the scientific literature related to such effects on an ongoing basis and develop RF exposure guidelines, commonly referred to as Safety Code 6. Safety Code 6 sets recommended limits for safe human exposure to EMF in federally regulated industries and workplaces in the frequency range from 3 kHz to 300 GHz.

Health Canada scientists consider all potential adverse health effects when evaluating the possible health risks from exposure to RF energy, whether they are the result of heating or not. At frequencies below 10 megahertz (MHz), the first adverse effect to be experienced is nerve stimulation (a tingling sensation that is not caused by heating) and therefore becomes the basis for the exposure limits in this frequency range. The recommended exposure limits in Safety Code 6 are set below the level at which this effect occurs. At frequencies above 10 MHz, the first scientifically-established adverse health effect to occur (as exposure levels increase) is tissue heating. The recommended exposure limits in Safety Code 6, for frequencies above 10 MHz, are therefore set well below the threshold where tissue heating would occur.

Harmful health effects at levels below the recommended limits in Safety Code 6 have not been scientifically established.

Question 2

Given that Health Canada states on its website "It is true that there are no completed studies of the long term effects of Wi-Fi radiation specifically on children", will it use the information provided here (more than 40 studies showing potential harm below Safety Code 6 guidelines, children absorb more radiation than adults, etc.) to issue precautionary warnings regarding small children and pregnant women to minimize exposures?

In the establishment of recommended limits for Safety Code 6, departmental scientists consider all peer-reviewed scientific studies, and employ a weight-of-evidence approach

when evaluating possible health risks from exposure to RF energy. The weight-of-evidence approach takes into account both the quantity of studies on a particular endpoint (whether adverse or no effect), and more importantly, the quality of those studies. Poorly conducted studies (e.g., an inadequate exposure evaluation, a lack of appropriate control samples or inadequate statistical analysis) receive relatively little weight, while properly conducted studies (e.g., with all controls included, appropriate statistics and a complete exposure evaluation) receive more weight.

As with most scientific conclusions, it is possible to find differing scientific opinions. It is important to note that when thousands of research studies are conducted on any test agent (e.g. RF fields), statistical chance dictates that a small number of studies (even if conducted properly) will demonstrate a “false positive” or “false negative” result. Furthermore, studies with inappropriate study design or methodology can lead to erroneous results that are scientifically meaningless. It is for these reasons that the scientific literature on a given test agent must be evaluated both for the quality of the studies conducted but also for the strength of the evidence. Such analysis must consider all relevant properly conducted studies on the test agent. While some studies have reported biological effects or adverse health effects of RF fields at levels below the limits in Safety Code 6, these studies only form part of the dataset and do not represent the prevailing line of scientific evidence in these respective areas.

The limits within Safety Code 6 are designed to provide protection for all age groups, including infants and children, on a continuous basis. When establishing Safety Code 6, Health Canada incorporated several tiers of precaution into the human exposure limits. These included conservative thresholds for the occurrence of adverse effects, extreme worst-case situations for body size and orientation in relation to the RF fields, and additional safety margins. Since these conservative approaches are cumulative, i.e., stacked upon each other, Safety Code 6 provides very large margins of safety against the occurrence of all established adverse health effects associated with RF field exposure. It is therefore Health Canada’s position, based on the latest scientific evidence, that exposure to low-level RF energy, including that from Wi-Fi technology, is not dangerous to the public if the limits of Safety Code 6 are respected. As a result, no additional precautionary measures are required since RF energy exposure levels from Wi-Fi are typically well below Canadian and international safety limits.

Health Canada continues to monitor and analyze ongoing scientific research on this issue. Should new scientific evidence arise demonstrating that exposure to RF fields poses a health risk to Canadians, Health Canada would take the appropriate action to safeguard the health of Canadians.

Question 3:

What peer reviewed, published studies on radiofrequency/microwave radiation does Health Canada rely on (itself and not from other “authorities”) to indicate long term exposures are safe from non-heating (non-thermal) effects?

Canada is recognized worldwide for the rigour with which it gathers, assesses, and incorporates scientific information into its decision making and standards. In the case of electromagnetic radiation Health Canada carefully tracks developments in the scientific literature, in particular studies in relation to adverse health impacts. As indicated earlier, Health Canada uses a "weight of evidence" approach in evaluating scientific studies, which takes into account both the quantity and quality of studies, and gives more weight to studies which have been reproduced and which meet the highest standards of rigor and control. Canada also recognizes the importance of leveraging scientific expertise from around the world and as such, works closely with organizations like the World Health Organization (WHO), which includes the International Agency for Research on Cancer (IARC). Canada's approach protects the health and safety of Canadians, including our most vulnerable populations.

Comprehensive reviews of the scientific literature relating to RF fields have been carried out by scientists and expert panels under the auspices of highly recognized international bodies including the European Union's Scientific Committee on Emerging and Newly Identified Health Risks and the International Committee on Non-Ionizing Radiation Protection. The approach, commonly referred to as a scientific monograph, is generally conducted by international bodies requiring the participation of many scientific experts (40+) and many years of effort. Recent similar efforts have taken place by IARC as well as the WHO. Health Canada has been taking part in the International EMF Project, coordinated by the WHO.

Health Canada's participation on these bodies allows the Department to leverage these large-scale and highly resourced international efforts which are widely recognized as comprehensive, and more detailed, than any review from a single jurisdiction could be. In addition to participating in the international monograph exercises, Health Canada scientists carry out an ongoing surveillance of emerging scientific studies in this area.

While it is not practical to include a detailed listing of all studies relied upon, a few key references, which address the existence of adverse health effects (whether related to heating or not) are indicated below:

- International Commission on Non-Ionising Radiation Protection
<http://www.icnirp.org/en/publications/index.html>
- European Commission: Scientific Committee on Emerging and Newly Identified Health Risks
https://ec.europa.eu/health/sites/health/files/scientific_committees/emerging/docs/scenihr_o_041.pdf
- EMF-PORTAL: literature database of individual scientific studies on the effects of electromagnetic fields
<https://www.emf-portal.org/en>
- IEEE ICES EMF Literature Database
<http://ieee-emf.com/index.cfm>
- World Health Organization: EMF Project - Publications and information resources
<http://www.who.int/peh-emf/publications/en/>

Questions 5 and 6

Question 5:

What was the decision making process that Health Canada followed to give more weight to the information in the French ANSES report as justification for inaction on the HESA 2015 recommendations when that report also made the recommendation to immediately reduce children's exposure to wireless devices and that France has, in fact, legislated reduced exposure of Wi-Fi for young children?

Question 6:

What has the Government of Canada done to identify what actions and for what reasons protective measures have been taken in France (legislation), Belgium (no marketing of wireless devices to children under 14 years), Taiwan (legislation) and Cyprus (strong precautionary messaging)?

In the report cited by the petitioner, the French Agency for Food, Environmental and Occupational Health & Safety (ANSES) called for "a reduction in exposure of children to radiofrequencies emitted by mobile telephones, by promoting moderate use of these devices and favouring the use of hands-free kits". Practical guidance offered by Health Canada on its website is consistent with the ANSES recommendation:

<https://www.canada.ca/en/health-canada/services/consumer-radiation/safety-cell-phones-cell-phone-towers.html>

Health Canada's citation of the ANSES report in the Government Response to HESA's report was in reference to the fact that ANSES concurred with Health Canada's decision to lower the reference levels in Safety Code 6 (2015) in order to increase the safety margins, especially for children.

The health of Canadians is well protected from RF energy by the recommended human exposure limits in Safety Code 6. Health Canada is committed to using the best available science to inform its decision making and to ensure that the exposure limits in Safety Code 6 are consistent with science-based standards used in other parts of the world (e.g., the United States, the European Union, Japan, Australia and New Zealand). Internationally, a few jurisdictions have applied more restrictive limits for RF field exposures; however scientific evidence does not support the need for limits that are more restrictive than those recommended in Safety Code 6.

Questions 4, 7, 8 and 10

Question 4:

Given that epidemiological studies (CEFALO on children) and on adults (INTERPHONE (13 countries), INTERPHONE Canada (odds ratio of 2.0), the

Hardell team and CERENAT) show an increased risk of brain cancer in long term avid users using regular cell phones (while meeting all current safety standards) and that children absorb more radiation than adults into the brain, will Health Canada update its archived "Practical Advice on Safe Cell Phone Use" issued in 2011 and post it prominently on its website, and will the Government of Canada examine and implement protective measures and messaging regarding the sale and marketing of cell phones? If not, why not?

Question 7:

Given the lessons learned from not acting sooner to protect unborn children in cases such as fetal alcohol syndrome (FAS), tobacco (cigarette) smoke exposure, diethylstilbestrol (DES) and thalidomide, will the Government of Canada act immediately to the scientific evidence linking radiofrequency/microwave wireless radiation to autism and other potential adverse health outcomes, and require warnings, similar to alcohol consumption and cigarette packaging, to warn pregnant women on the potential harmful effects of wireless devices to them and their unborn child as well as update its web page "Safety of cell phones and cell phone towers" to include the most recent science and cautionary advice from other countries such as France, Belgium, Taiwan, and Cyprus? If not, why?

Question 8:

Will the Government of Canada conduct an educational campaign such as the "Baby Safe Project" from the United States, led in part by researchers at Yale University, to educate pregnant women on the potential harmful effects of wireless devices to their unborn child?

Question 10:

With the new scientific evidence presented here, what specific actions will Health Canada take regarding the recommendations from both the 2010 and 2015 Parliamentary Health Committee Reports to run awareness sessions and/or campaigns to educate Canadians, especially relating to children and pregnant women, on the safer use of wireless devices?

When establishing Safety Code 6, Health Canada incorporated several tiers of precaution into the human exposure limits. These included conservative thresholds for the occurrence of adverse effects, extreme worst-case situations for body size and orientation in relation to the RF fields, and additional safety margins. Since these conservative approaches are cumulative, i.e., stacked upon each other, Safety Code 6 provides very large margins of safety against the occurrence of all established adverse health effects associated with RF field exposure.

It is Health Canada's position, and that of an Expert Panel of the Royal Society of Canada, that current measures on RF EMF protect our most vulnerable. The recommended human RF exposure limits in Safety Code 6, established by Health Canada, are designed to provide protection for all age groups, including infants and children, on a continuous basis (24 hours a day/seven days a week). This means that if

someone, including a small child, were to be exposed to RF energy, within the Safety Code 6 limits, from multiple sources for 24 hours a day, 365 days a year there would be no adverse health effects. This conclusion is similar to that arrived at by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), the European Commission's Scientific Committee on Emerging and Newly Identified Health Risks, and the WHO.

Health Canada maintains messaging on its website that reminds cell phone users that they can take practical measures to reduce their RF exposure by limiting the length of cell phone calls, using "hands-free" devices and replacing cell phone calls with text messages. This messaging also encourages parents to take these measures to reduce their children's RF exposure from cell phones in acknowledgement that children are typically more sensitive to a variety of environmental agents.

Health Canada information on wireless devices is available at the following:

Wi-Fi Equipment:

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/radiation/consumer-radiation/equipment.html>

Safety of cell phones and cell phone towers:

<https://www.canada.ca/en/health-canada/services/consumer-radiation/safety-cell-phones-cell-phone-towers.html>

Under the *Radiocommunication Act*, the Minister of Innovation, Science and Economic Development Canada (ISED), has the authority to manage the use of radio spectrum and regulate radio apparatus through technical standards and conditions of authorization. Under this authority, ISED has adopted Health Canada's RF EMF exposure guideline for the purpose of protecting the general public from RF over-exposure. ISED requires that all broadcasting antennas and radiocommunication apparatus such as cell phones, base stations and Wi-Fi routers, comply with the relevant limits outlined in Safety Code 6 at all times.

Regarding the marketing of cell phones, under the *Canada Consumer Product Safety Act*, it is prohibited to advertise a consumer product, including consumer products that are radiation emitting devices, if the advertisement in question creates an erroneous impression regarding the device's safety, or if the product itself is a danger to human health or safety. Prohibitions respecting the advertising of radiation emitting devices are also set out in the *Radiation Emitting Devices Act*. Following the release of the HESA report and its recommendations, Health Canada shared the report with both the Advertising Standards Canada and the Canadian Radio-television and Telecommunications Commission (CRTC) for their consideration as appropriate.

Finally, Health Canada is committed to safeguarding the health and safety of Canadians by actively monitoring scientific research and collaborating with various international organizations, partners, stakeholders, federal, provincial and territorial governments to

protect Canadians from the adverse health effects from radiation emitting devices. The Department continues to monitor and analyze ongoing scientific research on this issue and will update its advice to Canadians accordingly. Should new scientific evidence arise demonstrating that exposure to RF fields poses a health risk to Canadians, Health Canada would take appropriate action to safeguard the health of Canadians.

Question 9:

Given that few health related studies have been conducted on 5G technology and that this technology will be pervasive because it will be used for intense connectivity e.g., for the Internet of Things, what precautionary measures will the Government of Canada take to protect the health of Canadians, particularly pregnant women and children?

Current exposure limits found in Safety Code 6 cover the frequency range used by devices employing 5G technology. As previously stated, ISED is the regulatory authority for wireless communication technology, which includes the roll-out of 5G wireless cellular networks. In particular, ISED requires compliance with Safety Code 6 as part of its technical standards for radio apparatus.

Environmental Petition

Name of petitioner(s):

Barbara Payne on behalf of Electromagnetic Pollution Illnesses Canada Foundation (EPIC)

Address of petitioner(s):

Telephone number(s):

Email address:

Office of the Auditor General of Canada
240 Sparks Street, Ottawa, Ontario, K1A 0G6
Via email to petitions@oag-bvg.gc.ca

Attention: Petitions

Date: June 16, 2017

Dear Commissioner,

I hereby submit this petition to the Auditor General of Canada under section 22 of the *Auditor General Act*.

Signature of the petitioner:



Electromagnetic Pollution Illnesses Canada Foundation (EPIC) is a volunteer-based not-for-profit in Canada established to:

- provide support and services to adults and children affected by electromagnetic pollution;
- provide information to the public about electromagnetic pollution and its impact on health and wellbeing;
- promote the creation of healthy environments.

Title of the Petition: Recognition, protection, and accessibility for persons who suffer health impairment related to contamination by electromagnetic pollution in indoor and outdoor environments: Furthering Honourable Health Minister Philpott's topic "Greater Understanding and Management of Electromagnetic hypersensitivity (EHS)" in response to the Standing Committee on Health (HESA) report *Radiofrequency Electromagnetic Radiation and the Health of Canadians* (related to *Safety Code 6* et al.)

We request a response from Health Canada, Statistics Canada, and the Honourable Minister of Science.

INTRODUCTION:

In the 41st Parliament, the Standing Committee on Health (HESA) studied *Safety Code 6* and heard testimony from 22 witnesses. Meetings were held March 24¹, April 23², and 28³, 2015. Consequently, a HESA report, *Radiofrequency Electromagnetic Radiation and the Health of Canadians*⁴, which included 12 Recommendations, was tabled in the House of Commons in June 2015. Four of the report's Recommendations are regarding Electromagnetic hypersensitivity (EHS).

An immediate response was not prepared because of the dissolution of Parliament. The HESA in the next Parliament re-tabled the report in June 2016. On October 6, 2016, the Honourable Jane Philpott, Minister of Health, responded on behalf of the Government of Canada.

The purpose of this petition is to ask questions regarding Minister Philpott's response to the four HESA Recommendations regarding EHS:

RECOMMENDATION 2

That Statistics Canada consider including questions related to electromagnetic hypersensitivity in the Canadian Community Health Survey.

RECOMMENDATION 3

That the Government of Canada, through the Canadian Institutes of Health Research, consider funding research into electromagnetic hypersensitivity testing, diagnosis and treatment, and its possible impacts on health in the workplace.

RECOMMENDATION 4

That the Canadian Medical Association, the Royal College of Physicians and Surgeons, the College of Family Physicians of Canada and the World Health Organization consider updating their guidelines and continuing education materials regarding the diagnosis and treatment of electromagnetic hypersensitivity to ensure they are based on the latest scientific evidence and reflect the symptoms of affected Canadians.

1 March 24, 2015 -

<http://www.parl.gc.ca/HousePublications/Publication.aspx?Language=e&Mode=1&Parl=41&Ses=2&DocId=7892702>

2 April 23, 2015 -

<http://www.parl.gc.ca/HousePublications/Publication.aspx?Language=e&Mode=1&Parl=41&Ses=2&DocId=7936469>

3 April 28, 2015-

<http://www.parl.gc.ca/HousePublications/Publication.aspx?Language=e&Mode=1&Parl=41&Ses=2&DocId=7945128>

4 <http://www.parl.gc.ca/content/hoc/Committee/412/HESA/Reports/RP8041315/hesarp13/hesarp13-e.pdf>

RECOMMENDATION 5

That the Government of Canada continue to provide reasonable accommodations for environmental sensitivities, including electromagnetic hypersensitivity, as required under the *Canadian Human Rights Act*.

Minister Philpott's response consisted of an introduction and three sections that addressed the 12 Recommendations. The section that is the subject of this petition is in Minister Philpott's response⁵ titled "Greater Understanding and Management of Electromagnetic-hypersensitivity (EHS)" and addressed the above recommendations.

We have divided the Minister's response text (appears framed and in italics) according to six Topics, and within each Topic the Minister's response is followed by our background information and our questions. Topics 7 and 8 deal with closely related issues.

Topic 1⁶ **Health Canada's statement on symptoms attributed to electromagnetic fields (EMFs)**

Health Canada acknowledges that some people have reported an array of health symptoms that they attribute to exposure to EMF [electromagnetic fields]. At present, the symptoms attributed to EMF exposure have been termed idiopathic environmental intolerance (IEI-EMF) by the WHO, where "idiopathic" refers to unknown causes. This means that while the symptoms attributed by some persons to EHS are real, the scientific evidence provides strong support that these health effects are not associated with EMF exposure.⁷

BACKGROUND:

Electromagnetic hypersensitivity (EHS) is a descriptive term for symptoms caused by exposure to electromagnetic fields radiation (such as radiofrequency radiation, microwave radiation, et al.). Other names often used for EHS are: electrosensitivity (ES), electromagnetic sensitivity (EMS), electrohypersensitivity (EHS), electromagnetic fields (EMF) syndrome, and idiopathic environmental intolerance (IEI-EMF).⁸

Physical symptoms of EHS can be acute or chronic and range from mild effects such as headache, nausea, tingling, skin reactions, anxiety, and tinnitus (buzzing/ringing in the ears) to severe effects such as pain, neurological conditions, cardiovascular irregularities, hormonal irregularities, blood sugar irregularities, seizures, paralysis, and stroke. For many people, sleep disruption is a symptom of EHS, and reduced

⁵ <http://www.parl.gc.ca/HousePublications/Publication.aspx?DocId=8481964>

⁶ [Sentences 1-3]

⁷ <http://www.parl.gc.ca/HousePublications/Publication.aspx?DocId=8481964>

⁸ The Swedish Radiation Safety authority in its 2015 report uses the terms idiopathic environmental intolerance attributed to electromagnetic fields (IEI--EMF) and electromagnetic hypersensitivity (EHS) as synonyms depending on the use of the terminology in the original papers. Page 75.

<https://www.stralsakerhetsmyndigheten.se/Global/Publikationer/Rapport/Stralskydd/2015/SSM-Rapport-2015-19.pdf>

quantity or quality of sleep contributes to further physiological and other problems. Behaviour, concentration, and memory can also be affected. Other information on EHS and other environmental illnesses can be found in “The Medical Perspectives on Environmental Sensitivities” on the Canadian Human Rights Commission website.⁹

The World Health Organization (WHO) also uses the term “electromagnetic sensitivity” to describe this condition. However, the WHO’s information sheet, “Electromagnetic fields and public health. Electromagnetic hypersensitivity. Background. December 2005”¹⁰, is outdated. Likewise, the draft report, and latest version available to the public, on this topic that the WHO is working on does not include all of the more recent relevant studies. Concerns about the WHO working group and process that the WHO is using in preparing the report have been expressed.^{11,12}

QUESTIONS:

1. (a) How have Canadians reported their electromagnetic hypersensitivity (EHS) symptoms to Health Canada? (b) How many Canadians have reported their EHS symptoms to Health Canada? (c) Has Health Canada conveyed those reports to the World Health Organization?
2. What are the specific primary research studies (complete references with author, year, title, journal name), other than short-term provocation studies, that Health Canada relies on to make its evidence statement about association of health effects with EMF exposure?
3. Has Health Canada contacted representatives in the Swedish government: to understand its decision to officially designate electrohypersensitivity (EHS) as a fully recognized functional impairment; and to identify what benefits are provided to individuals in Sweden who suffer due to EHS?

Topic 2¹³ Other agencies' statements on symptoms attributed to electromagnetic fields (EMFs)

Other recent reviews have been carried out by international bodies including the Swedish Radiation Safety Authority (2015), Public Health England (2012) and the Australian Radiation Protection and Nuclear Safety Agency (2015); all reaching similar conclusions. Domestically, in its 2014 review of Safety Code 6 the Royal Society of Canada found, “taken together, research in the past ten years does not provide firm evidence for the hypothesis that people with IEI-EMF can perceive RF energy levels below the limits in Safety Code 6 or that there is a causal link between exposure to RF and their symptoms”.

BACKGROUND:

None of the reports cited refer to the following highly relevant publications¹⁴.

⁹ http://www.chrc-ccdp.gc.ca/sites/default/files/envsensitivity_en.pdf

¹⁰ <http://www.who.int/peh-emf/publications/facts/fs296/en/> [accessed 3 May 2017]

¹¹ <http://www.bioinitiative.org/advisors-committee/>

¹² Starkey, S. J. (2016). Inaccurate official assessment of radiofrequency safety by the Advisory Group on Non-ionising Radiation. *Reviews on Environmental Health*, 31(4), 493–503.

¹³ [Sentences 4-5]

¹⁴ Although the Minister cites the Australian report as being published in 2015 the title of the Australian Radiation

a) The “EUROPAEM [European Academy for Environmental Medicine] EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses”¹⁵ lists over 20 “health problems” and provides guidelines for treatment and diagnosis for family physicians to help identify and treat patients with EHS.*

b) Belpomme, D., Campagnac, C., & Irigaray, P. (2015). Reliable disease biomarkers characterizing and identifying electrohypersensitivity and multiple chemical sensitivity as two etiopathogenic aspects of a unique pathological disorder. *Reviews on Environmental Health*, 30(4), 251–271.*

* Authors and their affiliations are listed in Appendix 1.

It should also be noted that the opinions and conclusions in the reports cited by the Minister of Health are surrounded by controversy in aspects of flawed process, potential conflict of interest, and omissions – as detailed by the Swedish Radiation Protection Foundation¹⁶, the Australian group Oceania Radiofrequency Scientific Advisory Association (ORSAA)¹⁷, Starkey (2016)¹⁸, the BioInitiative Working Group¹⁹, Pall (2015)²⁰, the Canadians for Safe Technology report on “140 omitted studies”²¹, and in articles published in the *Canadian Medical Association Journal* (CMAJ).^{22,23}

The concerns, which include bias of an unbalanced group evaluating the scientific literature, also extend to the European Union's report²⁴ and are outlined in a letter to the European Ombudsman signed by over 40 non-governmental organizations (NGOs).²⁵

In 2014, more than 50 Canadian medical doctors appealed to the Minister of Health for “guidelines and resources to assist Canadian physicians in assessing and managing problems related to microwave

Protection (ARPANSA) report is “Review of Radiofrequency Health Effects Research - Scientific Literature 2000-2012” Technical Report Series 164. [ARPANSA site <http://www.arpansa.gov.au/> - accessed 3 May 2017]

15

https://www.researchgate.net/publication/305689940_EUROPAEM_EMF_Guideline_2016_for_the_prevention_diagnosis_and_treatment_of_EMF-related_health_problems_and_illnesses

16 <http://www.stralskyddsstiftelsen.se/english/> The report is on the conflict of interest of the experts in the 2016 version which are the same experts as in 2015. <http://www.stralskyddsstiftelsen.se/2016/05/varning-for-stralsakerhetsmyndigheten-ssm-fyra-skal-till-varfor-du-inte-kan-lita-pa-ssm/>

17 Personal communication with Steve Weller, member of Oceania Radiofrequency Scientific Advisory Association (ORSAA) - <http://www.orsaa.org/>.

18 Starkey, S. J. (2016). Inaccurate official assessment of radiofrequency safety by the Advisory Group on Non-ionising Radiation. *Reviews on Environmental Health*, 31(4), 493–503.

19 The 2012 working group consisted of 29 electromagnetic field (EMF) experts from 10 countries - http://www.bioinitiative.org/report/wp-content/uploads/pdfs/sec25_participants.pdf

20 Pall, M. L. (2015). Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. *Reviews on Environmental Health*, 30(2), 99–116.

21 <http://archives.c4st.org/website-pages/hc-resolution-documents/c4st-analysis-of-ignored-studies-full.html>

22 Scientists Decry Canada's Outdated Wi-Fi Safety Rules

<http://archives.c4st.org/news/what-s-happening-in-canada/scientists-decry-canadas-outdated-wi-fi-safety-rules.html>

23 Canadian Medical Association Journal reports Health Canada's wireless limits are "A Disaster to Public Health" <http://archives.c4st.org/news/what-s-happening-in-canada/canadian-medical-association-journal-reports-health-canadas-wireless-limits-are-a-disaster-to-public-health.html>

24 Mentioned elsewhere in the Minister's response.

25 <http://www.stralskyddsstiftelsen.se/2015/03/bias-in-the-assessment-of-electromagnetic-fields-emf/>

radiation”²⁶ (Appendix 2).

QUESTIONS:

4. Given the new information from experts in clinical settings from respected institutions, and the request to the Minister of Health outlined in the Canadian medical doctors’ 2014 declaration, will Health Canada update its assumptions regarding electromagnetic hypersensitivity (EHS)?
5. (a) Will Health Canada provide the necessary resources to provide appropriate care for Canadians who suffer due to electromagnetic hypersensitivity (EHS)? (b) If not, why not?

Topic 3²⁷ Accommodating Electromagnetic hypersensitivity (EHS) in the workplace

Health Canada agrees that the Government of Canada should continue to provide accommodation measures for individuals suffering from disabilities, as required under the Canadian Human Rights Act and has shared a copy of the Committee’s report with officials at the Canadian Human Rights Commission for their consideration as appropriate.

BACKGROUND:

The Canadian Human Rights Commission establishes guidelines for employers to accommodate workers and has published a rationale titled “The Medical Perspectives on Environmental Sensitivities”²⁸. We are aware that the Government of Canada has accommodated at least one individual in the workplace.

More than 1000 physicians signed the “Freiburg Appeal” in 2002. The 2012 updated Appeal states, “... as physicians and scientists call again on our colleagues and the wider global community, but also on all politicians around the world to identify and clearly mark protected zones for electrohypersensitive people; establish public areas without wireless access or coverage, especially on public transport, similar to smoke-free areas for nonsmokers.”²⁹

QUESTIONS:

6. What other proactive steps will Health Canada take to inform and educate within the public service, as well as in the private sector, to make employers aware of the potential consequences of firsthand and secondhand exposures to wireless radiation and increased risk to susceptible individuals?
7. Are there any plans to determine the extent of electromagnetic hypersensitivity (EHS) within the federal public service?
8. Why is the government of Canada not taking an active and visible approach to educate employers about the need to provide a safe working environment for employees as recommended by the

26 <http://www.c4st.org/images/documents/hc-resolutions/medical-doctors-submission-to-health-canada-english.pdf>

27 [Sentence 6]

28 http://www.chrc-ccdp.gc.ca/sites/default/files/envsensitivity_en.pdf

29 <http://freiburger-appell-2012.info/en/home.php>

Topic 4³¹ Research on Electromagnetic hypersensitivity (EHS)

As outlined above, the Government of Canada supports research in areas related to EMF and health through CIHR's investigator-initiated research programs. We encourage scientists interested in conducting further research studies in this area to make use of CIHR funding opportunities (<https://www.researchnet-recherchenet.ca/rnr16/search.do?fodAgency=CIHR&fodLanguage=E&all=1&search=true&org=CIHR&sort=program&masterList=true&view=currentOpps>).

BACKGROUND:

We did not find pertinent funding opportunities at the suggested website.

QUESTION:

9. What are the specific details of the opportunities for this type of project? Please provide links.

Topic 5³² Estimating prevalence of Electromagnetic hypersensitivity (EHS) in the Canadian population

The Canadian Community Health Survey (CCHS) is a cross-sectional survey that collects information related to health status, health care utilization and health determinants for the Canadian population. New questions related to EHS could only be included in the CCHS once they meet Statistics Canada quality criteria for content. In the case of EHS, the lack of a clear etiology and definition by the research community (standard and accepted definition related to an accepted medical disorder) would limit the feasibility of interpreting and reporting on any data collected.

BACKGROUND:

There are no data for Canada. Studies elsewhere estimate per cent of the general population affected:

a. Sweden: Electrohypersensitivity (EHS) is officially a fully recognized, functional impairment, i.e. it is not regarded as a disease. Survey studies show that somewhere between 230,000 to 290,000 Swedish men and women – out of a population of 9,000,000 (2.6 to 3.2%) – report a variety of symptoms when being in contact with electromagnetic field (EMF) sources.³³

b. Taiwan: Tseng M, M.-C., Lin, Y.-P., & Cheng, T.-J. (2011). Prevalence and psychiatric comorbidity of self-reported electromagnetic field sensitivity in Taiwan: A population-based study. *Journal of the*

30 http://www.chrc-ccdp.gc.ca/sites/default/files/envsensitivity_en.pdf

31 [Sentence 7-8]

32 [Sentences 9-10]

33 <http://iopscience.iop.org/article/10.1088/1755-1315/10/1/012005/meta>

Formosan Medical Association, 110(10), 634–641. reported 13.3% of the population.

c. United Kingdom: Eltiti, S., Wallace, D., Zougkou, K., Russo, R., Joseph, S., Rasor, P., & Fox, E. (2007). Development and evaluation of the electromagnetic hypersensitivity questionnaire. *Bioelectromagnetics, 28(2)*, 137–151. found 4.0% of the population reported symptoms.

d. USA (California): Levallois, P., Neutra, R., Lee, G., & Hristova, L. (2002). Study of self-reported hypersensitivity to electromagnetic fields in California. *Environmental Health Perspectives, 110(Suppl 4)*, 619–623. reported 3.2% of the population were affected.

Based on information from other countries, it is not unreasonable to estimate that this condition could be affecting at least 3% of Canadians.

Note that approximately 2% of Canadian children have a peanut allergy.³⁴

According to a January 2007 Statistics Canada report, approximately 5% of Canadians (1.2 million persons) suffer “medically unexplained physical symptoms”. These included multiple chemical sensitivity, fibromyalgia, and chronic pain.³⁵ A similar survey was also conducted in 2014.³⁶ Appendix 3 shows a Statistics Canada table with population percentages: “Prevalence of disability by type, Canada, 2012”; 8 of the 11 types are lower than 4%.

QUESTIONS:

10. Has the Government of Canada evaluated the potential loss in productivity and other economic factors with over 1 million Canadians possibly suffering from Electromagnetic hypersensitivity (EHS)?
11. Would Statistics Canada conduct a survey similar to those conducted in 2007 and 2014 that would also include Electromagnetic hypersensitivity (EHS)?

Topic 6³⁷ Clinical guidelines for Electromagnetic hypersensitivity (EHS) and related education about EHS and EMFs in indoor and outdoor environments

In response to the Committee’s recommendation for updates to clinical guidelines and continuing education materials for health care providers, Health Canada has shared the report of the Committee with the Canadian Medical Association, the Royal College of Physicians and Surgeons, the College of Family Physicians, and the WHO for their consideration of recommendations relating to their respective mandates as appropriate.

34 Approximately 2% of the population has a peanut allergy - <http://www.theglobeandmail.com/life/parenting/for-schools-and-parents-what-is-the-right-approach-to-food-allergies/article16618717/>

35 <http://www.statcan.gc.ca/pub/82-003-x/2006001/article/9526-eng.htm>

36 <http://www.statcan.gc.ca/daily-quotidien/150617/dq150617b-eng.htm>

37 [Sentence 11]

BACKGROUND:

EHS is an emerging medical phenomenon. Dr. Riina Bray, Medical Director, Environmental Health Clinic, Women's College Hospital in Ontario, in her testimony to the Parliamentary Standing Committee on Health (HESA) in April 2015³⁸, stated, “Since the time these diagnoses were initially made 10 years ago, the numbers have increased dramatically....” One key element of treatment involves identifying and reducing exposure to sources of wireless radiation. Yet, Canadian family physicians are not informed by Health Canada to interview symptomatic patients about the use of wireless devices in their personal, home, or work environments and to prescribe practices of prudent avoidance. In the absence of authoritative instruction, the Canadian physician’s standard of practice is to prescribe a costly treatment plan to abate the symptoms, instead of eliminating the cause.

The following are two recent publications (mentioned previously) that outline objective testing, diagnoses, and treatment:

- a) The “EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses”³⁹ lists over 20 “health problems” and provides guidelines for treatment and diagnosis for family physicians to help identify and treat patients who suffer due to EHS.
- b) Belpomme, D., Campagnac, C., & Irigaray, P. (2015). Reliable disease biomarkers characterizing and identifying electrohypersensitivity and multiple chemical sensitivity as two etiopathogenic aspects of a unique pathological disorder. *Reviews on Environmental Health*, 30(4), 251–271.

In their published research paper “Electromagnetic hypersensitivity – an increasing challenge to the medical profession”, Dr. Lena Hedendahl et al.⁴⁰ state, “It seems necessary to give an International Classification of Diseases to EHS to get it accepted as EMF-related health problems”.

QUESTIONS:

12. How can the Government of Canada invest resources to better understand electromagnetic hypersensitivity (EHS) testing, diagnosis, treatment, and possible impacts on health in the workplace that could impact over 1 million Canadians⁴¹? Will it invest; and if not, why not?
13. (a) Has Health Canada undertaken to gather perspectives on the emerging public health issue of electromagnetic hypersensitivity (EHS) and suggestions for a working definition from the Environmental Health Clinic at Women's College Hospital, Toronto, Ontario⁴², the Environmental Health Centre, Rivers Falls, Nova Scotia,⁴³ Dr. Stephen Genuis, MD⁴⁴ in

38 <http://www.parl.gc.ca/content/hoc/Committee/412/HESA/Evidence/EV7945128/HESAEV58-E.PDF>. As an individual.

39 <https://www.emfanalysis.com/wp-content/uploads/2016/09/EUROPAEM-EMF-Guideline-2016.pdf>

40 <https://www.ncbi.nlm.nih.gov/pubmed/26372109>

<https://doi.org/10.1515/reveh-2015-0012>

41 3% of 35 million

42 <http://www.womenscollegehospital.ca/>

43 Integrated Chronic Care Service, Environmental Health Centre, Nova Scotia

<http://www.cdha.nshealth.ca/integrated-chronic-care-service-iccs>

44 Author of: Genuis, S. J., & Lipp, C. T. (2012). Electromagnetic hypersensitivity: fact or fiction? *The Science of the Total Environment*, 414, 103–112. Dr. Genuis invited the members of the Royal Society of Canada to contact him if they had any questions when they had the public hearings.

Edmonton, Alberta,⁴⁵ or any of the medical doctors who provided submissions to the Royal Society of Canada's panel during their 2013 hearings⁴⁶? (b) If not, why not? (c) If yes, when will details be publicly available?

14. What is Health Canada doing to support the International Classification of Diseases initiative proposed by Dr. Lena Hedendahl et al. (2015) in their paper "Electromagnetic hypersensitivity – an increasing challenge to the medical profession"?⁴⁷
15. In keeping with Recommendation 4: (a) Did Health Canada provide the EUROPAEM (2016) and Belpomme et al. (2015) papers on clinical guidelines and markers for EHS as part of the "latest scientific evidence" on electromagnetic sensitivity when it forwarded the HESA Committee's report to the Canadian Medical Association, the Royal College of Physicians and Surgeons, the College of Family Physicians, and the World Health Organization? (b) What other "latest scientific evidence" was provided by Health Canada to these bodies?

Topic 7 Health Canada inaction regarding recommendations made by the Royal Society of Canada expert panel in 2014

BACKGROUND:

The Royal Society of Canada panel's 2014 report states: "*Health Canada is urged to investigate the symptoms of IEI-EMF [Idiopathic Environmental Intolerance-Electromagnetic Fields] individuals with the aim of understanding the etiology of their condition, developing criteria for differential diagnosis of the condition, and finding ways to provide effective treatment for such individuals*"⁴⁸

QUESTION:

16. Health Canada references the Royal Society report at least three times in its defense of *Safety Code 6*.^{49,50,51} Why has Health Canada not followed through on this recommendation?

Topic 8 Transparency and gaps in recordkeeping

BACKGROUND:

In the 2009 update of *Safety Code 6* (1999), the sentence "*Certain members of the general public may be more susceptible to harm from microwave exposure*" was removed. Attempts to learn under whose direction this sentence was removed have been made by filing a records request under the *Access To Information Act*. Official responses show that, "*Health Canada has no emails or written correspondences regarding the rationale for removal of this statement.*" (Appendix 4)

45 Genuis, S. J., & Lipp, C. T. (2012). Electromagnetic hypersensitivity: fact or fiction? *The Science of the Total Environment*, 414, 103–112.

46 These were later forwarded to Health Canada by Canadians for Safe Technology during the public consultations on *Safety Code 6*.

47 Reviews on Environmental Health, 30(4), 209–215. <https://www.ncbi.nlm.nih.gov/pubmed/26372109>

48 https://rsc-src.ca/sites/default/files/pdf/SC6_Report_Formatted_1.pdf

49 <http://www.parl.gc.ca/HousePublications/Publication.aspx?DocId=8481964>

50 http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct/index-eng.php

51 <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09583.html>

QUESTIONS:

17. Why was the above statement – about susceptibility to harm from exposure – removed from the 2009 update to Safety Code 6?
18. How is it possible that such an important statement was removed without any internal communication within Health Canada?
19. Will a process be put in place so that any changes in the current *Safety Code 6* (2015)⁵² are made in a transparent manner with reasons given?

52 http://www.hc-sc.gc.ca/ewh-semt/consult/_2014/safety_code_6-code_securite_6/final_finale-eng.php

Appendix 1

Lists of authors and their affiliations for the EUROPAEM publication and the Belpomme et al. publication (re Topic 2 and Topic 6)

a) Names and affiliations of authors of the EUROPAEM Guideline:

European Academy for Environmental Medicine (EUROPAEM) – EMF working group: *Corresponding author: Gerd Oberfeld, Department of Public Health, Government of Land Salzburg, Austria, E-mail: gerd.oberfeld@salzburg.gv.at Igor Belyaev: Cancer Research Institute BMC, Slovak Academy of Science, Bratislava, Slovak Republic; and Prokhorov General Physics Institute, Russian Academy of Science, Moscow, Russia Amy Dean: American Academy of Environmental Medicine, Wichita, KS, USA Horst Eger: Association of Statutory Health Insurance Physicians of Bavaria, Medical Quality Circle “Electromagnetic Fields in Medicine – Diagnostic, Therapy, Environment”, no. 65143, Naila, Germany Gerhard Hubmann: Center for Holistic Medicine “MEDICUS”, Vienna, Austria; and Wiener Internationale Akademie für Ganzheitsmedizin (GAMED), Vienna, Austria Reinhold Jandrisovits: Medical Association Burgenland, Environmental Medicine Department, Eisenstadt, Austria Markus Kern: Medical Quality Circle “Electromagnetic Fields in Medicine – Diagnosis, Treatment and Environment”, Kempten, Germany; and Kompetenzinitiative zum Schutz von Mensch, Umwelt u. Demokratie e.V., Kempten, Germany Michael Kundi and Hanns Moshhammer: Institute of Environmental Health, Medical University Vienna, Vienna, Austria Piero Lercher: Medical Association Vienna, Environmental Medicine Department, Vienna, Austria Kurt Müller: European Academy for Environmental Medicine, Kempten, Germany Peter Ohnsorge: European Academy for Environmental Medicine, Würzburg, Germany Peter Pelzmann: Department of electronics and computer science engineering, HTL Danube City, Vienna, Austria Claus Scheingraber: Working Group Electro-Biology (AEB), Munich, Germany and Association for Environmental- and Human-Toxicology (DGUHT), Würzburg, Germany Roby Thill: Association for Environmental Medicine (ALMEN), Beaufort, Luxembourg

b) Names and affiliations of authors of the publication on reliable disease markers for electrohypersensitivity (EHS):

Dominique Belpomme: Paris V University Hospital, France; and European Cancer and Environment Research Institute (ECERI), Brussels, Belgium Christine Campagnac: Hospital Director, seconded from Assistance Publique-Hôpitaux de Paris (AP-HP), Paris, France; and European Cancer and Environment Research Institute (ECERI), Brussels, Belgium; Philippe Irigaray, PhD, Association for Research and Treatments Against Cancer (ARTAC) France; and European Cancer and Environment Research Institute (ECERI), Brussels, Belgium.

Appendix 2

Declaration sent by Canadian medical doctors to the Minister of Health during the public consultation process regarding revisions to *Safety Code 6* (2009)

Declaration: Doctors Call for Protection from Radiofrequency Radiation Exposure

Physicians Call for Health Canada to Provide:

- i) Wireless safety standards that are more protective of the health of Canadians; and
- ii) Guidelines and resources to assist Canadian physicians in assessing and managing health problems related to microwave radiation.

There is considerable evidence and research from various scientific experts that exposure to microwave radiation from wireless devices; Wi-Fi, smart meters and cell towers can have an adverse impact on human physiological function.^{1 2} Many recent and emerging studies from university departments and scientific sources throughout the world support the assertion that energy from wireless devices may be causatively linked to various health problems including reproductive compromise, developmental impacts, hormonal dysregulation and cancer. In fact, in 2011 the World Health Organization listed microwave radiation as a Class 2B possible carcinogen³ and subsequent research strengthened the evidence that a stronger designation may be justified.^{4 5 6}

Out of sincere concern for the health of Canadians at all stages of life – from the developing fetus through childhood and into adulthood – we respectfully request that:

- i) Health Canada develop and support strategies to raise awareness about microwave radiation impacts and to minimize prolonged exposure to microwave radiation in schools and other places where children are regularly exposed.
- ii) As Health Canada has acknowledged that a full literature review was not part of its latest update of Safety Code 6 (the safety guideline for wireless exposure pertaining to thermal effects on the tissue of adult males) we request a comprehensive literature review for all age ranges with less reliance on industry-funded studies.
- iii) Health Canada provide guidelines and resources to assist Canadian physicians in becoming apprised of microwave exposure and related health problems and clinical presentations that may be associated with over-exposure or sensitivity (similar to the 2012, “**Guideline of the Austrian Medical Association for the diagnosis and treatment of EMF related health problems and illnesses.**”) (Note; this guideline is under review with an update expected.)

Dr. Jennifer Armstrong, MD, DIBEM, BSc, Past President, American Academy of Environmental Medicine, OEHC Ottawa Environmental Health Clinic, Ottawa, ON

Dr. Claire Astley, MD, DrTCM, Medical Acupuncture Practice, Victoria, BC

Dr. Robert Banner, MD, CCFP, FCFP, FRCP, Dip AAPM, Dip CAPM, ABIHM, London, ON

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Dr. Warren Bell, BA MD CM CCFP FCFP; Board member and Past Founding President, CAPE (Canadian Association of Physicians for the Environment); Member and Past Founding President, WA:TER (Wetland Alliance: The Ecological Response); Founding member, HUESSS (Health Uranium Environment Sustainability Survival Solidarity); Rural Preceptor, Faculty of Medicine, UBC, Vancouver, BC

Dr. Alison C. Bested, MD, FRCP(C), Clinical Associate Professor, Faculty of Medicine, University of British Columbia, BC

- More to Follow -

Dr. Mel Borins, MD, Toronto, ON
Dr. Jody Bowle-Evans, BA, MD, CGPP, Creemore, ON
Dr. Riina Bray, BAsc MSc MD, FCFP MHSc, Assistant Professor, Department of Family and Community Medicine, University of Toronto, ON
Dr. Phillip Bright, MD, G.P, Kitchener, ON
Dr. Chad Burkhardt, MD, Southampton, ON
Dr. Adam Chen, MD, CCFP, Mississauga, ON
Dr. John Cline, MD, Family Doctor / General Practitioner, Nanaimo, BC
Dr. D.G.W. Cooper, Physician, M.A., BCh., D.M.(Oxon) F.R.C.S., Victoria, BC
Dr. Suzanne Crocker, MD, CCFP, Dawson City, YT
Dr. David Esdaile, MD, Chair, Section on Complementary and Integrative Medicine, Ottawa, ON
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Dr. James Tucker, MD, Victoria, BC

Dr. Adil Vasanji, MD, LMCC, CCFP, Family Doctor / General Practitioner, Edmonton, AB

Dr. Latifa Yeung, MD, MSc, FRCPC, Scarborough, ON

Date of Issuance: September 28, 2014

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⁵ Hardell L, Carlberg M. Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. *Rev Environm Health*. 2013 Oct 11.

⁶ Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. *Pathophysiology*. 2013 Apr; 20(2):123–9.

Appendix 3

Excerpt from “Disability in Canada: Initial findings from the Canadian Survey on Disability” (viewed May 6, 2017 at <http://www.statcan.gc.ca/pub/89-654-x/89-654-x2013002-eng.htm>)

Table 1
Prevalence of disability by type, Canada, 2012

Disability type	%
Pain	9.7
Flexibility	7.6
Mobility	7.2
Mental/psychological	3.9
Dexterity	3.5
Hearing	3.2
Seeing	2.7
Memory	2.3
Learning	2.3
Developmental	0.6
Unknown	0.3

Appendix 4

Excerpt from a request made under the *Access To Information Act*

"I am writing in regards to your complaint filed with the Office of the Information Commissioner concerning your request A-2011-00827:

("Previously disclosed records under A-2011-00503 that read as follows:)

Request all submissions, emails, printed and electronic correspondence sent or received by Health Canada concerning the 2009 update of Safety Code 6 (Limits of Human Exposure to Radio-frequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz)"

Please note that our office of primary interest, Healthy Environments and Consumer Safety Branch- Environmental and Radiation Health Sciences Directorate (HECSB- ERHSD) at Health Canada has confirmed that there are no e-mails or written correspondence on why the sentence "Certain members of the general public may be more susceptible to harm from microwave exposure" was removed.

We trust this information clarifies the matter.

Sincerely,
N. Muminovic
Access to Information and Privacy
Health Canada
Public Health Agency of Canada
Holland Cross, Tower B
1600 Scott Street, 7th Floor
Ottawa, ON K1A 0K9

Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

OCT 25 2017

Ms. Barbara Payne
Electromagnetic Pollution Illnesses Canada Foundation

Dear Ms. Payne:

This is in response to your environmental petition no. 406 of June 16, 2017, addressed to Ms. Julie Gelfand, Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised concerns regarding the Government of Canada's response to the House of Commons Standing Committee on Health's report entitled *Radiofrequency Electromagnetic Radiation and the Health of Canadians* on the issue of electromagnetic hypersensitivity. I am pleased to provide you with the enclosed response to your questions. I understand that the Minister of Innovation, Science and Economic Development will be responding separately to a question that comes under the purview of Statistics Canada.

I appreciate your interest in this important matter.

Yours sincerely,

A handwritten signature in black ink, appearing to read "Ginette Petitpas Taylor".

The Honourable Ginette Petitpas Taylor, P.C., M.P.

Enclosure

c.c. Ms. Julie Gelfand, CESD
The Honourable Navdeep Bains, P.C., M.P.

Canada

Health Portfolio Response to Petition #406

Health Canada acknowledges that some people have reported an array of health symptoms that they attribute to exposure to electromagnetic fields (EMF). However, the scientific evidence available to date provides strong support that health effects are not associated with EMF exposure. Moreover, symptoms attributed to radiofrequency (RF) exposure have been termed idiopathic environmental intolerance (IEI-EMF) by the World Health Organization (WHO), where “idiopathic” refers to unknown causes. This means that while the symptoms attributed by some persons to electromagnetic hypersensitivity (EHS) are real, the scientific evidence provides strong support that these health effects are not associated with EMF exposure. This evidence aligns with the Government of Canada’s position outlined in the Government Response to the Thirteenth Report of the Standing Committee on Health (HESA) entitled *Radiofrequency Electromagnetic Radiation and the Health of Canadians*.

The Health Portfolio’s response is grouped into the following themes:

- Reporting and International Cooperation
- Resources for Canadians
- Workplace Health and Safety
- Research
- Outreach and Education
- Transparency and Safety Code 6 Updates

Reporting and International Cooperation

Question 1

(a) How have Canadians reported their electromagnetic hypersensitivity (EHS) symptoms to Health Canada? (b) How many Canadians have reported their EHS symptoms to Health Canada? (c) Has Health Canada conveyed those reports to the World Health Organization?

Question 3:

Has Health Canada contacted representatives in the Swedish government: to understand its decision to officially designate electrohypersensitivity (EHS) as a fully recognized functional impairment; and to identify what benefits are provided to individuals in Sweden who suffer due to EHS?

Health Canada, other leading health agencies, and the WHO, have concluded that, to date, there is no convincing scientific evidence linking adverse symptoms to levels below existing RF exposure limits. Reports by individuals that claim to have experienced such symptoms are few in numbers, generally received through correspondence or consultative processes, such as the 2014 Safety Code 6 public consultation. Specific individually-cited informal reports of EHS are not shared with foreign jurisdictions.

In relation to the exchange of information between foreign jurisdictions, Health Canada takes part in many global efforts including the International EMF Project, coordinated by the WHO. Health Canada's participation on international bodies allows the Department to leverage large-scale and highly resourced international efforts, which are widely recognized as more comprehensive and detailed than any review from a single jurisdiction could be.

In addition to participating in the international monograph exercises, Health Canada officials carry out an ongoing surveillance of emerging scientific studies in this area. If new scientific evidence were to demonstrate that exposure to RF energy below levels found in Safety Code 6 from wireless technologies is a concern, the Government would take appropriate action to help protect the health and safety of Canadians. Internationally, a few jurisdictions, including Sweden, have applied more restrictive limits for RF field exposures; however, scientific evidence does not support the need for limits that are more restrictive than Safety Code 6.

The health of Canadians is well protected from RF energy by the human exposure limits recommended by Safety Code 6. Health Canada is committed to using the best available science to inform its decision making and the exposure limits in Safety Code 6 are consistent with science-based standards used in other parts of the world (e.g., the United States, the European Union, Japan, Australia and New Zealand).

Question 13

(a) Has Health Canada undertaken to gather perspectives on the emerging public health issue of electromagnetic hypersensitivity (EHS) and suggestions for a working definition from the Environmental Health Clinic at Women's College Hospital, Toronto, Ontario, the Environmental Health Centre, Rivers Falls, Nova Scotia, Dr. Stephen Genuis, MD in Edmonton, Alberta, or any of the medical doctors who provided submissions to the Royal Society of Canada's panel during their 2013 hearings? (b) If not, why not? (c) If yes, when will details be publicly available?

Question 14

What is Health Canada doing to support the International Classification of Diseases initiative proposed by Dr. Lena Hedendahl et al. (2015) in their paper "Electromagnetic hypersensitivity- an increasing challenge to the medical profession"?

As stated previously, Health Canada has concluded that there is no convincing scientific evidence linking adverse symptoms to levels below existing RF exposure limits. While the Public Health Agency of Canada's mandate is to conduct surveillance using various data sources including administrative data from provinces and territories along with health related survey data to understand the burden of maternal/child health, chronic conditions and injury, related risk and protective factors, EHS is not a condition or risk factor for which the Agency has surveillance.

For efforts related to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10-CA), Canada is represented by officials from Statistics Canada and the Canadian Institute for Health Information. The development of ICD is an independent process that falls outside of the Minister's purview.

Resources for Canadians

Question 5

- (a) *Will Health Canada provide the necessary resources to provide appropriate care for Canadians who suffer due to electromagnetic hypersensitivity (EHS)?*
(b) *If not, why not?*

Health Canada administers the *Radiation Emitting Devices Act* (REDA) which governs the sale (including re-sale), lease and importation of radiation emitting devices in Canada. In addition to administering the REDA's authorities that pertain to devices that emit RF electromagnetic energy, the Department's mandate regarding human exposure to RF electromagnetic energy from wireless devices is to carry out research into possible health effects, monitor the scientific literature related to such effects on an ongoing basis and develop RF exposure guidelines, commonly referred to as Safety Code 6. Safety Code 6 sets recommended limits for safe human exposure to EMF in federally regulated industries and workplaces in the frequency range from 3 kHz to 300 GHz.

Roles and responsibilities for health care services are shared between the federal government and provincial and territorial governments. The federal government sets national standards for the health care system through the *Canada Health Act*, provides funding support for provincial and territorial health care services through the Canada Health Transfer, supports the delivery for health care services to some population groups (e.g., First Nations people living on reserves, Inuit, members of the Canadian Forces, among others), and provides other health-related functions (regulating food and drugs, health research, among other things). The provincial and territorial governments are responsible for the management, organization and delivery of health care services for their residents, which can include the collection of diagnostic data and decisions regarding appropriate care.

Workplace Health and Safety

Question 6

What other proactive steps will Health Canada take to inform and educate within the public service, as well as in the private sector, to make employers aware of the potential consequences of firsthand and secondhand exposures to wireless radiation and increased risk to susceptible individuals?

Question 7

Are there any plans to determine the extent of electromagnetic hypersensitivity (EHS) within the federal public service?

Question 12

How can the Government of Canada invest resources to better understand electromagnetic hypersensitivity (EHS) testing, diagnosis, treatment, and possible impacts on health in the workplace that could impact over 1 million Canadians? Will it invest; and if not, why not?

Health Canada's mandate in relation to non-ionizing radiation exposure and federal facilities is to support occupational health and safety requirements through the development of exposure guidelines, i.e., Safety Code 6. Assessments of the health status of federal employees fall outside the Department's mandate as it relates to non-ionizing radiation. The role of testing, diagnosis, treatment and possible impacts on health in the workplace falls outside of the Public Health Agency of Canada's mandate, as well. Further information is available for anyone that has a workplace health concern at the following website:

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/occupational-health-safety/occupational-health.html>

Health Canada, other leading health agencies, and the WHO, have concluded that, to date, there is no convincing scientific evidence linking adverse symptoms to levels below existing RF exposure limits.

Question 8

Why is the government of Canada not taking an active and visible approach to educate employers about the need to provide a safe working environment for employees as recommended by the Canadian Human Rights Commission?

The Government of Canada fully respects the Canadian Human Rights Commission's (CHRC) role and guidance and has implemented federal measures to support a healthy workplace including accommodation practices to assist individuals suffering from disabilities. With respect to EHS, please note that the rationale document cited within the petition is a third party document i.e., not a CHRC document, with a prominent disclaimer that "the opinions expressed...do not necessarily reflect the views of the Canadian Human Rights Commission."

Research**Question 9**

What are the specific details of the [CIHR] opportunities for this type of project? Please provide links.

Question 10

Has the Government of Canada evaluated the potential loss in productivity and other economic factors with over 1 million Canadians possibly suffering from Electromagnetic hypersensitivity (EHS)?

The Government of Canada, through the Canadian Institutes of Health Research (CIHR), supports research in areas related to electromagnetic fields through CIHR's investigator-initiated research programs. Specifically, the Project Grant program is designed to capture ideas with the greatest potential to advance health-related fundamental or applied knowledge, health research, health care, health systems and/or health outcomes. The Project Grant program supports projects with a specific purpose and a defined endpoint. The Government encourages scientists interested in conducting further research studies in the area of EMF to consult the Project Grant program website for more information, including upcoming funding opportunities:
<http://www.cihr-irsc.gc.ca/e/49804.htm>.

Question 16

Health Canada references the Royal Society report at least three times in its defense of Safety Code 6. Why has Health Canada not followed through on this recommendation [“Health Canada is urged to investigate the symptoms of IEI-EMF individuals with the aim of understanding the etiology of their condition, developing criteria for differential diagnosis of the condition, and finding ways to provide effective treatment for such individuals.”]?

Jurisdiction for health care is shared across many levels of government in Canada, and indeed it is possible for both federal and provincial governments to legislate in areas of health. Some of the Royal Society of Canada Expert Panel non-binding recommendations do not pertain to authorities administered by Health Canada; however, the Department regularly engages with provincial governments and local health authorities, in particular through committees including the Pan-Canadian Public Health Network (PHN) and the Council of the Chief Medical Officers of Health. Health Canada shared the recommendations of the Expert Panel with these committees (and provided briefings to them in late 2014), as well as with the Royal College of Physicians and Surgeons and the Canadian Medical Association for their review and consideration as appropriate. These groups are best placed to address recommendations pertaining to the development of clinical guidelines and education curricula, respectively, in addition to those related to investigating reports of disease clusters.

In its 2014 review of Safety Code 6, the Expert Panel found, “taken together, research in the past ten years does not provide firm evidence for the hypothesis that people with IEI-EMF can perceive RF energy levels below the limits in Safety Code 6 or that there is a causal link between exposure to RF and their symptoms”.

Outreach and Education

Question 4:

Given the new information from experts in clinical settings from respected institutions, and the request to the Minister of Health outlined in the Canadian medical doctors' 2014 declaration, will Health Canada update its assumptions regarding electromagnetic hypersensitivity (EHS)?

Canada is recognized worldwide for the rigour with which it gathers, assesses, and incorporates scientific information into its decision making and standards. In the case of electromagnetic radiation, Health Canada carefully tracks developments in the scientific literature, in particular studies in relation to adverse health impacts. It is Health Canada's position that the health of Canadians is protected from RF energy when the human exposure limits recommended by Safety Code 6 are respected. Accordingly, no additional precautionary messaging is warranted. With respect to EHS, as stated earlier, the scientific evidence provides strong support that health effects are not associated with EMF exposure below existing limits.

Health Canada maintains web-based information to inform the public on exposure to EMF. Components include web pages which address issues such as the safety of cell phones and cell phone towers, electric and magnetic fields at extremely low frequencies, electromagnetic hypersensitivity, Wi-Fi equipment and smart meters: <https://www.canada.ca/en/health-canada/services/consumer-radiation.html>. If new scientific evidence were to demonstrate that exposure to RF energy below the levels found in Safety Code 6 from wireless technologies is a concern, Health Canada would take appropriate action to help protect the health and safety of Canadians.

Question 15

In keeping with Recommendation 4: (a) Did Health Canada provide the EUROPAEM (2016) and Belpomme et al. (2015) papers on clinical guidelines and markers for EHS as part of the "latest scientific evidence" on electromagnetic sensitivity when it forwarded the HESA Committee's report to the Canadian Medical Association, the Royal College of Physicians and Surgeons, the College of Family Physicians, and the World Health Organization? (b) What other "latest scientific evidence" was provided by Health Canada to these bodies?

As per the Government of Canada response to HESA, Health Canada has shared the report of the Committee with the Canadian Medical Association, the Royal College of Physicians and Surgeons, the College of Family Physicians, and the WHO for their consideration of recommendations relating to their respective mandates as appropriate. The evidence to be considered by these bodies in their respective decision-making processes falls to their discretion and may include non-scientific considerations.

Transparency and Safety Code 6 Updates

Question 2

What are the specific primary research studies (complete references with author, year, title, journal name), other than short-term provocation studies, that Health Canada relies on to make its evidence statement about association of health effects with EMF exposure?

Health Canada officials carry out an ongoing surveillance of emerging scientific studies in this area. During the 2015 update to Safety Code 6, Health Canada considered all studies that were both in the scope and of sufficient quality for consideration in the development of recommended exposure limits. The Department uses a “weight of evidence” approach in evaluating scientific studies, which takes into account both the quantity and quality of studies, and gives more weight to studies which have been reproduced and which meet the highest standards of rigour and control.

Canada also recognizes the importance of leveraging scientific expertise from around the world and as such, works closely with organizations like the WHO, which includes the International Agency for Research on Cancer (IARC). Comprehensive reviews of the scientific literature relating to RF fields have been carried out by scientists and expert panels under the auspices of highly recognized international bodies including the European Union’s Scientific Committee on Emerging and Newly Identified Health Risks and the International Committee on Non-Ionizing Radiation Protection. The approach, commonly referred to as a scientific monograph, is generally conducted by international bodies requiring the participation of many scientific experts (40+) and many years of effort. As mentioned earlier, Health Canada’s participation on these bodies allows the Department to leverage these large-scale and highly resourced international efforts which are widely recognized as more comprehensive and detailed than any review from a single jurisdiction could be.

Question 17

Why was the above statement- about susceptibility to harm from exposure- removed from the 2009 update to Safety Code 6?

Question 18

How is it possible that such an important statement was removed without any internal communication within Health Canada?

Safety Code 6 contains more restrictive limits for the general public than for workers based upon the knowledge that workers are expected to be aware of the RF field intensities, the potential health risks and the mitigation strategies necessary to avoid such risks. In contrast, the general public is not expected to possess such knowledge and comprises a wider variety of individuals including the elderly, children, and infirmed individuals. For these reasons, the 1999 version of Safety Code 6 contained text explaining the need for more restrictive limits for the general public than for workers. Safety Code 6 (2009) introduced editorial changes for clarity and while the same

principles were applied, i.e. more restrictive limits were set for the general public than for workers, it was simply not stated in the same way. The 2009 update did not introduce a change in approach or policy and the exposure limits remained comparable to all international science-based human RF exposure limits.

Question 19

Will a process be put in place so that any changes in the current Safety Code 6 (2015) are made in a transparent manner with reasons given?

Health Canada's latest process to revise Safety Code 6 was the most comprehensive, inclusive and transparent process to date. Health Canada published its proposed 2014 revisions to Safety Code 6 for public consultation between May 16 and July 15, 2014 and welcomed feedback from interested Canadians and stakeholders. The summary of consultation feedback is available on Health Canada's website:

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/consultations/2015-revisions-safety-code-6-summary-consultation-feedback.html>

The revised document also underwent an extensive independent peer review by an Expert Panel of the Royal Society of Canada; a process which further considered stakeholder feedback. Overall, the Royal Society's review of Safety Code 6 was favourable and supported the science based conclusions that the basic restrictions in the Safety Code 6 provided adequate protection. Based on evidence, which emerged after Health Canada submitted Safety Code 6 for review, the Society did recommend slightly more restrictive reference levels in some frequency ranges to ensure larger safety margins for all Canadians, including newborn infants and children. Health Canada accepted the recommendation and adjusted Safety Code 6 accordingly. As per the Government Response to HESA's report, Health Canada is considering various strategies for further supporting the transparency of its processes, including implementing an enhanced process for the review and documentation of scientific literature related to RF EMF exposure and health.

Minister of Science



Ministre des Sciences

Ottawa, Canada K1A 0H5

OCT 24 2017

Ms. Barbara Payne
Electromagnetic Pollution Illnesses
Canada Foundation

Dear Ms. Payne:

I am writing with respect to your Environmental Petition no. 406, submitted to the Auditor General of Canada under Section 22 of the *Auditor General Act*, on the “Recognition, protection, and accessibility for persons who suffer health impairment related to contamination by electromagnetic pollution in indoor and outdoor environments: Furthering Honourable Health Minister Philpott’s topic ‘Greater Understanding and Management of Electromagnetic hypersensitivity (EHS)’ in response to the Standing Committee on Health report *Radiofrequency Electromagnetic Radiation and the Health of Canadians* (related to *Safety Code 6* et al.)”

The Office of the Auditor General of Canada forwarded your questions to the Minister of Health and to me. I am writing in response to question 11, which is directed at Statistics Canada, an agency that is part of Innovation, Science and Economic Development Canada’s portfolio. The Honourable Ginette Petitpas Taylor will be providing you with a separate response addressing questions that fall under her department’s mandate and areas of responsibility.

Question 11: Would Statistics Canada conduct a survey similar to those conducted in 2007 and 2014 that would also include Electromagnetic hypersensitivity (EHS)?

Statistics Canada could add EHS to the Canadian Community Health Survey (CCHS) if such information is required and if the presence of the condition can be accurately reported by Canadians. Survey respondents to the CCHS are asked to report on chronic conditions that have been diagnosed by a health professional, such as chronic fatigue syndrome, fibromyalgia, and multiple chemical sensitivities. In order for respondents to report accurately on EHS, clear diagnosis guidelines for health professionals would need to have been fully implemented, and health professionals must be correctly diagnosing the condition.

...2

Health Canada acknowledges that a number of people have reported an array of health symptoms they attribute to exposure to electromagnetic fields (EMF). However, the scientific evidence available to date strongly suggests that health effects are not associated with EMF exposure. Moreover, symptoms attributed to radiofrequency exposure have been termed “idiopathic environmental intolerance” by the World Health Organization, where “idiopathic” refers to unknown causes. This means that while the symptoms attributed by some persons to EHS are real, the scientific evidence indicates that these health effects are not associated with EMF exposure. This evidence aligns with the Government of Canada’s position outlined in the Government Response to the Thirteenth Report of the Standing Committee on Health entitled *Radiofrequency Electromagnetic Radiation and the Health of Canadians*.

Our Government has committed to prioritizing science and evidence in its decision making. As Minister of Science, I have been given an overarching mandate to support science and research and to ensure that science is considered in the federal government’s policy-making and investment choices.

Fulfilling a key commitment of my mandate, I announced the appointment of Dr. Mona Nemer to the position of Chief Science Advisor on September 26, 2017. She will serve primarily in an advisory and coordinating capacity and will directly advise the Prime Minister, myself, and members of Cabinet on government-wide scientific matters.

I appreciate this opportunity to respond to your petition, and I trust that this information is helpful.

Sincerely,

A handwritten signature in blue ink, appearing to read 'K. Duncan', written in a cursive style.

The Honourable Kirsty Duncan, P.C., M.P.

c.c.: The Honourable Navdeep Bains, P.C., M.P.
Minister of Innovation, Science and Economic Development

The Honourable Ginette Petitpas Taylor, P.C., M.P.
Minister of Health

Mr. Anil Arora
Chief Statistician of Canada, Statistics Canada

Ms. Julie Gelfand
Commissioner of the Environment and Sustainable Development

20	406 Electromagnetic Pollution Illnesses Canada Foundation (EPIC)	Recognition, protection, and accessibility for persons who suffer health impairment related to contamination by electromagnetic pollution [Title as submitted: Recognition, protection, and accessibility for persons who suffer health impairment related to contamination by electromagnetic pollution in indoor and outdoor environments: Furthering Honourable Health Minister Philpott's topic "Greater Understanding and Management of Electromagnetic hypersensitivity (EHS)" in response to the Standing Committee on Health (HESA) report <i>Radiofrequency Electromagnetic Radiation and the Health of Canadians (related to Safety Code 6 et al.)</i>	16 June 2017	17 pages
	REPLY: Minister of Health- Ginette Petitpas Taylor		25 October 2017	1 page
	RESPONSE: Health Canada- Minister Ginette Petitpas Taylor		With letter of 25 October 2017	8 pages
	REPLY: Minister of Science- Kristy Duncan		24 October 2017	2 pages
	Statistics Canada		No response ?	No response ?



www.PreventCancerNow.ca

Petitioner: Meg Sears MEng, PhD
Scientific Chair, Prevent Cancer Now
Email: Meg@PreventCancerNow.ca



Via email to petitions@oag-bvg.gc.ca

I hereby submit this petition to the Auditor General of Canada under section 22 of the *Auditor General Act*



June 21, 2017 (original submitted June 15)

Petition under the *Auditor General Act*, Section 22, to the Commissioner on the Environment and Sustainable Development

Regarding Scientific Review Processes to Determine Limits on Exposure to Radiofrequency Radiation according to *Safety Code 6 - Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz (2015)*

We request responses from: Health Canada; Environment and Climate Change Canada; the Public Health Agency of Canada; and Innovation, Science and Economic Development Canada.

We also ask that the petition please be shared with the Office of the Minister of Science. Given the Minister’s role in Innovation and Science, as well as the central role of scientific rigour in protection of health and the environment, we would be grateful for a response from the Minister of Science.

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Introduction

In 2016, the Canadian Wireless Telecommunications Association (CWTA) reported over 30 million cell phone subscriptions, 3 million machine-to-machine connections (e.g. “smart” meters for utilities), and wireless coverage for more than 99% of the population.¹ Microwave or radiofrequency radiation (RFR) connects many devices such as cell phones, baby monitors, cordless phones, local area networks (WiFi), and the proliferation of devices in the “Internet of Things.”

Increasing exposures to RFR are ubiquitous, complex, and utilize more and more frequencies and modulations for a diversity of devices, for an expanding variety of applications. This increase of environmental exposures by many orders of magnitude over historical levels should trigger very careful scrutiny. Associated adverse health effects, even if subtle (e.g. lower fertility or IQ) or rare (e.g. brain cancer), can have large, costly impacts on public health and society.

Responsibility for RFR exposure scientific assessment and exposure guideline development rests with the Consumer and Clinical Radiation Protection Bureau of Health Canada. *Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz, Safety Code 6 (2015)*² applies to all individuals working at, or visiting, federally regulated sites, and has been adopted by Innovation, Science and Economic Development Canada (previously Industry Canada) as the scientific basis for equipment certification and RF field exposure compliance specifications for wireless devices in Canada. Safety Code 6 is also referred to by provincial and local public health authorities, school boards and others as being definitive, and as a reason not to restrict exposures further in order to protect vulnerable populations, such as children.

Rapidly strengthening science indicates that RFR can affect basic biological reactions, with microscale effects on oxidative stress, membranes and DNA leading to diverse impacts such as neurodevelopmental impairment, infertility and cancers. These commonly used technologies are widely assumed to be “safe,” and even with knowledgeable efforts it is difficult to avoid continuous exposures. If current and future RFR levels precipitate even small shifts in hazards and risks of serious and chronic conditions, this has large implications for public health, and society overall.

Hallmarks of wireless technologies deployment have included limited up front research, perpetuated (in the face of advancing scientific knowledge) by an absence of adaptive management in terms of regulation, and design and choices of technologies. Initial cell phones were already in use when absorption of RFR in the head was modelled in 1996 to be proportionally deeper into children’s brains compared with adults’.³ Higher frequency 5G is currently being rolled out, with little research and apparently no critical scrutiny of effects on human health and the environment. In this context, a June 2017 Parliamentary Standing Committee on Environment and Sustainable Development review of the *Canadian Environmental Assessment Act, 1999* references the need to consider RFR effects on biota.⁴

On March 24, 2017, the Canadian Broadcasting Corporation (CBC) revealed that cell phones exceed Canada’s standard for exposure to RFR when held against the head or carried in a pocket, as done by the majority of Canadians (two thirds according to a CBC

poll).⁵ Furthermore, 81% of Canadians were not aware of warnings of excessive exposure, buried in fine print or deep in the device. A report from the Government of France replicated the findings that as they are commonly used, some cell phones greatly exceed exposure standards.⁶

Periodic review of Safety Code 6² is meant to ensure that Canadians' health is protected according to all of the available scientific knowledge, including the most recent research. The methods, process and findings of this scientific review were examined by the Parliamentary Standing Committee on Health (HESA) in 2015.⁷ The government did not respond to the report recommendations before the 2015 election, and the report was then re-tabled by the HESA Committee. Minister Philpott responded on behalf of Health Canada in 2016.⁸ This petition addresses the HESA hearing and the Health Canada response, in light of the evolving scientific evidence and standards for assessment.

The present petition pertains to RFR, and the degree to which Canadians are protected by Health Canada's guideline for exposure, Safety Code 6 (SC6),² as follows:

1. RFR catalysis of (bio)chemical reactions and other non-thermal effects – from engineering uses, to *in vivo*;
2. Adequacy of margins of safety;
3. Standard of scientific review and adequacy of evidence before technological roll-out; and
4. Implementation of SC6 guidelines, including verification that devices in Canada comply as used by many Canadians, and incentives for the industry to design, manufacture and import non-emitting (e.g. wired) or “as low as achievable” emitting devices.

Issue: Assumption that RFR cannot affect rates of chemical reactions – RFR catalysis of (bio)chemical reactions

The basis of Safety Code exposure limits for RFR is that heating is the only effect of exposure to microwave (MW) radiation² that is both “established” and “adverse.” The stated assumption that as long as heating is avoided then harm is avoided, is challenged by mounting evidence that biological effects and harms ensue at non-heating, “athermal” or “non-thermal” microwave/RFR exposure levels.

This issue is obscured in Safety Code 6 by references to ionizing radiation, that imparts a high activation energy to break chemical bonds outright. In fact, this is irrelevant. Biochemical reactions in living systems do not result from such high energy chemical reactions. In all life forms enzymes catalyze reactions, and biochemical changes occur at very low activation energies.

Catalysis of (bio)chemical reactions with MW energy in the absence of obvious heating is an established fact. Chemical engineers and chemists are routinely making use of and exploiting for profit MW catalysis, often with more rapid and complete chemical conversion.

A recent application of the MW catalytic effect is reduction of the time for biochemical reactions for an Enzyme-Linked Immune Specific Antigen (ELISA) test for human IgG,

that takes 18 hours to complete using conventional heating, and less than 5 minutes using athermal MW radiation.⁹ The authors postulated "... a microwave catalytic effect acting by lowering the activation energy of reactants."

A 2001 review with 603 references describes hundreds of long-standing "microwave assisted" chemical reactions, many occurring at temperatures lower than necessary with thermal heating.¹⁰

Research from 2016 confirms that catalysis is tied to reduction of the activation energy for reactions. "Our findings ... open a promising avenue for the development of novel MW catalytic reaction technology."¹¹ Further, a 2016 discovery of MW interaction in electrochemistry provides "firm evidence of the microwave special non-thermal effect on the electron transfer reactions caused by interaction of oscillating microwaves and irradiated samples."¹² The same year, long-standing researchers Barnes and Greenbaum published a summary of interactions of electromagnetic fields in biochemistry, relating *in vitro* effects both to human disease, and to therapy.¹³ Indeed, the field is sufficiently recognized that a new journal *Current Microwave Chemistry* has been established for the topic of effects and efficiencies of MW or radiofrequency radiation (RFR) for (bio)chemistry (benthamscience.com/journals/current-microwave-chemistry).

Question:

1. What is the process, and factors considered, when Health Canada assesses primary science regarding whether non-thermal effects are *established* (even if not adverse)? In this context, has Health Canada examined catalysis, decreased activation energy and electron-transfer as mechanisms of non-thermal effects of RFR?

Issue: Adequacy of margins of "safety"

Safety Code 6² sets the permitted energy deposition for workers at one tenth the exposure that causes heating of more than 1 Celsius degree in living, perfused tissue in animals. Guidance was extended to non-military/non-occupational situations with an additional "safety factor" of five-fold. Thus a 10 X 5 = 50 fold uncertainty factor is used to set permitted exposures for people in a non-occupational setting.

In other contexts, much higher extrapolation or uncertainty factors are used to protect workers, as well as the rest of the population (including the most vulnerable such as the aged, young and unborn, as well as people with compromised health, and those with other, potentially interacting, adverse exposures). For example, pesticide extrapolation or uncertainty factors include: 10-fold intra-species (e.g. rat to people) and inter-species (e.g. adult to child) factors (i.e. 100-fold minimum), as well as a possible further 10-fold factor for vulnerable populations, and yet another 10-fold factor to address data gaps. In this context, the 50-fold uncertainty factor to avoid heating that is used for Safety Code 6 – half the bare minimum for pesticides – does not appear to be substantial.

Furthermore, actual exposures may exceed regulatory limits. According to March 2017 CBC reports on radio (The Current) and television (Marketplace), RFR from modern cell phones is 3- to 4-fold higher than Safety Code 6. This was replicated in data released in May 2017 by the Agence Nationale des Fréquences (France).⁶ Thus, a child with a

cellphone against his/her head is being exposed to RFR levels comparable to those deemed appropriate for a healthy adult worker. Of note, with thinner skulls and smaller heads, deeper regions of the brain are more highly exposed in the young.³

Some “eco” devices entail much lower RFR exposures and energy consumption, but are not available in Canada. During the HESA Committee hearing Bernard Lord, speaking on behalf of the industry, stated that industry will comply with what the Government of Canada requires.

Questions:

2. Given that the combined uncertainty factors in Safety Code 6 is significantly less than for other adverse exposures (pesticides for example), what is the biological origin and justification for the 5-fold extrapolation factor from a healthy adult worker to the most vulnerable individuals?
3. With potentially severe and costly individual and public health implications, what modeling and surveillance programs are tracking RFR exposures in the workplace, schools, public places and private spaces?
4. How can the public request investigations and access modeling, survey or surveillance data? For example, what are the average and peak exposures at various frequencies and modulations, of children in close proximity to one another streaming wireless data?
5. What initiatives are planned and in place, to ensure that Canadians understand the “fine print” in their devices, and that they respect the manufacturers’ distance requirements?
6. What encouragement and incentives are directed at the industry from the government, to design and market information technology products that incorporate best-practices to eliminate or minimize RFR exposures – both to protect the health of Canadians, and to position Canadian technological solutions at the global forefront as the safest possible technology?

Issue: Systematic Scientific Review in Environmental Health

In June 2015 HESA recommended: *That Health Canada conduct a comprehensive review of all existing literature relating to radiofrequency fields and carcinogenicity based on international best practices.*⁷

This recommendation was well founded, given evidence submitted during the hearing, of 140 studies showing potential harm from RFR, within the timeframe of the review, that were absent from all relevant documentation including reports by Health Canada, a review by a panel convened by the Royal Society of Canada, as well as the numerous “authoritative reviews” referenced by Health Canada.

Systematic review is a highly prescribed methodology in clinical medicine, and is demonstrated to produce more reliable, credible and actionable conclusions. Systematic reviewing is now formulated for application to environmental health questions, to provide the same benefits to public health.¹⁴ This methodology is used to address specific key questions that may pertain to:

- specific frequency ranges and exposure sources
- experimental systems or populations (e.g. cell cultures, animal studies or human cases, cohorts or populations); and
- particular outcomes (e.g. brain tumours, sperm damage, biochemical markers, etc.)

Health Canada claims to examine all relevant literature, and to come to conclusions using a “weight of evidence” approach. This requires systematic presentation of the evidence, and the weighing thereof. To meet international best practice standards, this type of review should entail:

- systematic searching for all relevant scientific research;
- screening for relevance and streaming per key questions;
- data extraction, compilation, analyses and meta-analyses;
- grading of studies according to study quality and indicators of reliability (e.g. size of study, exposure ascertainment, controls, quality of reporting, funding sources, etc.);
- application of the grading to the extracted evidence (sometimes termed “weighing”); and
- drawing of conclusions regarding key questions.

Systematic searches may identify thousands of peer-reviewed references, and a review may include data from more than a hundred studies for each key question. At a September 2014 meeting with Health Canada personnel, and Dr. David Moher and Dr. Meg Sears, it was evident that personnel lacked the wherewithal, and even familiarity with key features of a systematic review. For example, to minimize chance of bias overall, the best practice is to include *all* relevant studies and to account for potential weaknesses or biases during grading of the evidence. This was not Health Canada’s practice, and it was suggested in Minister Philpott’s response to the HESA report that Health Canada continues to exclude potentially relevant literature.

A strong systematic review would cover the entire relevant timeframe. An updated review should only be carried out to build upon a previous, demonstrably rigorous systematic review, but evidence before the HESA Committee identified 140 studies demonstrating potential harm, published in the review timeframe but absent from Canadian reports, as well as international reviews referenced by Health Canada and the Royal Society of Canada panel.¹⁵ Thus, a systematic review is required from inception of the field of research, and this was recommended by the HESA Committee.⁷

Although Health Canada has not completed any systematic reviews in the course of assessment, several have been published in the peer reviewed literature, including on athermal/low exposure effects,¹⁶ fertility^{17,18} and cancer.^{19,20,21}

The need to stay current is illustrated by a 2017 analysis of Canadian data from a large international study, showing doubled glioma risk with a mere 558 lifetime hours of cell phone use.²² As well, RFR may exacerbate effects of other adverse exposures, such as synergism with a carcinogen in animals,²³ and with lead affecting behaviour in children.²⁴

Questions:

7. What are some of the details of Health Canada’s systematic reviewing of health effects of RFR, including:

- Software and features used by Health Canada to maintain a database and to review systematically potentially relevant RFR exposure scientific literature;
 - Search strategies, updating and notification services to stay up to date;
 - Timeframe covered by the database, and number of records (papers) contained therein;
 - Topics identified for ongoing attention, and number of studies presently included for each topic;
 - Access for citizens to the bibliographic search strategies and results on key topics or specific outcomes (e.g. sperm damage, cancers, etc.), with reasons for study exclusions, and data extracted from included studies;
 - Health Canada capacity (staff, skills and competencies, and information technology) to catch up and to keep up with the relevant scientific literature for today's common RFR exposures?
8. In the Health Canada determination of the 36 studies that are in scope and meet quality criteria during the HESA hearing, studies using a cell phone or other wireless device as the source of exposure were excluded. Studies using realistic emissions from commercial devices also appear to have been excluded from the SC6 review, even when emissions were quantified. How does Health Canada integrate the large body of evidence from research using “status quo” exposures from commercial devices, in ongoing SC6 review?
 9. In the absence of Health Canada systematic reviews on key outcomes, will Health Canada take action on the basis of up-to-date independent systematic reviews by academic experts, published in the peer-reviewed literature? If Health Canada will not take action, what are the reasons for not doing so?
 10. Does Health Canada maintain and update a comprehensive list of relevant studies and database of results (extracted data), for RFR? If so, from the comprehensive list of potentially relevant studies, what numbers of bibliographic records are presently included and excluded in the Safety Code 6 literature compilation regarding RFR/MW effects on chemical/biochemical reactions and catalysis (*in vitro* and *in vivo*), addressing whether non-thermal RFR effects are *established*?
 11. Is it the role of the Office of the Minister of Science to ensure rigorous scientific review according to international best practices, of potentially adverse exposures of Canadian residents such as to RFR? If not, which bod(ies) is/are the arbiter of the conduct of science (methodologies) in toxicology, epidemiology and public health?

Issue: Precautionary Approach

In other health topics, Health Canada generally claims to take a precautionary approach in the face of uncertainty, to protect the health of Canadians. A precautionary approach is not to wait for final, incontrovertible proof before taking actions to reduce risks, particularly for severe outcomes that are appearing increasingly certain. A precautionary approach does not appear to be consistent with evidentiary requirements stated in the Minister's response to the HESA report, referring to the “totality” of evidence, “consensus,” “established” and “adverse” (as opposed to assuming that perturbation of homeostasis will be adverse for those with other stressors). It is unclear that with the

inherent difficulties with epidemiology, and well-known generation of doubt and funding bias in research, that such extraordinarily high bars for proof will ever be met.²⁰

Question:

12. How does Health Canada reconcile and incorporate precautionary approaches alongside the extraordinary stated evidentiary requirements for consensus on established, adverse effects of RFR radiation based on the “totality of the evidence”?

Issue: Capacity of the Government of Canada to ensure compliance with SC6, to stay up to date with the scientific literature, and to carry out adaptive management

As of 2014, near the culmination of the most recent iteration of Safety Code 6, Health Canada’s work was not supported with specialized software such as the world-class system developed in Ottawa and used by prominent methodology and systematic review scientists (e.g. DistillerTM), to support the necessary scale of systematic review. (At time of writing, the Public Health Agency of Canada was utilizing this software).

During the HESA hearing, of the 140 studies indicating adverse effects of RFR but absent from Health Canada’s considerations, Health Canada identified 36 as meeting quality criteria and being in scope. The Committee asked for a report on these 36 studies, but was informed that it would take Health Canada staff an inordinate length of time to complete this task. Without doing the systematic review for a report, however, staff nevertheless indicated that the 36 studies would not influence the decision of Health Canada. Of the 36 studies, 26 were at levels below Safety Code 6 (Appendix 1).

Research on health effects of RFR is rapidly evolving, with hundreds of studies to screen annually, and perhaps dozens of studies a year with relevant data that might contribute to meta-analyses. It is the responsibility of the Government of Canada to stay abreast of this information and to consult and act appropriately. For example, public consultations regarding 5G technologies and infrastructure are occurring in the U.S.¹

Questions:

13. Given authoritative reports that cell phones as they are currently used do not comply with SC6 guidelines, what validation and verification does the Government of Canada conduct to ensure that Canadians are not exposed to RFR levels exceeding SC6 guidelines, and what measures are taken to rectify circumstances resulting in over-exposures?
14. What identification of data requirements, research, outreach and exposure assessment activities are Health Canada, Innovation, Science and Economic Development Canada and the Public Health Agency of Canada engaged in, with respect to 5G deployment?
15. If Health Canada is not currently collecting and reviewing scientific all relevant data with respect to higher frequency 5G, are there any plans to do so and if not, why not?

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Appendix 1 “Missing studies” identified as in scope by Health Canada

This material was kindly shared by Marg Friesen, MSc.

During the HESA hearing, 140 studies were identified that indicated potential harm from RFR exposure, but that had been missed completely in the Health Canada review process. These studies are in the Canadians for Safe Technology (C4ST) "140 omitted studies" report submitted to Health Canada, 15 July 2014.¹⁵ None of the 140 studies are in Safety Code 6 Rationale (2015), nor in the Royal Society of Canada's Expert Panel report (2014), nor in any referenced "Authoritative Reviews." All studies are in the cell/mobile phone frequency range of 900MHz to 2450 MHz, except #26 (2573 MHz) and some listed in section IV below. Specific Absorption Rate (SAR) levels were taken from the original papers and from EMF Portal <http://www.emf-portal.de/>

Health Canada then identified that 36 reports were in scope and met quality criteria for the Safety Code 6 Risk Assessment (see minutes of House of Commons, Standing Committee on Health, 2nd Session, 41st Parliament, 24 March 2015).

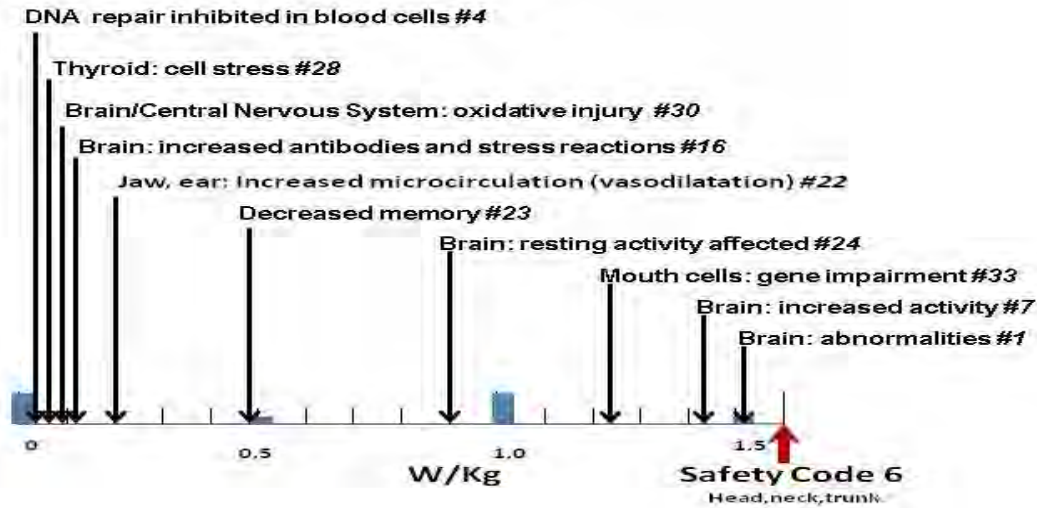
Potentially harmful effects documented in 36 studies that Health Canada determined to meet quality criteria and to be in scope are indicated in Table I.

Table I: Potentially harmful effects reported in 36 “acceptable quality” studies: Case-control epidemiological studies (6), Case reports (1), Literature review (1), Laboratory tests (1) (

CONDITION	FINDINGS
Brain cancer: #17,18 Swedish case-control studies [note: Hardell et al. recently published further studies]	Dr. Hardell now recommends a World Health Organization, International Agency on Cancer Research (WHO/IARC) Group 1, known carcinogen classification [along with asbestos and cigarette smoke]. Dr. Hardell's work was used by the WHO/IARC to reach a near unanimous Group 2b, possible carcinogen classification in 2011.
Brain cancer: French case-control study #10	Higher cancer incidence among earliest and heaviest mobile phone users; findings are consistent with Hardell's group's work
Breast cancer: #35	USA case report of four (4) young women with no familial history of breast cancer in the precise location where they tucked their cell phones in their bras
Acoustic Neuroma: #19 Benign tumour on 8th cranial nerve	Confirmation of previous studies of an association with mobile/cordless phone use
Infertility: #21	Review found adverse effects. Conclusion: "... men should not keep mobile phone in their trouser pockets or near testicles to avoid potential harmful effect..."
Children: Attention Hyperactivity Deficit Disorder (ADHD) #6	Association with mobile phone use among children with higher lead levels
Children: 7 years in age #13	Behavioural problems associated with prenatal exposure
Electrohypersensitivity (EHS):#11	Laboratory tests: thyroid and liver dysfunction, chronic inflammation

indicates the number of the reference in the list below.

II Biological effects below Safety Code 6 SAR for the head, neck and trunk (1.6 W/kg): Human, animal and cell culture studies



III Biological effects below Safety Code 6 SAR for whole body (0.08) W/kg: Human, animal and cell culture studies

%SC6	BIOLOGICAL EFFECTS	%SC6	BIOLOGICAL EFFECTS
1%	Brain: single strand DNA breaks #12	21%	Thyroid: cell stress #28
1%	Brain: oxidative stress, cognitive impairment, inflammation #27	38%	New born decreased body weight, effects on biochemistry #15
20%	Brain: neurodevelopment - increased damaged cells #3	63%	Brain: dopamine and serotonin changes, impaired behaviour # 25
20%	Brain: cell loss, decrease in Purkinje cells #32	75%	Liver: DNA strand breaks #15

IV Other studies

Other studies (n=10) showed significant biological effects at levels >SC6. #5, 8, 9, 14, 20, 26, 29, 31, 34, 36.

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 26. Maskey (2010). **Effect of 835 MHz radiofrequency radiation exposure on calcium binding proteins in the hippocampus of the mouse brain.** *Brain Research.* (South Korea)
 27. Megha (2012). **Microwave radiation induced oxidative stress, cognitive impairment and inflammation in brain of Fischer rats.** *Indian Journal of Experimental Biology.* (India)
 28. Misa Agustino (2012). **Electromagnetic fields at 2.45 GHz trigger changes in heat shock proteins 90 and 70 without altering apoptotic activity in rat thyroid gland.** *Biology Open* (Spain)
 29. Moretti (2013). **In-vitro exposure of neuronal networks to the GSM-1800 signal.** *Bioelectromagnetics* (France)
 30. Naziroglu (2012). **Melatonin modulates wireless (2.45 GHz)-induced oxidative injury through TRPM2 and voltage gated Ca(2+) channels in brain and dorsal root ganglion in rat.** *Physiology & Behavior.* (Turkey)
 31. Ni (2013). **Study of oxidative stress in human lens epithelial cells exposed to 1.8 GHz radiofrequency fields.** *PloS On* (China)
 32. Sonmez (2010). **Purkinje cell number decreases in the adult female rat cerebellum following exposure to 900 MHz electromagnetic field.** *Brain Research.* (Turkey)
 33. Souza (2014). **Assessment of nuclear abnormalities in exfoliated cells from the oral epithelium of mobile phone users.** *Electromagnetic Biology and Medicine.* (Brazil)
 34. Valbonesi (2014). **Effects of the exposure to intermittent 1.8 GHz radio frequency electromagnetic fields on HSP70 expression and MAPK signaling pathways in PC12 cells.** *International Journal of Radiation Biology* (Italy)
 35. West (2013). **Multifocal breast cancer in young women with prolonged contact between their breasts and their cellular phones.** *Case Reports in Medicine.* (USA)
 36. Zhang (2013). **Effects of 1.8 GHz radiofrequency radiation on protein expression in human lens epithelial cells.** *Human & Experimental Toxicology.* (China)

GET FROM Aud General Package

21	407 Prevent Cancer Now	Scientific review processes to determine limits on exposure to radiofrequency radiation according to Safety Code 6 Title as submitted: <i>Regrading Scientific Review Processes to Determine Limits on Exposure to Radiofrequency Radiation according to Safety Code 6 – Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz (2015)</i>	21 June 2017	14 pages
	RESPONSE: Health Canada- Minister Ginette Petitpas Taylor		25 October 2017	00452 1 page
	RESPONSE: Health Canada		With letter of 25 October 2017	00453-00458 6 pages
	REPLY: JOINT LETTER – Minister of Industry, Science and Economic Development (ISED), Navdeep Bains and Minister of Science, Kristy Duncan		27 October 2017	00447-00451 5 pages
	REPLY: Minister of Environment and Climate Change - Catherine McKenna		3 August 2017	459 1 page

Environmental Petition

Date: 27 June 2017

Name of petitioner(s) - [REDACTED]

Address of petitioner(s): [REDACTED]

Telephone number: [REDACTED]

Email address: [REDACTED]

I hereby submit this petition to the Auditor General of Canada under section 22 of the Auditor General Act.

Signature of the petitioner: via email to - petitions@oag-bvg.gc.ca

Title of the Petition: Health Canada's Safety Code 6 for Specific Absorption Rate (SAR) actual threshold of excessive heating and other adverse effects, for exposure of the eye, and of early human developmental stages e.g. newborn babies, to radiofrequency/microwave wireless radiation e.g. from baby monitors, cell phones and 5th Generation (5G) technologies.

I request a response from Health Canada.

BACKGROUND:

Health Canada maintains it uses evidence-based science to set threshold limits in Safety Code 6¹, its guidelines for safe exposure of humans to radiofrequency/microwave (RF/MW) radiation in the 3 kHz to 300 GHz range. This includes the range of 100 MHz to 300 GHz used for many, if not all wireless telecommunications purposes such as for baby monitors, cell phones, smart meters, tablets, Wi-Fi devices and 2, 3, 4 and 5 G technologies as well as some medical equipment.

On October 6, 2016 the Honourable Jane Philpott signed a response letter² saying that:

"Health Canada's recommended human exposure limits are outlined in a document entitled "Safety Code 6 Limits of human exposure to radiofrequency electromagnetic fields in the frequency range 3 kHz to 300 GHz" (Safety Code 6). While the human exposure limits in Safety Code 6 were initially developed for, and applied by, federally-regulated employers, some of the exposure limits in the Code have since been referenced by other federal departments and non-federal jurisdictions. In particular, Innovation, Science and Economic Development Canada (ISED) requires compliance with Safety Code 6 as part of its technical standards for radio apparatus."

Later Minister Philpott's letter states:

"Safety Code 6 human exposure limits, established by Health Canada, are designed to provide protection for all age groups, including infants and children, on a continuous basis (24 hours a day/seven days a week). This means that if someone,

¹ Safety Code 6 (2015)-Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz. Safety Code 6. http://www.HealthCanada-sc.gc.ca/ewh-semtpubs/radiation/radio_guide-lignes_direct/index-eng.php

² Response to the 13th report of the House of Commons Standing Committee on Health (HESA). <http://www.ourcommons.ca/DocumentViewer/en/42-1/HESA/report-2/response-8512-421-78>

including a small child, were to be exposed to RF energy from multiple sources for 24 hours a day, 365 days a year, within the Safety Code 6 limits, there would be no adverse health effects.

On June 8 and June 21, 2017, the Consumer and Clinical Radiation Protection Bureau (CCRPB) of Health Canada, responding to queries³ made May 24 and June 9, 2017, respectively, stated:

Extract from June 8, 2017: "the recommended peak SAR limit of 1.6 W/kg is not the threshold for the occurrence of adverse health effects. In fact, as a precautionary measure, the peak SAR limit in Safety Code 6 was set more than 50 times below the level at which excessive tissue heating could occur in the most sensitive tissue (the eye). This means that the peak SAR limits in Safety Code 6 would need to be exceeded by more than 50 times before one would see any thermally related adverse health effects."

Extract from June 21, 2017: "The peak spatially-averaged specific absorption rate (pk-SAR) limit in Safety Code 6 (SC6) applies to the head, neck and trunk. This limit is 1.6 W/kg, as averaged over any 1 g and for any 6 minute exposure period (reference period - please see Fact Sheet - What is Safety Code 6? for the explanation of the reference period). This limit is based upon avoiding cataract formation in the eye, which has been conservatively estimated to occur at sustained pk-SAR levels of 100-150 W/kg to the eye (as reviewed in Elder, 2003 and IEEE C95.1 (2005)).⁴

It is important to note that the recommended pk-SAR limit of 1.6 W/kg is not the threshold for the occurrence of adverse health effects. As mentioned in our previous email, the pk-SAR limit was set more than 50 times below the level where excessive tissue heating could occur in the eye. This means that the pk-SAR limits in Safety Code 6 (SC6) would need to be exceeded by more than 50 times in the eye before the occurrence of any thermally-related adverse health effects would be possible. Exposures to the body (skin and underlying tissue) at the SC6 pk-SAR limit of 1.6 W/kg would result in a localized temperature increase of less than a few tenths of 1 degree Celsius (Anderson et al., 2010; Moore et al., 2017)."⁵

To summarize: According to the CCRPB statement the actual threshold, in the frequency range of 100 MHz to 300 GHz, the only established effect on the eye recognized by Health Canada in Safety Code 6 is heating (thermal); and that excessive heating i.e. adverse effects, would not occur until levels were above 80 W/kg.⁶

3 Relating to the 100 MHz to 300 GHz radiofrequency/microwave range.

4 - Elder JA. Ocular effects of radiofrequency energy. *Bioelectromagnetics Suppl.* 6:S148-161 (2003).

- Institute of Electrical and Electronics Engineers. *Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields C95.1, 3 kHz to 300 GHz.* New York, USA (2005).

5 - Anderson V, Croft R, McIntosh RL. SAR versus S(inc): What is the appropriate RF exposure metric in the range 1-10 GHz? Part I: Using planar body models. *Bioelectromagnetics.* 2010 Sep;31(6):454-66.

- Moore SM, McIntosh RL, Iskra S, Lajevardipour A, Wood AW. Effect of adverse environmental conditions and protective clothing on temperature rise in a human body exposed to radiofrequency electromagnetic fields. *Bioelectromagnetics.* 2017 Mar 24. doi: 10.1002/bem.22048. [E-pub ahead of print]

6 - 1.6 W/kg x 50 (safety margin)

If this is the case, then according to the CCRPB's statements it appears that Health Canada's position is that if the eye is not adversely affected, then even a newborn baby would be unaffected by RF/MW radiation⁷ at below 80 W/kg. This petition presents information questioning the underlying assumption that the eye is not adversely affected below the Safety Code 6 (2015) safety margin threshold.

The Royal Society of Canada expert panel, when it was contracted by Health Canada to review certain questions regarding proposed revisions to Safety Code 6 (2009), was provided by Health Canada with a draft of a document titled Safety Code 6 (2013) Rationale. An updated version of the rationale, Safety Code 6 (2015) Rationale is available to the public from Health Canada upon request. This petition also presents information indicating that Health Canada has stated in its Safety Code 6 (2015) Rationale that the 50x safety margin for the Safety Code (2015) power density (W/m²) does not apply in all cases; specifically not to newborn babies with a low Body Mass Index (BMI).

A. The Eye

The level of SAR for the eye has shifted from being most protective in the 1991 version of Safety Code 6 (0.2 W/kg) to the least protective level in the current 2015 version (1.6 W/kg)(Table 1).

Table 1. Specific Absorption Rates (SARs) as set out in each Safety Code 6 version since first published in 1979⁸. The SAR level 50x safety margins are also indicated*.

Health Canada Safety Code 6	Specific Absorption Rate (SAR) for eye (W/kg)	Specific Absorption Rate SAR for the eye (W/kg) x 50 (safety margin)*
1979 (first version)	No value	No value
1991	0.2	10
1993	0.4	20
1999	0.2 (suggested)	10
2009	0.4 (suggested)	20
2015	1.6	80

* assuming that a 50x safety margin applies in all versions.

There is scientific evidence documented in at least four studies (Addendum 1⁹) published since the Royal Society panel's report¹⁰ and Safety Code 6 (2015) Rationale were made available, that indicate adverse effects at below 80 W/kg. Furthermore, there are at least seven additional studies (Addendum 2) showing adverse effects in the eye below 80 W/kg which the Royal Society panel's report and the Safety Code 6 (2015) Rationale did not include in their evaluations.¹¹

⁷ Relating to the 100 MHz to 300 GHz radiofrequency/microwave range.

⁸ Source: Health Canada

⁹ Source: PubMed - US National Library of Medicine National Institutes of Health

¹⁰ https://rsc-src.ca/sites/default/files/pdf/SC6_Report_Formatted_1.pdf

¹¹ <http://c4st.org/c4st-reviews-ignored-studies/>

These adverse effects in the eye, identified in human and animal studies, include:

- alteration in the cornea and lens
- cell proliferation alterations
- blurring of vision
- retinal development derangement in embryos
- oxidative stress changes
- protein expression changes.

B. Early human developmental stages: the embryo, fetus, premature babies and small children

Health Canada's Safety Code 6 (2015) Rationale, on page 33, states:

*"It should be pointed out that the estimation formula in Hirata (2010) is approximate and that the discrepancy of it versus the SAR calculation of the newborn model in Dimbylow et al. (2010; having a BMI¹² of 14.8 kg/m²) is an underestimation of 11%. Thus the information in Table A-4 and Figure A-3 should be treated with some caution. However, it can be used to arrive at some qualitative conclusions, the most important of which, is the likelihood that **any future calculations of WBA-SAR¹³ on models of premature newborns will likely produce non-compliance of the power density reference levels to the basic restriction.** This cannot be prevented without a further reduction of the power density reference levels at the frequencies of isolated, whole-body resonance. Thus, the power density reference levels in SC6 (2015) provide the full margin of safety (50-fold) for most of the population, **but not for all population sub-groups (e.g. low BMI newborns) in all worst-case exposure scenarios.** The portion of the population that does not receive the full measure of the intended safety margin (50-fold) is a small one, consisting of low BMI, premature newborns who would be unlikely to be exposed to levels of power density anywhere near the SC6 (2015) reference levels under any conceivable scenario."¹⁴*

The gestational age for the youngest newborn shown in Safety Code 6 (2015) Rationale in Table 4, is listed as 29 weeks and the corresponding Body Mass Index (BMI) appears to be the data used in further determinations in that document. However, it is not uncommon for premature babies to be born and survive at 22 to 23 weeks with considerably lower BMI values. For example, in 2013 a baby was born in McMaster University Medical Centre, Ontario weighing 330 grams and "could easily have fit in her father's hand."¹⁵ The developing fetus, from conception to birth, naturally, is much smaller in body mass early in development - the embryo being miniscule at conception.

Although the Rationale states that the population sub-group is a "small one", it is estimated that 1 in 12 babies in Canada are born prematurely. In Alberta there are over 4,000 premature babies born per year.¹⁶ This is a subgroup that is physiologically fragile and often undergoes highly intensive medical treatment.

12 Body Mass Index

13 WBA-SAR is Whole Body Averaged- Specific Absorption Rate

14 Bolded portions have been added by me.

15 <http://www.cbc.ca/news/canada/hamilton/hospital-s-tiniest-preemie-ever-thrives-and-is-now-at-home-1.2101677>

16 Canadian Premature Babies Foundation - <http://www.cpbfbpc.org/>

Further adverse exposures as a neonate may have lifelong ramifications and costs for the individual, family, medical system and society.

QUESTIONS:

- 1) Would Health Canada confirm that it has identified no other adverse effects except excessive heating at Specific Absorption Rates (SARs) at and below 80 W/kg of exposure, in the 100 MHz to 300 GHz range, in any human or animal studies?
- 2) If other adverse effects have been identified, what are they?
- 3) The Safety Code 6 Specific Absorption Rate (SAR) levels are calculated using extrapolations and assumptions. Can Health Canada say with 100% certainty that these assumptions and extrapolations accurately apply to actual small living children (as opposed to computerized models) for both heating and non-heating effects?
- 4) What data other than extrapolations are used to determine safe levels for an embryo, fetus and newborn child?
- 5) What is known about the protective capacity of the pregnant woman for her fetus, for example if she were to stream a movie on a tablet or cell phone directly next to her pregnant belly?
- 5) Given that Safety Code 6 (2015) Rationale states that a newborn child with a low Body Mass Index could be non-compliant of Safety Code 6 power density (W/m^2) safety margins, what would the safety margin be for a newly conceived child (embryo) and for a (premature) newborn baby 330 grams and 20 cm in length?
- 6) How has Health Canada evaluated, in its weight-of-evidence approach, the eleven studies presented here showing adverse effects to the eye at less than 80 W/kg and which have not been evaluated in the Royal Society of Canada panel report or in the Safety Code 6 (2015) Rationale?
- 7) What five most credible peer-reviewed studies on living people or animals would Health Canada name which justify the shift in the easing of Safety Code 6 SAR level for the eye from the 1991 level of 0.2 W/kg to the 2009 suggested level of 0.4 W/kg?
- 8) What five most credible peer-reviewed studies on living people or animals would Health Canada name which justify the shift in the easing of Safety Code 6 SAR from the 2009 suggested level for the eye of 0.4 W/kg to the 2015 level of 1.6 W/kg?
- 9) What five of the most credible peer-reviewed studies would Health Canada name as ensuring that the human eye, or people in any stage of development, will not be adversely affected from exposures by the proposed widespread roll-out of 5th Generation (5G) technologies that will require intense infrastructure near homes and schools?

Addendum 1. Studies published since the release of the Royal Society of Canada's expert panel report and Health Canada's Safety Code 6 (2015) Rationale indicating adverse effects below Safety Code 6 (2015) safety margin threshold.

1. Effect: Long-term - adverse effects on visual evoked potentials and oxidant/oxidative status

Hidisoglu, E., Kantar Gok, D., Er, H., Akpınar, D., Uysal, F., Akkoyunlu, G., ... Yargicoglu, P. (2016). 2100-MHz electromagnetic fields have different effects on visual evoked potentials and oxidant/antioxidant status depending on exposure duration. *Brain Research*, 1635, 1-11 doi:10.1016/j.brainres.2016.01.018

ABSTRACT: "The purpose of the present study was to investigate the duration effects of 2100-MHz electromagnetic field (EMF) on visual evoked potentials (VEPs) and to assess lipid peroxidation (LPO), nitric oxide (NO) production and antioxidant status of EMF exposed rats. Rats were randomized to following groups: Sham rats (S1 and S10) and rats exposed to 2100-MHz EMF (E1 and E10) for 2h/day for 1 or 10 weeks, respectively. At the end of experimental periods, VEPs were recorded under anesthesia. Brain thiobarbituric acid reactive substances (TBARS) and 4-hydroxy-2-nonenal (4-HNE) levels were significantly decreased in the E1 whereas increased in the E10 compared with their control groups. While brain catalase (CAT), glutathione peroxidase (GSH-Px) activities and NO and glutathione (GSH) levels were significantly increased in the E1, reduction of superoxide dismutase (SOD) activity was detected in the same group compared with the S1. Conversely, decreased CAT, GSH-Px activities and NO levels were observed in the E10 compared with the S10. Latencies of all VEP components were shortened in the E1 compared with the S1, whereas latencies of all VEP components, except P1, were prolonged in the E10 compared with the S10. There was a positive correlation between all VEP latencies and brain TBARS and 4-HNE values. Consequently, it could be concluded that different effects of EMFs on VEPs depend on exposure duration. In addition, our results indicated that short-term EMF could provide protective effects, while long-term EMF could have an adverse effect on VEPs and oxidant/antioxidant status."

<https://www.ncbi.nlm.nih.gov/pubmed/26776477>

2. Effects: negative impact on ocular symptoms

Kim, J., Hwang, Y., Kang, S., Kim, M., Kim, T.-S., Kim, J., ... Park, S. K. (2016). Association between Exposure to Smartphones and Ocular Health in Adolescents. *Ophthalmic Epidemiology*, 23(4), 269-276 doi:10.3109/09286586.2015.1136652

ABSTRACT: "PURPOSE: Smartphone use has dramatically increased in recent years. Smartphones may have adverse health effects, particularly on the eyes, because users stare at the screen for a much longer time than they do with ordinary mobile phones. The objective of this study was to elucidate the relationship between smartphone use and ocular symptoms among adolescents. METHODS: Information on smartphone use and ocular symptoms (blurring, redness, visual disturbance, secretion, inflammation, lacrimation and dryness) related to eye fatigue and strain from 715 adolescent subjects from three cities in Korea was obtained using a structured questionnaire. Ocular health was scored using number of ocular symptoms. Odds ratios (ORs), 95% confidence intervals (95% CIs) and p-

values for ocular symptoms were calculated with binomial and multinomial logistic regression models. RESULTS: Higher prevalence rates for ocular symptoms were observed in groups with greater exposure to smartphones ($p < 0.05$). Longer daily smartphone use was associated with a higher likelihood of having multiple ocular symptoms (5-7 symptoms out of 7 symptoms; $p = 0.005$). Excessive/intermittent use (>2 hours daily and ≤ 2 hours continuously) and excessive/persistent use (>2 hours daily and >2 hours continuously) compared to shorter use (<2 hours daily) were associated with multiple ocular symptoms (OR 2.18, 95% CI 1.09-4.39; OR 2.26, 95% CI 1.11-4.57, respectively). A higher lifetime exposure to smartphones was associated with a higher likelihood of having multiple ocular symptoms (OR 3.05, 95% CI 1.51-6.19; $p = 0.001$). CONCLUSION: Increasing exposure to smartphones can have a negative impact on ocular health in adolescents.”

<https://www.ncbi.nlm.nih.gov/pubmed/27254040>

3. Effects: significant association between health problems and mobile phone use.

Stalin, P., Abraham, S. B., Kanimozhy, K., Prasad, R. V., Singh, Z., & Purty, A. J. (2016). Mobile Phone Usage and its Health Effects Among Adults in a Semi-Urban Area of Southern India. *Journal of Clinical and Diagnostic Research: JCDR*, 10(1), LC14-16 doi:10.7860/JCDR/2016/16576.7074

ABSTRACT: “INTRODUCTION: Worldwide, mobile phone usage has been increased dramatically which could affect the health of the people. India has the second largest number of mobile phone users. However there are only few studies conducted in India to assess its effects on health. AIM: To determine the prevalence and pattern of mobile phone usage and to assess the relationship between certain selected health problems and mobile phone usage among adults. SETTINGS AND DESIGN: Community-based cross-sectional study was conducted in Kottakuppam, a town panchayat in Villupuram district of Coastal Tamil Nadu, Southern India. It is a semi-urban area with a population of about 16,000. Majority of the residents are Muslim by religion and belong to different socio economic status. MATERIALS AND METHODS: The study was approved by the Institutional Ethics Committee. A total of 2121 study participants were interviewed by the pre-final medical students through house-to-house survey using a pretested structured questionnaire. The questionnaire included the variables such as socio demographic profile, mobile phone usage and pattern, selected health problems, perceived benefits and threats and blood pressure. Selected health problems included headache, earache, neck pain, tinnitus, painful fingers, restlessness, morning tiredness, tingling fingers, fatigue, eye symptoms, sleep disturbance and hypertension. STATISTICAL ANALYSIS USED: Only 2054 were included for data analysis using SPSS 17 version. Proportions were calculated. Chi-square test was used to measure the p-value. The p-value < 0.05 was considered as statistically significant. RESULTS: The prevalence of mobile phone usage was 70%. Calling facility (94.2%) was used more than the SMS (67.6%). Health problems like headache, earache, tinnitus, painful fingers and restlessness etc., were found to be positively associated with mobile phone usage. There was negative association between hypertension and mobile phone usage. CONCLUSION: The prevalence of mobile phone usage was high. There was significant association between selected health problems and mobile phone usage. In future, higher studies are required to confirm our findings.”

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4740623/>

4. Effects: oxidative stress

Tök, L., Nazıroğlu, M., Doğan, S., Kahya, M. C., & Tök, O. (2014). Effects of melatonin on Wi-Fi-induced oxidative stress in lens of rats. *Indian Journal of Ophthalmology*, 62(1), 12-15 doi:10.4103/0301-4738.126166

ABSTRACT: "INTRODUCTION: Melatonin has been considered a potent antioxidant that detoxifies a variety of reactive oxygen species in many pathophysiological states of eye. The present study was designed to determine the effects of Wi-Fi exposure on the lens oxidant, antioxidant redox systems, as well as the possible protective effects of melatonin on the lens injury induced by electromagnetic radiation (EMR). MATERIALS AND METHODS: Thirty-two rats were used in the current study and they were randomly divided into four equal groups as follows: First and second groups were cage-control and sham-control rats. Rats in third group were exposed to Wi-Fi (2.45 GHz) for duration of 60 min/day for 30 days. As in the third group, the fourth group was treated with melatonin. The one-hour exposure to irradiation in second, third and fourth took place at noon each day. RESULTS: Lipid peroxidation levels in the lens were slightly higher in third (Wi-Fi) group than in cage and sham control groups although their concentrations were significantly ($P < 0.05$) decreased by melatonin supplementation. Glutathione peroxidase (GSH-Px) activity was significantly ($P < 0.05$) lower in Wi-Fi group than in cage and sham control groups although GSH-Px ($P < 0.01$) and reduced glutathione ($P < 0.05$) values were significantly higher in Wi-Fi + melatonin group than in Wi-Fi group. CONCLUSIONS: There are poor oxidative toxic effects of one hour of Wi-Fi exposure on the lens in the animals. However, melatonin supplementation in the lens seems to have protective effects on the oxidant system by modulation of GSH-Px activity."

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3955064/>

Addendum 2. Studies not evaluated in the Royal Society of Canada's expert panel report nor in Health Canada's Safety Code 6 (2015) Rationale indicating adverse effects below Safety Code 6 (2015) safety margin threshold.

1. Effects: alterations in rat cornea

Akar, A., Karayığit, M. Ö., Bolat, D., Gültiken, M. E., Yarim, M., & Castellani, G. (2013). Effects of low level electromagnetic field exposure at 2.45 GHz on rat cornea. *International Journal of Radiation Biology*, 89(4), 243-249 doi:10.3109/09553002.2013.754557

ABSTRACT: "PURPOSE: To investigate the effects of low level electromagnetic field (low level-EMF) exposure, as frequently encountered in daily life, on the normal rat cornea using histological and stereological method. METHODS: Twenty-two adult male Wistar rats were randomly divided into two groups: Study group (n = 11) and control group (n = 11). Rats in the study group were exposed to 2.45 GHz microwave (MW) radiation (11.96 ± 0.89 V/m), 0.25 W/kg specific absorption rate (SAR) for 2 hours each day for 21 days. The corneal thickness and the anterior epithelium corneal thickness were measured using two different methods. RESULTS: Using the histological method, the mean corneal thicknesses in the control and study group were 278.9 ± 54.5 μ m, and 272.4 ± 85.6 μ m, respectively. There was no statistically significant difference between the groups ($p > 0.05$). The anterior corneal epithelium thickness was 28.1 ± 4.9 μ m in the control group and 31.7 ± 5.5 μ m in the study group. There were statistically differences between the groups with regard to the thickness of anterior epithelium ($p < 0.05$). In the measurement made by the stereological method, the percentage of the cornea occupied by anterior corneal epithelium was 15.94% in the control group and

17.9% in the study group. Despite the fact that there was a relation between increased anterior epithelial area (AEA) and radiation exposure, no statistically significant relationship in area fraction of each compartment was found between the control and study groups. CONCLUSIONS: Results of this preliminary study show that exposure to MW radiation might cause alterations in the rat cornea.”

<https://www.ncbi.nlm.nih.gov/pubmed/23206266>

2. Effect: oxidative stress in rat cornea and lens

Balci, M., Namuslu, M., Devrim, E., & Durak, I. (2009). Effects of computer monitor-emitted radiation on oxidant/antioxidant balance in cornea and lens from rats. *Molecular Vision*, 15, 2521-2525

ABSTRACT: “PURPOSE: This study aims to investigate the possible effects of computer monitor-emitted radiation on the oxidant/antioxidant balance in corneal and lens tissues and to observe any protective effects of vitamin C (vit C). METHODS: Four groups (PC monitor, PC monitor plus vitamin C, vitamin C, and control) each consisting of ten Wistar rats were studied. The study lasted for three weeks. Vitamin C was administered in oral doses of 250 mg/kg/day. The computer and computer plus vitamin C groups were exposed to computer monitors while the other groups were not. Malondialdehyde (MDA) levels and superoxide dismutase (SOD), glutathione peroxidase (GSH-Px), and catalase (CAT) activities were measured in corneal and lens tissues of the rats. RESULTS: In corneal tissue, MDA levels and CAT activity were found to increase in the computer group compared with the control group. In the computer plus vitamin C group, MDA level, SOD, and GSH-Px activities were higher and CAT activity lower than those in the computer and control groups. Regarding lens tissue, in the computer group, MDA levels and GSH-Px activity were found to increase, as compared to the control and computer plus vitamin C groups, and SOD activity was higher than that of the control group. In the computer plus vitamin C group, SOD activity was found to be higher and CAT activity to be lower than those in the control group. CONCLUSION: The results of this study suggest that computer-monitor radiation leads to oxidative stress in the corneal and lens tissues, and that vitamin C may prevent oxidative effects in the lens.”

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2787304/>

3. Effects: blurring of vision, inflammation of eyes

Kucer, N. (2009). Some Ocular Symptoms Experienced by Users of Mobile Phones. *Electromagnetic Biology and Medicine*, 27, 205-209 doi:10.1080/15368370802072174

ABSTRACT: “This survey study was conducted, using a questionnaire, on 229 university students (181 women, 48 men) in Kocaeli, Turkey. Six ocular symptoms experienced during use of mobile phones were studied by means of the chi-square test with Yates correction. The studied symptoms were blurring of vision, redness of the eyes, vision disturbance, secretion of the eyes, inflammation in the eyes, and lachrymation of the eyes. A significant increase in blurring of vision ($p < 0.05$) was reported by users of mobile phone possession >2 years compared to users of mobile phone possession <2 years. In users of mobile phones, women significantly ($p < 0.05$) complained more often of inflammation in the eyes than men.”

<https://www.ncbi.nlm.nih.gov/pubmed/18568938>

4. Effects: oxidative stress

Ni, S., Yu, Y., Zhang, Y., Wu, W., Lai, K., & Yao, K. (2013). Study of oxidative stress in human lens epithelial cells exposed to 1.8 GHz radiofrequency fields. *PLoS One*, 8(8), e72370 doi:10.1371/journal.pone.0072370

ABSTRACT: "OBJECTIVES: The aims of the present study were to determine oxidative stress and to explore possible reasons of reactive oxygen species (ROS) increase in human lens epithelial (HLE) B3 cells exposed to low intensity 1.8 GHz radiofrequency fields (RF).METHODS: The HLE B3 cells were divided into RF exposure and RF sham-exposure groups. The RF exposure intensity was at specific absorption rate (SAR) of 2, 3, or 4 W/kg. The ROS levels were measured by a fluorescent probe 2',7'-dichlorofluorescein diacetate (DCFH-DA) assay in the HLE B3 cells exposed to 1.8 GHz RF for 0.5, 1, and 1.5 h. Lipid peroxidation and cellular viability were detected by an MDA test and Cell Counting Kit-8 (CCK-8) assays, respectively, in the HLE B3 cells exposed to 1.8 GHz RF for 6, 12, and 24 h, respectively. The mRNA expression of SOD1, SOD2, CAT, and GPx1 genes and the expression of SOD1, SOD2, CAT, and GPx1 proteins was measured by qRT-PCR and Western blot assays in the HLE B3 cells exposed to 1.8 GHz RF for 1 h.RESULTS: The ROS and MDA levels significantly increased ($P<0.05$) in the RF exposure group and that the cellular viability, mRNA expression of four genes, and expression of four proteins significantly decreased ($P<0.05$) compared with the RF sham-exposure group.CONCLUSIONS: Oxidative stress is present in HLE B3 cells exposed to 1.8 GHz low-intensity RF and that the increased production of ROS may be related to down-regulation of four antioxidant enzyme genes induced by RF exposure."

<https://www.ncbi.nlm.nih.gov/pubmed/23991100>

5. Effects: review finds studies on the lens and lens cells showing effects on lens transparency, altered cell proliferation and other adverse effects.

Yu, Y., & Yao, K. (2010). Non-thermal Cellular Effects of Lowpower Microwave Radiation on the Lens and Lens Epithelial Cells. *The Journal of International Medical Research*, 38(3), 729-736

ABSTRACT: "Because of the increased use of modern radiofrequency devices, public concern about the possible health effects of exposure to microwave radiation has arisen in many countries. It is well established that high-power microwave radiation can induce cataracts via its thermal effects. It remains unclear whether low-power microwave radiation, especially at levels below the current exposure limits, is cataractogenic. This review summarizes studies on the biological effects of low-power microwave radiation on lens and lens epithelial cells (LECs). It has been reported that exposure affects lens transparency, alters cell proliferation and apoptosis, inhibits gap junctional intercellular communication, and induces genetic instability and stress responses in LECs. These results raise the question of whether the ambient microwave environment can induce non-thermal effects in the lens and whether such effects have potential health consequences. Further in vivo studies on the effects on the lens of exposure to low-power microwave radiation are needed."

<https://www.ncbi.nlm.nih.gov/pubmed/20819410>

6. Effects: deranged epithelial chicken embryo retinal differentiation

Zareen, N., Khan, M. Y., & Ali Minhas, L. (2009). Derangement of chick embryo retinal differentiation caused by radiofrequency electromagnetic fields. *Congenital Anomalies*, 49(1), 15-19 doi:10.1111/j.1741-4520.2008.00214.x

ABSTRACT: "The possible adverse effects of radiofrequency electromagnetic fields (EMF) emitted from mobile phones present a major public concern. Biological electrical activities of the human body are vulnerable to interference from oscillatory aspects of EMF, which affect fundamental cellular activities, in particular, the highly active

development process of embryos. Some studies highlight the possible health hazards of EMF, while others contest the hypothesis of biological impact of EMF. The present study was designed to observe the histomorphological effects of EMF emitted by a mobile phone on the retinae of developing chicken embryos. Fertilized chicken eggs were exposed to a ringing mobile set on silent tone placed in the incubator at different ages of development. After exposure for the scheduled duration the retinae of the embryos were dissected out and processed for histological examination. The control and experimental embryos were statistically compared for retinal thickness and epithelial pigmentation grades. Contrasting effects of EMF on the retinal histomorphology were noticed, depending on the duration of exposure. The embryos exposed for 10 post-incubation days exhibited decreased retinal growth and mild pigmentation of the epithelium. Growth retardation reallocated to growth enhancement on increasing EMF exposure for 15 post-incubation days, with a shift of pigmentation grade from mild to intense. We conclude that EMF emitted by a mobile phone cause derangement of chicken embryo retinal differentiation.”

<https://www.ncbi.nlm.nih.gov/pubmed/19243412>

7. Effects: changes in protein expression in human lens cells

Zhang, Y., Yao, K., Yu, Y., Ni, S., Zhang, L., Wang, W., & Lai, K. (2013). Effects of 1.8 GHz radiofrequency radiation on protein expression in human lens epithelial cells. *Human & Experimental Toxicology*, 32(8), 797-806 doi:10.1177/0960327112472353

ABSTRACT: “Objective: The aim of the present study was to observe the effects of 1.8 GHz radiofrequency (RF) radiation on the protein expression of human lens epithelial cells (hLECs) in vitro. Methods: The hLECs were exposed and sham-exposed to 1.8 GHz RF radiation (specific absorption rate (SAR) of 4 W/kg) for 2 h. After exposure, the proteins extracted from LECs were loaded on the Ettan MDLC system connected to the LTQ-Orbitrap MS for screening the candidate protein biomarkers induced by RF. The quantitative real-time polymerase chain reaction (qRT-PCR) was used to detect the levels of messenger RNA of candidate biomarkers. After the hLECs were exposed to 1.8 GHz RF (SAR of 2, 3 and 4 W/kg) for 2 h, the Western blot assay was utilized to measure the expression levels of the above-screened candidate protein biomarkers. Results: The results of shotgun proteomic analysis indicated that there were eight proteins with differential expression between exposure and sham exposure groups. The results of qRT-PCR showed that there were three genes with expressional differences (valosin containing protein (VCP), ubiquitin specific peptidase 35 (USP35) and signal recognition particle 68 kDa (SRP68)) between exposure and sham exposure groups. The results of Western blot assay exhibited that the expressional levels of VCP and USP35 proteins significantly increased and the expressional level of protein SRP68 significantly decreased in hLECs exposed to 1.8 GHz RF radiation (SAR of 3 and 4 W/kg) for 2 h when compared with the corresponding sham groups ($p < 0.05$). Conclusion: The shotgun proteomics technique can be applied to screen the proteins with differential expression between hLECs exposed to 1.8 GHz RF and hLECs sham-exposed to 1.8 GHz RF, and three protein biomarkers associated with RF radiation were validated by Western blot assay.”

<https://www.ncbi.nlm.nih.gov/pubmed/23338683>

Minister of Health



Ministre de la Santé

Ottawa, Canada K1A 0K9

OCT 25 2017



Dear Ms. [REDACTED]:

This is in response to your environmental petition no. 409 of June 27, 2017, addressed to Ms. Julie Gelfand, Commissioner of the Environment and Sustainable Development (CESD).

In your petition, you raised concerns regarding the scientific analysis used to determine the recommended human exposure limits for radiofrequency radiation contained in Safety Code 6. I am pleased to provide you with the enclosed response to your questions.

I appreciate your interest in this important matter.

Yours sincerely,

A handwritten signature in cursive script, reading "Ginette Petitpas Taylor".

The Honourable Ginette Petitpas Taylor, P.C., M.P.

Enclosure

c.c. Ms. Julie Gelfand, CESD

Response to #409

Health Canada administers the *Radiation Emitting Devices Act* (REDA) which governs the sale (including re-sale), lease and importation of radiation emitting devices in Canada. The Department's mandate regarding human exposure to radiofrequency (RF) electromagnetic energy is to carry out research into possible health effects, monitor the scientific literature related to such effects on an ongoing basis, and develop recommended exposure guidelines such as the "Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3kHz to 300 GHz – Safety Code 6". Safety Code 6 sets recommended limits for safe human exposure to electromagnetic fields (EMF) in federally regulated industries and workplaces in the frequency range from 3 kHz to 300 GHz.

When developing the exposure limits in Safety Code 6, departmental scientists consider all relevant peer-reviewed scientific studies and employ a weight-of-evidence approach when evaluating possible health risks from exposure to RF energy. The weight-of-evidence approach takes into account both the quantity of studies on a particular endpoint (whether adverse or no effect), and, more importantly, the quality of those studies. Poorly conducted studies (e.g. inadequate exposure evaluation, a lack of appropriate control samples or inadequate statistical analysis) receive relatively little weight, while properly conducted studies (e.g. with all controls included, appropriate statistics and a complete exposure evaluation) receive more weight.

Q1) Would Health Canada confirm that it has identified no other adverse effects except excessive heating at Specific Absorption Rates (SARs) at and below 80 W/kg of exposure, in the 100 MHz to 300 GHz range, in any human or animal studies?

Q2) If other adverse effects have been identified, what are they?

Response to Q1/Q2:

This question relates to the peak-spatially averaged specific absorption rate (pk-SAR) exposure limits in Safety Code 6. The recommended human exposure limit for pk-SAR for the uncontrolled environment in Safety Code 6 is 1.6 W/kg.

Health Canada is aware that some scientific studies have reported biological and/or adverse health outcomes at exposure levels below a pk-SAR of 80 W/kg. However, in many of these cases, a large number of quality factors limit the conclusions that can be drawn from such studies. Many such studies do not have sufficiently detailed dosimetric information (e.g. measured and/or calculated pk-SAR values), including an assessment of heterogeneity of SAR distribution across the sample/tissue. Similarly, many such studies also do not take measures to control and/or monitor sample/tissue temperature, which is required to rule out the potential for thermal hotspots that could confound the study findings. Health Canada does not consider there to be sufficient scientific

evidence for the existence of any established adverse health effects, unrelated to tissue/sample heating, at pk-SAR values above 1.6 W/kg.

Q3) The Safety Code 6 Specific Absorption Rate (SAR) levels are calculated using extrapolations and assumptions. Can Health Canada say with 100% certainty that these assumptions and extrapolations accurately apply to actual small living children (as opposed to computerized models) for both heating and non-heating effects?

Q4) What data other than extrapolations are used to determine safe levels for an embryo, fetus and newborn child?

Q5) What is known about the protective capacity of the pregnant woman for her fetus, for example if she were to stream a movie on a tablet or cell phone directly next to her pregnant belly?

Q5) [sic] Given that Safety Code 6 (2015) rationale states that a newborn child with a low Body Mass Index could be non-compliant of Safety Code 6 power density (W/m²) safety margins, what would the safety margin be for a newly conceived child (embryo) and for a (premature) newborn baby 330 grams and 20 cm in length?

Response to Q3/Q4/Q5:

The recommended whole-body average (WBA) SAR limits in Safety Code 6 are based upon avoiding a core body temperature increase of one degree Celsius. To provide a margin of safety from such a temperature change, a 50-fold safety margin from the threshold WBA-SAR required to cause a 1°C core body temperature increase (e.g. 4.0 W/kg) has been incorporated into the Safety Code 6 limits, resulting in a recommended WBA-SAR limit of 0.08 W/kg.

Since measurement of WBA-SAR is not practical within living persons, external electric- and magnetic-field strength and power density limits that correspond to a WBA-SAR of 0.08 W/kg have been established in Safety Code 6 (e.g. Reference Levels). These Reference Levels are based upon the latest scientific and dosimetric information and to the best of Health Canada's knowledge, provides a large margin of safety against the potential occurrence of body heating. When developing these Reference Levels, child body sizes, including premature infants (approximately 29 weeks), were considered.

For localized exposures of RF fields to the abdomen, from devices such as a laptop/tablet, most RF energy will be absorbed within the skin, sub-cutaneous fat and muscle. Due to thermal diffusion and thermoregulation, RF field exposures below the limits in Safety Code 6 may result in small localized temperature increases near the device, due to RF energy absorption, but no overall change in core body temperature. Very little RF energy will be absorbed at the location of the embryo/fetus. Since embryonic/fetal tissue is maintained within the uterus of the mother, such tissue temperature will be largely governed by maintenance of the maternal core body temperature. Through the safety margins applied within the recommended exposure limits in Safety Code 6 for WBA-SAR, embryonic/fetal tissue will be protected from adverse temperature increases due to RF fields.

Q6) How has Health Canada evaluated, in its weight-of-evidence approach, the eleven studies presented here showing adverse effects to the eye at less than 80 W/kg and which have not been evaluated in the Royal Society of Canada panel report or in the Safety Code 6 (2015) Rationale?

Response to Q6:

While Safety Code 6 references a number of large international reviews of the scientific literature, the Code is intended as an exposure guideline and not a scientific review article; and accordingly, most individual scientific studies are not referenced in the Code. However, this does not mean that Health Canada did not consider all relevant scientific information when deriving the science-based recommended human exposure limits in Safety Code 6.

It is important to note that when thousands of research studies are conducted on any test agent (such as RF fields), statistical chance dictates that a small number of studies (even if conducted properly) will demonstrate a "false positive" or "false negative" result. Furthermore, studies with inappropriate study design or methodology can lead to erroneous results that are scientifically meaningless. It is for these reasons that the scientific literature on a given test agent must be evaluated both for the quality of the studies conducted but also for the strength of the evidence. Such analysis must consider all relevant properly conducted studies on the test agent. While some studies have reported biological effects or adverse health effects of RF fields at levels below the limits in Safety Code 6, these studies only form part of the dataset and do not represent the prevailing line of scientific evidence in these respective areas. Similar conclusions have been reported in recent reviews of the scientific evidence by national and international health authorities.

Health Canada does not consider the findings of the studies supplied in Addendum 1 and 2 of your submission to change the assessment of the thresholds of adverse health effects to the eye from RF fields.

Q7) What five most credible peer- reviewed studies on living people or animals would Health Canada name which justify the shift in the easing of Safety Code 6 SAR level for the eye from the 1991 level of 0.2 W/kg to the 2009 suggested level of 0.4 W/kg?

Q8) What five most credible peer-reviewed studies on living people or animals would Health Canada name which justify the shift in the easing of Safety Code 6 SAR from the 2009 suggested level for the eye of 0.4 W/kg to the 2015 level of 1.6 W/kg?

Q9) What five of the most credible peer- reviewed studies would Health Canada name as ensuring that the human eye, or people in any stage of development, will not be adversely affected from exposures by the proposed widespread roll-out of 5th Generation (5G) technologies that will require intense infrastructure near homes and schools?

Response to Q7/Q8/Q9:

Health Canada is recognized worldwide for the rigour with which it gathers, assesses and incorporates scientific information into its decision making and standards. Although to date, thousands of scientific studies have been carried out globally to evaluate the safety of RF EMF, there is an inadequate body of scientific evidence upon which to support the causality of adverse health effects of RF fields on the human eye at exposure levels below the peak spatially-averaged SAR limits in Safety Code 6. Furthermore, despite the widespread use of a variety of consumer devices (e.g. cell phones, push-to-talk radios) over the past 20 years by the general population in Canada and abroad, Health Canada has not received any complaints and is not aware of any ocular injuries that have occurred from RF field exposures at levels below the current basic restrictions on pk-SAR outlined in Safety Code 6.

The basic restrictions (internal dose quantities) and reference levels (externally applied field strengths or internal body currents) in Safety Code 6 are intended to be based upon established adverse health effects. The available scientific evidence for non-cataractogenic effects on the eye below the current peak spatially-averaged SAR limits in Safety Code 6 is extremely limited, contradictory and not causally-established. Therefore, it is not considered scientifically-justifiable to establish basic restrictions or to maintain separate recommendations for pk-SAR for the eye that differ from those for all tissues of the head, neck and trunk (1.6 W/kg). A similar conclusion has been established by the Institute of Electrical and Electronics Engineers (IEEE) in their standard C95.1 (2005), International Commission on Non-Ionizing Radiation Protection (ICNIRP) (1998) and ICNIRP (2009, 2010). Health Canada will continue to monitor the scientific literature related to this issue.

With respect to the deployment of 5G technologies, as RF frequencies increase above 6 GHz, the penetration depth of RF energy into human tissue progressively diminishes. Forthcoming 5G technologies will use the millimeter wave frequency band (6-100 GHz),

of which the RF field absorption will occur mainly in the upper 1-2 millimeters of tissue. In this case, the primary health concern is related to the elevation in skin/eye temperature in response to such exposures. The current recommended exposure limits in Safety Code 6, in terms of power density for frequencies above 6 GHz, will effectively maintain both localized and whole body average temperatures far below the threshold for thermal damage to the skin or eye.

Safety Code 6 (2015) –Rationale

Most radiofrequency (RF) field exposure standards express exposure limits in terms of basic restrictions (internal dose quantities) and reference levels (externally applied field strengths or internal body currents). The role of reference levels is to provide an easily measured or calculated field strength or body current that can be used as a reference to judge whether the basic restrictions are exceeded or not. Reference levels prescribe the lowest possible external field strength or body current that produces the basic restriction in the body for the worst case body size and exposure condition (e.g. polarization of the field, grounding of the body, etc.). Standards often make note of the fact that since reference levels are derived from the worst-case conditions, non-compliance with them does not always imply non-compliance with the basic restrictions. Sometimes a further analysis of the specific exposure conditions confirms the basic restrictions are adhered to, despite the reference levels being exceeded.

This document provides an overview of the rationale for the basic restrictions and reference levels within the revised version of Safety Code 6 (SC6, 2015). This document is not intended as an authoritative scientific review of the relevant literature, as that would entail a much more thorough discussion of the relevant scientific literature. Such reviews have been recently conducted by other groups (SCENIHR, 2013; AGNIR, 2012; ANSES, 2013; WHO Draft Monograph on RF fields, 2014). Where appropriate, references are provided to authoritative reviews of the scientific literature or to some individual studies which form the scientific basis on specific issues. Since SC6 provides guidance for maximum human exposure to electromagnetic radiation across a wide frequency spectrum and the thresholds for adverse health effects are based upon different biological phenomena at different regions within this frequency range, this document has been subdivided into four (4) sections, namely:

1. Electric and Magnetic Fields (3 kHz – 10 MHz)
2. Induced and Contact Current (3 kHz – 110 MHz)
3. Electric-fields, Magnetic-fields and Power Density (10 MHz – 6 GHz)
4. Electric-fields, Magnetic-fields and Power Density (6 GHz – 300 GHz)

In the 3 – 100 kHz band, the threshold for adverse health effects is based upon the avoidance of peripheral nerve stimulation (PNS) by induced fields within the body from external magnetic fields. Basic restrictions in this frequency band are specified for electric field strength within the body (internal). In the 100 kHz – 10 MHz frequency range, the threshold for adverse health effects are based upon the avoidance of both PNS and thermal effects. As such, basic restrictions are specified for both internal electric field strength and specific absorption rate (SAR; whole body average and peak spatially-averaged SAR). In the frequency range 10 MHz – 6 GHz, the threshold for adverse effects is based upon the avoidance of tissue heating and basic restrictions are specified for whole-body average SAR and spatially-averaged peak SAR. In the frequency range from 6 - 300 GHz, since measurements of whole-body SAR and peak spatially-averaged SAR are not readily achievable or appropriate due to the superficial nature of tissue

heating within the body, reference levels for electric- and magnetic-fields and power density form the basis of the human exposure limits in this frequency range.

The basic restrictions outlined in SC6 (2015) are intended to protect against all established adverse health effects from electromagnetic radiation in the frequency range 3 kHz – 300 GHz. In the WHO Framework for the Development of EMF Standards (2006), adverse health effects are defined as “a biological effect that has health consequences outside the compensation mechanisms of the human body and is detrimental to health or well-being”. It is important to note that the WHO endorses international guidelines that are based upon a weight-of-evidence risk assessment of the scientific literature, such as those established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the Institute of Electrical and Electronics Engineers (IEEE), and it encourages member states to adopt these international guidelines or to base national exposure limits on similar risk assessment principles. Where justified, SC6 (2015) has been harmonized with applicable international standards.

Section 1 Electric and Magnetic Fields (3 kHz – 10 MHz)

In the frequency range 3 kHz – 10 MHz, the threshold for adverse health effects in SC6 (2009) and other science-based human exposure limits have been based upon the avoidance of both PNS and thermal effects from externally applied electric and/or magnetic fields (ICNIRP 1998, 2010; IEEE C95.1, 2005; Lin, 2007). PNS predominates at the lower end of this frequency range, while tissue temperature elevation due to energy absorption (e.g. SAR) generally predominates at higher frequencies. In the 100 kHz – 10 MHz range, low-duty cycle electromagnetic fields may elicit PNS before thermal effects arise, while continuous-wave exposures may elicit thermal effects before PNS occurs, therefore basic restrictions for both biological endpoints are required in the revised version of SC6, and both must be respected for compliance with SC6. While central nervous system (CNS) tissue and cardiac tissue can also be stimulated by induced internal electric fields, the thresholds for these effects occur at higher exposure levels than that for PNS in this frequency range. Since the last version of SC6 (2009), no newly identified adverse health effects have been established in this frequency range. Therefore, the avoidance of PNS and thermal effects remains the basis for the basic restrictions in this frequency range.

Peripheral Nerve Stimulation (PNS)

In unperturbed conditions, voltage-gated ion channels maintain the “resting” membrane potential of neurons at approximately -60 to -75 mV. Externally applied magnetic fields can induce internal electric fields that can perturb the “resting” membrane potential on neurons and can stimulate action potentials in peripheral nerve axons if the induced membrane depolarization is above a threshold value sufficient for the opening of voltage-gated sodium channels to become self-sustaining (WHO, 2007). Numerous studies have estimated that the minimum internal electric field strength threshold for perception of PNS (tingling sensation) to be in the range of 4 - 6 Vm⁻¹ using theoretical calculations of nerve stimulation thresholds (Reilly 1998, 2002) and empirical data from volunteers exposed to switched gradient magnetic resonance (Ham et al., 1997; Bourland et al.,

1999; Nyenhuis et al., 2001; Den Boer et al., 2002; Zhang et al., 2003; Recoskie et al. 2009). The avoidance of PNS perception serves as the basis for the basic restrictions and reference levels in SC6 (2015).

Magnetic Field PNS-based reference levels and basic restrictions 3kHz-10 MHz

The process of development for most electromagnetic exposure standards is to first derive a basic restriction (in this case, the induced electric field strength in tissue or E_i) that incorporates reduction or safety factors below the threshold for effect. This is followed by development of a reference level (in this case the externally applied magnetic flux density B or magnetic field strength H) that is found from dosimetric analysis (dosimetric analysis can be defined as the estimation of induced electric field strength in the body due to an externally applied magnetic flux density) to determine the flux density that produces the basic restriction.

Historically, PNS-based basic restrictions are developed from empirical data for nerve stimulation from MRI-based human volunteer studies or from in-vitro studies on isolated nerves. In the case of the former, threshold stimulation data is obtained in the form of time-rate-of-change of external magnetic flux density (dB/dt) that human volunteers were exposed to. This data can then be converted into internally-induced electric field strength (the dose quantity) through a dosimetric analysis. Using this approach, dosimetric analysis (modelling) is used (in two stages) when going from the empirical dB/dt data to a basic restriction for E_i and then back again to a reference level for B. Alternatively, basic restrictions have also been developed from electrical threshold data (voltages, currents and electric field strengths) from studies of isolated nerves. Since the dose quantity is applied directly to the nerve, this approach is independent of dosimetric analyses.

Dosimetric analyses or induction modelling has been carried out using a number of computational methods and models. Methods include numerical algorithms such as the scalar potential finite difference (SPFD), quasi-static finite difference time domain (FDTD), finite element and moment methods. Sophisticated models have been developed in the form of realistic 3-dimensional voxel representations of various human body sizes with conductivity assigned to each voxel. In addition to numerical algorithms, induction modelling applied by some organizations have been carried out using Faraday's law applied to simple homogeneous structures such as loops and ellipsoids (IEEE C95.1, ICNIRP 1998).

In general, induction modelling attempts to find the maximum sinusoidal induced electric field strength in the model for a given external sinusoidal magnetic flux density. In most cases, some form of averaging or filtering algorithm is applied to the induced electric field (as either required by an exposure standard or applied by the authors of scientific studies) in order to smooth numerical artefacts. Methods particularly prone to this type of artefact are ones based on finite differences where larger than expected induced electric field strengths occur at the interface of voxels with high conductivity contrast with respect to neighbouring ones (sometimes called "stair-casing error").

The parameter that defines the result of a dosimetric analysis or induction modelling is the induction coefficient C_i given by:

$$C_i = \frac{E_i}{f B_{\text{ext}}} \quad (1)$$

where E_i is the maximum induced electric field strength in the body or organ of interest (after averaging or filtering) in units of V/m, B_{ext} is the externally applied magnetic flux density in units of T (Tesla) and f is the frequency in Hz (Hertz or cycles per second). The induction coefficient has units of (V/m) per (Hz-T) or (V/m) per (T/s) and is usually frequency independent except where the conductivity in the model changes with frequency. In this case, the change of C_i with frequency is very gradual, in line with the gradual change of tissue conductivity with frequency.

The induction coefficient is useful for calculating a reference level flux density from the basic restriction electric field strength or vice versa by the appropriate manipulation of (1). A review of computational dosimetric analyses was carried out and induction coefficients judged to be representative of worst-case exposure scenarios were calculated from the published results. This is summarized in Table 1 below in terms of the worst-case 99th and 100th (or maximum) percentile induction coefficients found in the studies. The 99th percentile is calculated by using the level of induced electric field strength exceeded by only 1% of the voxels or discrete averaging volumes in the tissue. The 100th percentile is calculated using the maximum averaged E_i in the tissue of interest. Filtering by choosing the 99th percentile value is used by many authors and is specified in the ICNIRP 2010 standard as a means of dealing with stair-casing errors.

Table 1. Summary of worst-case 99th percentile and 100th percentile (maximum) induction coefficients using various anatomical modelling results:

Author(s)	Induction Coefficient (V/m per Hz-T)		Model Grid (mm)	Skin cond. (S/m)	Comments
	99th %tile	100th %tile			
Dimbylow (2005)	1.02	2.6	2	0.1	-adult male & female
So et al., (2004)	1.28	4.7	3.6, 2	0.1	-used non-uniform exposure field, adults only
Schmid et al., (2013)	0.90	3.0	1	0.1	-10 yr old female model
	0.75	88.0	1	0.0002	-10 yr old female model
Bakker et al., (2012)	3.1	N/A	2	0.0002	-6 yr old male model
Caputa et al., (2001)	1.63	19.3	2	0.0002	-76 kg male model
	1.68	22.5	2	0.0002	-104 kg male model

ICNIRP 2010	1.20	n.a.	n.a.	-value used in the derivation of magnetic flux density reference levels
IEEE 2005	1.03	n.a.	n.a.	-obtained from homogeneous ellipsoidal model. Used in the derivation of reference level.

n.a.- not applicable, N/A – not available

As can be observed from Table 1, the induction coefficients derived from the various induction modelling studies outlined above are variable and known to be influenced by voxel (grid) size, numerical modelling procedures, body model size, applied conductivity parameters and tissues chosen as part of the modelling exercise, among others. With the exception of the results of Bakker et al., (2012), the 99th percentile induction coefficients ranged from 0.75 to 1.68 V/m per Hz-T, with a mean of approximately 1.2.

Derivation of magnetic flux density reference level

For the frequency range applicable to SC6 (i.e. greater than 3 kHz), the IEEE C95.1-2005 and ICNIRP 2010 standards specify the basic restriction for induced electric field strength in the form:

$$E_{BR}(f) = \frac{E_o}{K} \frac{f}{f_e} \quad \text{for } f \geq f_e \quad (2)$$

where E_o is the rheobase threshold induced electric field strength, K is a safety or reduction factor (reduction factors are typically 5 or 10 depending on the protected population group) and f_e is the transition frequency beyond which, the basic restriction has a linear dependence on frequency. For example, the ICNIRP 2010 general public basic restriction has $E_o/Kf_e = 1.35 \times 10^{-4}$ V/m/Hz, $K = 10$ and $f_e = 3000$ Hz.

The flux density reference level can be calculated by rearranging (1) to give:

$$B_{RL} = \frac{E_{BR}}{f C_i} = \frac{E_o/Kf_e}{C_i} \quad (3)$$

It can be seen from (3) that the large disparity of induction coefficients obtained through induction modelling would lead to a wide variation in derived reference levels. In addition, ICNIRP 2010 specifies So et al. (2004) as its reference for its adopted value of $E_o = 4$ V/m. The study of So et al. (2004) was essentially a dosimetric analysis of induced electric fields in 3 different realistic anatomical voxel models exposed to MR gradient coils. So et al. (2004) used their calculated induction coefficients obtained from induction modelling to convert empirical, rheobase threshold dB/dt data from Den Boer et al. (2002) into a rheobase threshold electric field strength E_o . Thus, the steps in going from the original empirical dB/dt data to the calculation of a reference level B in ICNIRP 2010, ultimately relied upon two dosimetric modelling steps.

An alternate approach to the derivation of flux density reference levels that does not rely on dosimetric analysis is based on the strength-duration relationship for electro-stimulation of nervous tissue written in terms of dB/dt (Den Boer et al. 2002) as:

$$\left(\frac{dB}{dt}\right)_{Th} = \left(\frac{dB}{dt}\right)_{Rh} \left(1 + \frac{\tau_e}{t_p}\right) \quad (4)$$

where $(dB/dt)_{Th}$ is the nerve stimulation threshold as a function of stimulus duration t_p , τ_e is the “chronaxie” or SD time constant and $(dB/dt)_{Rh}$ is the rheobase time-rate-of-change of the magnetic flux density $B(t)$.

Relationship (4) has been found to accurately describe the empirical threshold response in a wide range of experimental studies on human volunteers using magnetic resonance imaging (MRI) gradient systems and other means of magnetically-induced electro-stimulation (Den Boer et al., 2002; Bourland et al., 1999; Recoskie et al., 2009). Rheobase thresholds and chronaxie times vary for different nervous tissue types (Reilly 1998) and for different individuals.

Reference levels are usually derived for exposure to continuous sinusoidal fields while the relationship (4) is obtained from so-called “trapezoidal” waveforms of $B(t)$ consisting of ramps of duration t_p followed by flat-topped plateaus. To derive a reference level, it is assumed that the stimulus waveform for which the parameters in (4) were found, consists of a triangular wave with stimulus duration $t_p = T/2 = 1/2f$, where T is the period and f is the frequency of the waveform. A sinusoidal flux density with amplitude B_o and the same frequency f will have its maximum derivative equal to $2\pi f B_o$. Equating the maximum derivative of the sinusoid to the nerve stimulation threshold in (4), divided by a reduction factor K , gives:

$$2\pi f B_o = \frac{1}{K} \left(\frac{dB}{dt}\right)_{Rh} (1 + 2f \tau_e) \quad (5)$$

The peak sinusoidal flux density B_o in (5) is equivalent to a peak sinusoidal reference level since it should not be exceeded by an environmental field. As is customary in most standards, for the range of frequencies $f > 1/2\tau_e$, the asymptotic form of (5) is used (i.e. the “1” inside the brackets is ignored) and the RMS reference level becomes:

$$B_{RL,RMS} = \frac{\tau_e}{\pi \sqrt{2} K} \left(\frac{dB}{dt}\right)_{Rh} \quad (6)$$

where the factor $\sqrt{2}$ arises from the conversion of a sinusoidal peak to RMS quantity.

Using (6), magnetic flux density reference levels can be calculated using data from a number of empirical human MR studies. Table 2 outlines mean (50% percentile) rheobase threshold levels, chronaxie times and calculated reference levels (for a reduction factor $K=10$) from the human volunteer study data summarized by Zhang et al., 2003; Table 5.

Table 2. Mean threshold magnetic flux density for perception of PNS with a reduction factor K=10 incorporated, calculated using (6).

Study	Number of Subjects	Waveform	Rheobase $(dB/dt)_{Rh}$ (T/s)	Chronaxie τ_e (ms)	Magnetic flux density B_{RL} (μ T RMS)
Ham et al. (1997)	4	Trapezoidal	n/a	0.810	n/a
Bourland et al. (1999)	84	Trapezoidal	14.9	0.365	122
Hebrank & Gebhardt (2000)	65	Trapezoidal	16.3	0.526	193
		Sinusoidal	12.4	0.672	232
Zhang et al. (2003)	22	Trapezoidal	23.8	0.370	198
Den Boer et al. (2002)	153*	Trapezoidal	18.8	0.360	153

Note (*) – This study was a meta-analysis of 3 previous studies, comprised of results from 153 subjects.

The meta-analysis study of Den Boer et al. (2002) combined data from 3 separate studies (Ham et al., 1997; Bourland et al., 1999; and Hebrank et al., 2000) using a total of 153 volunteers and provided statistics concerning the weights, heights and ages of the subjects, which indicated that they were mostly young, fit adults. This exposure group represents the most sensitive population for PNS as children and individuals suffering from a variety of peripheral neuropathies display higher perception thresholds (i.e. rheobase) for PNS and longer chronaxie than young healthy adults (Karup and Moldovan, 2009; Farrar et al., 2013; Bae et al., 2008; Yerdelen et al., 2010). The meta-analysis data of Den Boer et al. (2002) represents the most reliable estimate of human PNS perception thresholds.

Using the reported means and standard deviations of the rheobase threshold and chronaxie times (18.8 ± 0.6 T/s and 0.36 ± 0.02 ms, respectively) in Den Boer et al. (2002), reference levels based on different coverage factors (other than the 50th percentile) using the expanded uncertainty can be calculated. An RMS magnetic flux density value of 153 μ T is obtained for the mean (50th percentile) value of PNS perception for the uncontrolled environment (with a safety factor of 10 incorporated). Standard uncertainties of both rheobase and chronaxie parameters were calculated as the decibel equivalent of one standard deviation below the mean, normalized to the mean, resulting in standard uncertainties of -0.28 dB and -0.50 dB, respectively, with a combined standard uncertainty of -0.78 dB. By applying these uncertainty factors, Table 3 indicates that at a RMS magnetic flux density of 117 μ T, there is a probability greater than 99% (coverage factor of 3) that the mean threshold for perception of PNS falls above this value, with a 10-fold margin of safety incorporated.

Table 3. Estimated magnetic flux density reference levels for different expanded uncertainty coverage factors. Data for mean and standard deviation of rheobase threshold and chronaxie was from Den Boer et al. (2002).

Coverage factor	Expanded Uncertainty	B _{RL} at coverage factor (RMS values)
1	-0.78 dB	139 μT
2	-1.56 dB	127 μT
3	-2.34 dB	117 μT

Based upon the above considerations, the RMS magnetic flux density value at a coverage factor of 3 can be used for deriving Uncontrolled Environment magnetic field strength reference levels in SC6 (2015). Conversion into RMS magnetic field strength (H) and rounding down yields reference levels for Uncontrolled- and Controlled-Environments of 90 A/m and 180 A/m, respectively.

PNS-based basic restrictions from empirical human MR data

So far the reference levels derived in the previous section pertain to exposure of the main trunk of the body since they were ultimately based on whole body MRI gradient coil exposure data. The main trunk of the body, having the largest cross-sectional area, has the lowest perception thresholds in terms of dB/dt. If trunk-only exposure were the only consideration in the standard, then the need for a basic restriction, at least in regards to magnetically-induced stimulation, might be thought of as unnecessary. However, it is known from Faraday induction principles that body parts with smaller cross-sectional areas can be exposed to higher external magnetic flux densities at the same level of induced electric field strength as for larger cross-sectional areas. Thus, having a basic restriction is useful for allowing the estimate of an effective reference level for limbs if an induction coefficient for that part of the body and exposure field orientation is known. For example, an induction coefficient corresponding to an axially-oriented magnetic flux density in the arm or leg can be calculated using a simple homogeneous loop model. In this case the induction coefficient is known to be equal to the number pi times the radius of the limb (in m) (ICNIRP, 1998).

If the trunk-only reference level B_{RL,RMS} is established, the basic restriction can be calculated by rearranging (1) into:

$$E_{BR} = C_i f B_{RL,RMS} \quad (7)$$

where E_{BR} is the sinusoidal RMS basic restriction for the affected nerve tissues in the trunk arising from whole body exposure. If it is assumed that the nerve tissues in the

limbs exhibit similar threshold behaviour as nervous tissue in the trunk, then the E_{BR} from (7) can be considered a universal basic restriction for PNS throughout the body.

Using (7) and an assumed induction coefficient of 1.2 V/m per Hz-T (mean value in Table 1) and the RMS flux density reference level of 113 μ T (converted from $H_{RL,RMS} = 90$ A/m) for uncontrolled environments, an RMS internal electric field strength basic restriction of $1.36 \times 10^{-4}f$ is computed for the Uncontrolled Environment. Since ICNIRP (2010) has specified a similar basic restriction of $1.35 \times 10^{-4}f$ for Uncontrolled Environments, which is slightly lower than the value derived above, SC6 (2015) will harmonize its basic restriction for the avoidance of PNS perception in the 3 kHz to 10 MHz frequency range with that of ICNIRP (2010) for the Uncontrolled Environment at $1.35 \times 10^{-4}f$. The Controlled Environment basic restriction in SC6 (2015) would therefore also be harmonized with ICNIRP (2010) at $2.7 \times 10^{-4}f$. These values provide an estimated 10 fold (for uncontrolled environment) safety margin for perception of PNS at the assumed induction coefficient of 1.2 V/m per Hz-T.

Therefore, the basic restrictions for the avoidance of PNS perception in SC6 (2015) are:

Exposure Group	Frequency range	Internal E-field (Vm^{-1}) (for any part of the body)
Controlled Environment	3 kHz – 10 MHz	$2.70 \times 10^{-4}f$
Uncontrolled Environment	3 kHz – 10 MHz	$1.35 \times 10^{-4}f$

- f denotes frequency in Hz

For localized exposures to the limb (which have small cross-sectional areas and therefore lower rates of induction), the reference levels of 90 A/m (Uncontrolled) and 180 A/m (Controlled) may be exceeded provided that the basic restrictions within the limb are not exceeded.

Thermal Effects: SAR-based basic restrictions

In the 100 kHz – 10 MHz frequency range, SC6 (2009) specified basic restrictions for the avoidance of thermal effects. These basic restrictions specified limits on whole-body average (WBA) specific absorption rate (SAR; a measure of energy deposition rate within the body), and peak spatially-averaged SAR (maximum energy deposition rate within a discrete tissue volume). These basic restrictions are based upon scientific consensus of a threshold value of approximately 4 W/kg for thermally-related ($\sim 1^\circ C$ colonic temperature rise) behavioural changes in rodents, non-human primates and in human volunteers (reviewed in IEEE C95.1, 2005; Foster and Adair, 2004; Adair and Black, 2003; Foster and Glaser, 2007). Existing international (ICNIRP 1998; IEEE C95.1, 2005) and national (SC6, 2009; FCC, 2006) science-based exposure standards have incorporated safety margins of 10 and 50 in the derivation of basic restrictions for the avoidance of thermal effects for exposures in Controlled and Uncontrolled Environments, respectively. These safety factors ensure that worst-case human exposures

to RF fields incurred in uncontrolled- and controlled-environments, within the prescribed exposure limits, do not result in alterations in core body temperature of the individual of more than a few tenths of 1°C (reviewed in IEEE C95.1, 2005).

The basic restrictions for WBA-SAR in SC6 (2009) are identical to those in ICNIRP (1998) and IEEE C95.1 (2005). These basic restrictions remain unchanged in the revised version of SC6 (2015) since no new adverse health effects have been identified at exposures below these levels since the last version of SC6 (2009).

The basic restrictions specified for WBA-SAR in SC6 (2015) are:

Exposure Group	Frequency range	WBA-SAR limit (W/kg)*
Uncontrolled Environment	100 kHz – 10 MHz	0.08
Controlled Environment	100 kHz – 10 MHz	0.40

* - averaged over any 6 minute reference period.

In addition to basic restrictions on WBA-SAR, SC6 (2009) also includes basic restrictions for peak spatially-averaged SAR within discrete volumes of tissue. The original derivation of peak spatially-averaged SAR limits in SC6 and other international standards were based upon dosimetric estimates of a 20:1 variation in peak spatially-averaged SAR to WBA-SAR within the human body, whereby a 1.6 W/kg peak spatially-averaged SAR limit for the uncontrolled environment was based upon a WBA-SAR limit of 0.08 W/kg. With refinements in dosimetry, it was later determined that the actual variation among peak spatially-averaged SAR to WBA-SAR was more approximately a 100:1 ratio (Bernardi et al., 2003).

On the other hand, numerous studies have demonstrated cataract formation in experimental animals at peak spatially-averaged SARs of ~100-150 W/kg (Elder, 2003), presumably due to thermal effects in the eye (tissue volume ~ 10 g). However, recently Hirata et al. (2008) used modern computational approaches to re-examine some of the early work on cataract formation in rabbit eyes conducted by Guy et al. (1975). They found that the threshold for the occurrence of cataracts in rabbit eyes observed by Guy et al. (1975) may actually have occurred at a lower SAR (~67 W/kg) than previously estimated, although the use of anaesthesia in the Guy et al. (1975) study predisposed the animals to thermal effects in the lens. Additional work is required to study the effect of localized RF exposure in the near-field on temperature responses in the eye. Based upon a considerable breadth of historical information on cataract induction in animals, ICNIRP (1998) and IEEE C95.1 (2005) have established Uncontrolled Environment peak spatially-averaged SAR limits of 2 W/kg averaged over 10 g tissue, based upon an estimated 50-fold reduction below the threshold for cataract formation in animals (~100 W/kg).

Studies modelling the thermal response to RF fields in discrete volumes of human tissue have indicated that temperature changes in the eye from exposures at the ICNIRP (1998) Controlled Environment peak spatially-averaged SAR limits of 10 W/kg averaged over 10 g of tissue, are no more 1.4°C above pre-exposure levels (Wainwright, 2007). This is

well below the temperature threshold required for the induction of thermally-induced cataract effects, which requires lens temperature to reach $\sim 41^{\circ}\text{C}$. Similarly, studies on temperature increases in brain tissue at the ICNIRP (1998) Controlled Environment peak spatially-averaged SAR limit of 10 W/kg averaged over 10 g of tissue, found maximum discrete (10 g) temperature responses in the brain ranging from 0.6-1.2 $^{\circ}\text{C}$ (reviewed in IEEE C95.1, 2005). These increases are also well within the normal physiological range for brain tissue and well below the threshold required to induce pathological effects. Since SC6 (2009) specifies peak spatially-averaged SAR limits that are 20% lower than those in specified in ICNIRP (1998) and IEEE C95.1 (2005), and are averaged over 1 g of tissue (instead of 10 g), the relative temperature increases in human brain and eye tissues from peak spatially-averaged SARs at the Controlled Environment peak spatially-averaged SAR limit outlined in SC6 (2009) would be much lower than that estimated above.

The following table lists the basic restrictions on peak spatially-averaged SAR in SC6 (2015), ICNIRP (1998) and IEEE C95.1 (2005):

Exposure Group	Tissue	Frequency range	Peak spatially-averaged SAR limit (W/kg)	Averaging Volume (g)
SC6 (2015) Controlled Environment	Head, neck, trunk	100 kHz- 6 GHz	8*	1
	Limbs		20*	10
SC6 (2015) Uncontrolled Environment	Head, neck, trunk	100 kHz- 6 GHz	1.6*	1
	Limbs		4*	10
ICNIRP/IEEE-C95.1 Controlled	Head, neck, trunk	100 kHz- 6 GHz	10*	10
	Limbs		20*	10
ICNIRP/IEEE-C95.1 Uncontrolled	Head, neck, trunk	100 kHz- 6 GHz	2	10
	Limbs		4	10

* averaged over any 6 minute reference period.

While the peak spatially-averaged SAR limits in ICNIRP (1998) and IEEE C95.1 (2005) are biologically-based (cataract formation) and those in SC6 (2009) and FCC (2006) were derived from early dosimetric considerations, the peak spatially-averaged SAR limits in ICNIRP (1998) and IEEE C95.1 (2005) are less restrictive than those in SC6 (2009) for two reasons: 1) for localized exposures in the head, neck and trunk, SC6 (2009) specifies a maximum SAR of 1.6 W/kg and 8 W/kg for Uncontrolled and Controlled Environments, respectively, compared to 2 W/kg and 10 W/kg in the ICNIRP (1998) and IEEE C95.1 (2005) guidelines for the Uncontrolled and Controlled Environments, respectively; and 2) the peak spatially-averaged SAR in the head, neck and trunk is calculated over 1 g of tissue in the SC6 (2009) standard, whereas the peak spatially-averaged SAR is calculated over 10g of tissue in the ICNIRP (1998) and IEEE C95.1

(2005) standards. The lower tissue averaging volume in SC6 (2009) results in a more restrictive peak spatially-averaged SAR limit, as it provides more protection against the occurrence of small regions with thermal hot-spots. Based upon the uncertainties in exposure assessment, the occurrence of relatively higher brain peak spatially-averaged SARs in children compared to adults from near-field sources (e.g. cell phones) (Wiert et al., 2008; Christ et al., 2010), the uncertainty in possible long-term health risks associated with cell phone use and ongoing public concern about cell phone safety, the basic restriction for peak spatially-averaged SAR limits in SC6 (2015) remain unchanged from those in the previous version of SC6 (2009) to maintain an additional margin of safety.

SAR-based reference levels, 100 kHz-10 MHz

In this frequency range, electric and magnetic fields display characteristics similar to static fields in that they are, to a large extent, uncoupled and therefore can be treated separately. In addition, due to the long wavelengths at these frequencies, exposure from a source is typically in the near-field region and power density is not a useful metric. This means that, in general, both the electric field strength and magnetic field strength should be characterized when assessing electromagnetic safety.

In the quasi-static frequency range, the induction of internal voltages and currents in the body due to externally applied electric and magnetic fields is strongly determined by the constituent electrical parameters of tissue, namely the magnetic permeability, electrical permittivity and conductivity. The magnetic permeability of tissue is identical to that of free space and the induction of electric fields and currents in tissues from externally applied magnetic fields is governed by Faraday's law. For electric field exposure, the high permittivity and conductivity of tissues result in the coupling of strong surface charges on the body and relatively weak electric field strengths and currents within the body.

As indicated above, two biological phenomena exist that require two separate basic restrictions in this frequency range. Since PNS and thermal effects have significantly different latency times (onset from exposure to effect), the specification of two different sets of reference levels is warranted. PNS-based basic restrictions and reference levels require an effectively instantaneous reference period, for comparison to the exposure limits in SC6 (2015), due to the ability of induced electric fields to cause an instantaneous alteration of the resting membrane potential of neurons. Therefore, basic restrictions and reference levels for the avoidance of PNS require limits on the instantaneous peak (RMS) amplitudes of internally-coupled or external fields. Alternatively, SAR-based basic restrictions and reference levels are related to thermal effects and are therefore influenced by the thermal time constant of the human body to externally applied thermal influences. For the purposes of establishing SAR-based basic restrictions and reference levels, a six-minute reference period, based upon the thermal time constant of living tissues (i.e. the time it takes for tissue temperature to begin to rise in the case of sufficiently high exposure), has been selected to restrict the temporally averaged internally-coupled or external fields.

For pulsed RF field strengths at frequencies where both types of basic restrictions exist (0.1-10 MHz for magnetic fields and 1-10 MHz for electric fields), the effect of having the two sets of reference levels is to limit both the peak amplitude and duty factor, such that both sets of basic restrictions are respected.

SAR-based Magnetic Field Reference Levels, 3kHz – 10 MHz

Two simultaneous criteria were considered when establishing the reference levels for SC6 (2015) in the 3 kHz to 10 MHz frequency range. These were: 1) the adoption of separate basic restrictions for PNS and thermal effects, and 2) harmonization with international standards, where justified.

SAR in a discrete volume of tissue is proportional to the local conductivity and the square of the magnitude of the induced electric field strength. Therefore, SARs (whole-body-averaged and spatial-peak, 1g) from purely magnetic field exposure in this frequency range are due to the induction of internal electric fields. The distribution of SAR intensities in the body follow the patterns of induced electric field strength and locations of spatial peak 1g SAR in the body are likely to be close to those for peak induced electric field strength that are of interest to PNS dosimetry.

As in the case for PNS-oriented dosimetric analyses, a SAR-based induction coefficient similar to (1) can be defined as the square root of either the whole-body-averaged SAR (WBA-SAR) or spatial-peak, 1g SAR (SP1g-SAR) divided by the frequency, f , and the external magnetic field strength (usually uniform), H_{ext} :

$$K_{\text{WBA}} = \frac{\sqrt{\text{WBA} - \text{SAR}}}{f H_{\text{ext}}} \quad , \quad K_{\text{SP1g}} = \frac{\sqrt{\text{SP1g} - \text{SAR}}}{f H_{\text{ext}}} \quad (8)$$

where K_{WBA} and K_{SP1g} are the SAR-based induction coefficients corresponding to whole-body-averaged and spatial-peak, 1g SARs, respectively.

For sinusoidal, external magnetic field exposure, the induced electric field strength is proportional to frequency. Thus, for a frequency-invariant conductivity, the square roots of whole-body-averaged or spatial-peak, 1g SARs are proportional to frequency and the resulting SAR-based induction coefficients are constant. However, in this frequency range, tissue conductivities slowly increase with frequency, yielding slowly changing values of K_{WBA} and K_{SP1g} with frequency (since they vary with the square root of conductivity, their change with frequency is relatively small). An in-house dosimetric study using 2mm voxel models and conductivity data from Gabriel (1996), resulted in values of K_{WBA} and K_{SP1g} that increased by 36% from 100 kHz to 10 MHz. Below 100 kHz, their values changed by less than 3%.

From the definition of the SAR-based induction coefficients in (8) and the fact that basic restrictions for WBA-SAR and SP-1g SAR are frequency independent, a SAR-based reference level with f^{-1} dependence would be appropriate in this frequency range. This is

evidenced in the IEEE C95.1-2005 and ICNIRP 1998 standards (see Figures 1(b) and 2(b), respectively).

Limited SAR-based dosimetric analyses have been reported for pure magnetic field exposure in this frequency range (Kaune et al., 1997, Dawson & Stuchly, 1998). The results from these studies have been converted into values of H_{ext} that produce the uncontrolled and controlled environment WBA-SAR basic restrictions of SC6 (2015) and are plotted in Figures 1(b) and 2(b). The models include a homogeneous adult ellipsoid (Kaune et al., 1997) and an adult male voxel model (Dawson & Stuchly, 1998). For the latter, SAR calculations were performed only at 60 Hz so it was necessary to extrapolate to higher frequencies using the known variation of conductivity with frequency in the Gabriel, 1996 dataset.

In addition, an in-house study using voxel models of a 19.4 kg six year old and a 72.6 kg adult male (Christ et al. 2010) was undertaken (HC internal report, 2014). These models also utilized the conductivity data in Gabriel (1996) and computations were made using the magneto quasi-static FDTD solver available in the commercial software SEMCAD V14. Results from that study in terms of H_{ext} that produces the uncontrolled and controlled environment WBA-SAR and SP1g-SAR basic restrictions are also plotted in Figures 1(b) and 2(b).

From Figures 1(b) and 2(b) it can be seen that the homogeneous ellipsoid model produced the highest K_{WBA} of all the models and consequently the lowest threshold of H_{ext} that produces the basic restriction, for each frequency. The larger of the two different-sized voxel models used in the in-house study produced the higher K_{WBA} as expected from consideration of Faraday's law (i.e. the larger the cross-sectional area normal to the incident magnetic field, the greater the induced electric field strength). Also, it was found that K_{SP1g} is marginally greater than K_{WBA} for the 72.6 kg adult voxel model, suggesting that the spatial-peak, 1g SAR basic restriction is the most limiting factor for voxel-model-based dosimetry. Interestingly, it was observed that the locations of maximal SP1g-SAR in the adult voxel model, for frequencies at 100 kHz and higher, tended to be on the periphery of the trunk, in the general area of the hips. This is also the same general location as the maximum induced electric field strength and is an area often given as the site of experimentally-induced peripheral nerve stimulation in magnetic resonance imaging (MRI) studies (Glover, 2009)

A SAR-based reference level, when plotted versus frequency, should be below the lowest value of H_{ext} that produces the basic restriction (see Figures 1(b) and 2(b)). If set at the same rate of fall-off as the dosimetry H_{ext} data, it should have an f^{-1} dependence (as explained previously). Ideally, it should begin at the frequency where the NS-based reference level and the SAR-based reference level curves intersect. This is based on the consideration that NS-based RLs limit the temporal maximum of a waveform while the SAR-based ones limit the time averaged values, which must always be less than the temporal maximum.

For the SC6 (2015) SAR-based magnetic field reference levels, the sloped portion of the ICNIRP (1998) limits were extended back to 100 kHz (for the Uncontrolled Environment) or set to begin at 100 kHz (for the Controlled Environment). Both sets of frequency dependent limits are extended to 10 MHz as shown in Figures 1(b) and 2(b). This approach gives a common start frequency for controlled and uncontrolled reference levels and the same frequency dependency (f^{-1}). The ICNIRP (1998) magnetic field reference levels below 100 kHz were meant to protect against PNS, however this frequency range is covered by the new PNS-based reference levels specified in SC6 (2015). Therefore, it was decided to begin the SAR-based reference levels only at 100 kHz. The resulting reference levels are slightly more restrictive than the SAR-based reference levels in SC6 (2009). Based upon the dosimetry data depicted in Figures 1(b) and 2(b), there is a large margin of compliance of the SC6 (2015) SAR-based reference levels to the basic restrictions.

Magnetic Field Strength Reference Levels in SC6 (2015)

Frequency (MHz)	Reference Level Basis	Reference Level H_{RL} , (A/m) (rms)		Reference Period (min)
		Uncontrolled Environment	Controlled Environment	
0.003 – 10	PNS	90	180	Instantaneous
0.1 – 10	SAR	$0.73 / f$	$1.6 / f$	6 minutes

- Frequency, f , is in MHz.
- PNS, peripheral nerve stimulation
- SAR, specific absorption rate

Electric Field Reference Levels, 3kHz-10MHz

As with magnetic fields, two simultaneous criteria were considered when establishing the electric field reference levels for SC6 (2015). These were: 1) the adoption of separate basic restrictions for PNS and thermal effects, and 2) harmonization with international standards, where justified. Over the frequency range 3 kHz to 10 MHz, the ICNIRP (2010) NS-based electric field strength reference levels (uncontrolled and controlled) have been adopted in SC6 (2015) (see Figures 3 and 4).

For SAR-based reference levels, harmonization of the reference levels in SC6 (2015) with those of ICNIRP (1998) is relatively straight-forward for Uncontrolled Environments since the SAR-based and PNS-based reference levels intersect at approximately 1 MHz (the precise frequency is 1.10 MHz). Therefore, the Uncontrolled Environment SAR-based reference level for SC6 (2015) was applied at 1.10 MHz and follows the ICNIRP (1998) Uncontrolled Environment reference level up to 10 MHz. This also provides a match to the 10 MHz – 6 GHz electric field strength reference levels where the two frequency ranges meet and results in a convenient $f^{-0.5}$ frequency dependency.

For Controlled Environments, harmonization with ICNIRP (1998) was somewhat more difficult because of the f^{-1} frequency dependency of ICNIRP (1998) SAR-based Controlled Environment reference level. It was decided that matching the Controlled Environment electric field strength reference level at 10 MHz to the value specified for the 10 MHz - 6 GHz range and maintaining the same frequency dependency as for the Uncontrolled Environment, were the most important factors. The resulting Controlled Environment SAR-based reference level curve is shown in Figure 4. It can be seen that the SAR-based and PNS-based reference level curves do not conveniently intersect at 1 MHz. The precise frequency of intersection is 1.29 MHz and therefore, it was decided to apply the Controlled Environment SAR-based reference levels at 1.29 MHz.

Comparison of the SAR-based electric field strength reference levels to the minimum electric field strengths required to meet the basic restrictions in Figures 3 and 4, demonstrates that compliance for whole body SAR is achieved (Durney et al., 1986), however peak spatially-averaged SAR in the limbs at ~10 MHz is not (Gandhi et al., 1985). At this specific frequency, the margin of non-compliance is small (this case is due to induced current flowing in the ankles, with good contact to the ground and a vertically polarized electric-field). However, this situation is likely also non-compliant with induced current reference levels specified in SC6 (2015), see Section 2. This reinforces the notion that even though electric field strength levels may be compliant with the reference levels, induced current reference levels may be exceeded. Therefore, measurement of induced current is a necessary component of a complete RF compliance assessment.

Similarly, this same situation can occur with contact currents, as illustrated in Figures 5 and 6. In these figures, the levels of incident electric field strength of sufficient intensity to cause perception-level and let-go level contact currents are plotted for different ungrounded objects and are compared to the Uncontrolled- and Controlled-Environment electric field strength reference levels in SC6 (2015). Let-go level currents are defined as the maximum current at which a person can release an energized conductor using muscles that have been stimulated by the current. The amount of current is highly variable from person to person and is dependent upon the type of contact (finger touch versus hand grasp). All data represents the 50th percentile response (Gandhi et al., 1982; Bernhardt, 1988).

In Figures 5 and 6, it can be seen that both the Uncontrolled and Controlled Environment reference levels provide a greater level of protection from potential contact currents in SC6 (2015) as compared to SC6 (2009). However, it should be recognized that there are still situations in the Uncontrolled Environment where the electric field reference levels may be complied with, but contact current limits are exceeded. Therefore, in situations where contact with energized, ungrounded conductors can occur, assessment of compliance to the contact current reference levels in SC6 (2015) is necessary.

Based upon the above dosimetric information, the electric- and magnetic-field strength reference levels in the 3 kHz – 10 MHz frequency range of SC6 (2015) are:

Electric Field Strength Reference Levels in SC6 (2015)

Frequency (MHz)	Reference Level Basis	Reference Level E_{RL} , (V/m) (rms)		Reference Period
		Uncontrolled Environment	Controlled Environment	
0.003 – 10	PNS	83	170	Instantaneous
1.0 – 10	SAR	$87 / f^{0.5}$	$193 / f^{0.5}$	6 minutes

- Frequency, f , is in MHz.
- PNS, peripheral nerve stimulation
- SAR, specific absorption rate
- The precise frequencies at which SAR-based electric field strength reference levels for Uncontrolled and Controlled Environments begin are 1.01MHz and 1.29 MHz, respectively.

Recommendations for Spatial Averaging

For electric field exposure, the highest induced field strengths and current densities occur for the condition where the external electric-field vector is parallel to the long axis of the body and the body is standing on a conductive earth. At these frequencies, the body behaves similarly to a conductor where the distorted external field lines terminate perpendicularly on the surface of the body and induce a surface charge. At any horizontal cross-section through the body, the total current flowing towards ground is dependent on the total surface charge above that cross-section (Dimbylow, 2005). The result is that the highest current densities and induced electric field strengths occur in the ankle area and are a function of the surface area of the body above. This implies that a spatial average over the vertical extent of the body is a reasonable estimate of the equivalent uniform electric field strength that was used in the derivation of the reference levels.

For magnetic field exposure, the highest internally induced electric field strengths occur for geometries of the tissue or organs with the lowest conductivities that present the highest cross-sectional area to the field vector. A low-conductivity tissue or organ surrounded by high-conductivity tissue will selectively respond with higher induced electric-field strengths than the surrounding tissues despite the fact that the exposure field is uniform (Dimbylow, 2005). This implies that a spatially non-uniform external magnetic field and a uniform one with the same spatial peak magnitude could potentially induce the same internally induced electric-field strength in a target tissue or organ. In this case, spatial averaging of the non-uniform external magnetic field would give an under-estimate of the corresponding internally induced electric field strength. Thus, to ensure that the basic restriction for PNS is complied with, comparison of the spatial peak magnetic field strength (instead of the spatially-averaged magnetic field strength) should be made to the reference level at frequencies less than 100 kHz.

At frequencies where both PNS- and SAR-based BRs exist and beyond, spatial averaging of both the external electric- and magnetic-field strength are permitted since the SAR-based reference levels are based on whole-body absorption.

Section 2 Induced and Contact Currents (3 kHz – 110 MHz)

Contact currents can occur when a person simultaneously touches two conductive objects that are at different electrical potentials, resulting in current flowing through the body. The magnitude of the current is proportional to the electrical resistance between those two points (WHO 2007). Induced currents can occur when a person is exposed to EMF, typically in close proximity to the source, whereby internal body electric currents are induced by external fields. The magnitude of the induced current is dependent on the proximity to the source, frequency, orientation/polarization of the body to the incident field and grounding (e.g. footwear).

In the previous version of SC6 (2009), the induced and contact current limits were based upon avoidance of PNS (perception and/or pain) at frequencies from 3 – 100 kHz and thermal effects (thermal perception and/or pain) for frequencies from 0.1 – 110 MHz. These effects are known to be frequency-dependent in the 3 - 100 kHz frequency range, but quite stable at frequencies from 0.1 -110 MHz. However, the basic restrictions in SC6 (2009) were derived from volunteer studies conducted using adult men.

Additional studies assessing men, women and children exposed to EMF in the 3- 100 kHz range have identified the threshold for PNS (perception of tingling sensation) of induced/contact current to be in the range of ~1 – 25 mA for the most sensitive individuals under worst-case conditions across this frequency range. For finger-touch contact current, the threshold for pain on finger contact is estimated to be in the range of ~2 – 33 mA, dependent on frequency. The let-go threshold for painful shocks are estimated to be ~15 – 112 mA, dependent on frequency. Based upon this information, IEEE 95.1 (2005) and ICNIRP (2010) have established maximum contact current limits of $167f$ and $200f$ (where f is frequency in MHz), respectively, for exposures in the Uncontrolled Environment in the 3 – 100 kHz frequency range. While the basic restrictions in SC6 (2009) for contact current are below the threshold for the occurrence of painful let-go shocks for both the Uncontrolled and Controlled Environments, the occurrence of field perception (tingling sensation) and painful finger-contact shocks cannot be ensured. SC6 (2015) has been revised to avoid the occurrence of finger-touch shocks in the 3 – 100 kHz frequency range.

Studies on volunteers exposed to EMF in the 0.1 – 110 MHz frequency range have indicated thermal perception in the limbs at an internal current of 100 mA and the possibility of burns at exposure levels of 200 mA. This effect is not frequency-dependent. The current version of SC6 (2009) set basic restrictions for the avoidance of thermal effects from induced and contact currents (one foot) at 100 mA and 45 mA for the Controlled and Uncontrolled Environments, respectively. Alternatively, IEEE C95.1 (2005) and ICNIRP (2010, 1998) have established exposure limits for contact currents at

lower levels, providing an additional margin of safety from the occurrence of such effects.

Basic restrictions on Induced- and Contact Currents at 3 – 100 kHz specified in SC6 (2009), ICNIRP (2010) and IEEE C95.1 (2005) are:

Exposure Group	Type of Exposure (Environment)	Maximum Induced Current (mA) (One foot)	Maximum Contact Current (mA)
SC6 (2009)	Controlled	1000 <i>f</i>	1000 <i>f</i>
	Uncontrolled	450 <i>f</i>	450 <i>f</i>
ICNIRP (2010)	Controlled	n/a	400 <i>f</i>
	Uncontrolled	n/a	200 <i>f</i>
IEEE C95.1 (2005)	Controlled	500 <i>f</i>	500 <i>f</i>
	Uncontrolled	167 <i>f</i>	167 <i>f</i>

f – denotes frequency in MHz

Basic restrictions on Induced- and Contact Currents in the 0.1 – 110 MHz range specified in SC6 (2009), ICNIRP (1998, 2010) and IEEE C95.1 (2005) are:

Exposure Group	Type of Exposure (Environment)	Maximum Induced Current (mA) (One foot)	Maximum Contact Current (mA)
SC6 (2009)	Controlled	100	100
	Uncontrolled	45	45
ICNIRP (2010, 1998)	Controlled	n/a	40
	Uncontrolled	n/a	20
IEEE C95.1 (2005)	Controlled	100	50
	Uncontrolled	45	16.5

f – denotes frequency in MHz

While the basic restrictions in SC6 (2009) are below the threshold for the occurrence of RF shocks and burns for both the Uncontrolled and Controlled Environments, the occurrence of thermal perception in the Controlled Environment cannot be excluded. Therefore, the induced- and contact-current reference levels in SC6 (2015) have been revised to take into account recent dosimetric information and to provide a larger safety margin for the avoidance of painful RF shocks and burns.

Since induced- and contact current limits are actually derived from the basic restrictions for internal electric field strength and SAR (except for contact current below 100 kHz whose limits are based on results from human volunteer studies), these limits are now specified as reference levels in SC6 (2015).

Reference levels

Induced Current

For the purposes of most electromagnetic exposure guidelines, induced current is usually defined as the longitudinal flow of current through a body that is in good electrical contact with the ground (often defined as standing barefoot). At frequencies at and below the whole body resonance, the response of a grounded body to an incident vertically-polarized electric field is to behave somewhat like a short-circuited metallic monopole where the induced current distribution is greatest near the ground and diminishes towards the upper parts of the body (Gandhi et al., 1986). The implication of this is that the largest currents flow through the ankles, which have a narrow cross-section of conductive tissue to carry the current. This results in relatively high SAR in the ankle at frequencies where tissue heating is of concern or results in high current density and induced electric field strength for frequencies where PNS is the limiting factor.

The empirical formula that relates induced current magnitudes to electric field strength states that the ratio of current to field strength is proportional to frequency and to the square of the body height (Gandhi et al., 1985; 1986). This would imply that for the same frequency, taller individuals would be subjected to greater induced currents. This relationship is valid up to the whole body resonance frequency (under grounded conditions), which is approximately 40 MHz for a 1.75m adult, 51 MHz for a 1.38m (10y old) child and 63MHz for a 1.12m (5y old) child (Gandhi et al., 1986).

The resulting SAR or current density is a function of the effective cross sectional area, A_e , of current flow. In the case of SAR, it is equal to $SAR = I^2 / (A_e^2 \sigma \rho)$, where I is the induced current through one limb, σ is the conductivity of the current carrying wet tissues and ρ is the mass density (usually taken to be 1000 kg/m^3). In the case of current density J , it is given by $J = I / A_e$, while the resulting induced electric field, E_i , is related to the current density through Ohm's law: $E_i = J / \sigma$. Thus, the resulting SAR or induced electric field is strongly dependent on the reciprocal of the effective cross section, $1/A_e$, which would typically be larger for smaller sized bodies (short adults and children). This effect partially compensates for the increase in induced current for larger sized bodies, suggesting that at the same frequency, SARs between children and adults may be similar. However, it is also noted that induced current magnitudes reach a peak at whole body resonance and given the higher frequencies at which these occur for children and the fact that conductivity increases with frequency, it is expected that worst-case ankle SAR for constant incident electric field strength would be higher for smaller bodies. This can be observed in Figure 7 both from the empirical data from (Gandhi et al., 1986) and the numerically-simulated data from realistic voxel models of a male and female (Dimbylow, 2002; 2006).

Since the conditions for optimal induction of ankle current are not common in practice, separate reference levels for induced current are usually provided in most exposure standards. This allows electric field strength reference levels to be less restrictive than if they had to protect against peak spatially-averaged SAR in the ankles, however the measurement of induced current becomes an additional requirement in order to

demonstrate compliance to all of the basic restrictions. Admittedly, it is not always easy to judge under what circumstances measurement of induced current is warranted. Some guidance on this is given in IEEE C95.1 (2005, p22-23), where it is suggested that for electric field strengths greater than approximately 16 or 17% of the reference levels, the induced current reference level may be exceeded (for frequencies from about 1 MHz to whole body resonance). Induced current can also be mitigated by footwear and in occupational settings, by floor coverings and operator training.

3 kHz to 400 kHz

ICNIRP (1998) does not specify reference levels for induced current at frequencies below 10 MHz, while ICNIRP (2010) makes no recommendations for induced current reference levels. While there is only limited human experimental data on the stimulatory effects of induced current in the frequency range 3 - 400 kHz in the scientific literature upon which to base reference levels, an estimation of induced currents in the ankles of sufficient magnitude to exceed the basic restrictions for induced electric field can be made. This was the approach used to derive reference levels for induced current in the 3 kHz to 400 kHz range.

In this frequency range, the basic restrictions for both Controlled- and Uncontrolled Environments for induced electric field have the form $E=kf$, where f is the frequency in hertz and k is a constant. An approximation of the reference level current flowing through the ankles, I_{RL} required to meet the basic restriction can be written as $I_{RL} = \sigma A_e E$ where the terms σ and A_e are defined in the paragraphs above. If the effective area and conductivity are assumed to be constant over this frequency range, then it can be seen that the reference level induced current should have a f^{-1} frequency dependency.

Figures 8 and 9 depict the induced current reference levels in SC6 (2015) and calculated estimates of the induced currents necessary to meet the basic restrictions for PNS (induced electric field) in the 3 kHz – 1 MHz frequency range. The sloped portions of the reference level curves (controlled and uncontrolled) were designed to have a f^{-1} frequency dependency and approximately follow the dosimetric data derived from (Dimbylow, 1988). The flat portion was based on thermal considerations and is discussed in the following section. The two curves intersect at 400 kHz (thus explaining why 400 kHz was chosen as the frequency boundary between PNS and SAR-based reference levels). Extending the PNS (sloped) reference level curve beyond the intersection frequency (as was done for electric field reference levels) may result in unacceptably high induced currents in the 400 kHz – 10 MHz frequency range that could lead to RF burns. Therefore, it was decided to extend the PNS-based induced current reference levels, with their associated reference time, only to 400 kHz where they meet the frequency independent SAR-based reference levels (with a reference period of 6 minutes).

The method for estimating the dosimetric data derived from Dimbylow (1988) in Figures 8 and 9, was based on calculations of current densities in the ankle of a realistic voxel model of an adult. For comparison to the basic restriction, the maximum current densities given in Table 4 (model C) of Dimbylow (1988) were divided by the conductivity of

muscle to obtain the equivalent maximum induced electric field for a pre-defined induced current amplitude.

The method for estimating the other threshold data in Figures 8 and 9 is from the formula: $I = \sigma A_e E_{BR}$ where $A_e = 9.5 \text{ cm}^2$ for the effective cross-section of current flow along with values of muscle conductivity ranging from 0.44 S/m at 10 kHz to 0.55 S/m at 1 MHz (Gandhi, [7]). As seen in Figures 8 and 9, the resulting estimates using this method are only slightly lower than the ones derived from the voxel model calculations (Dimbylow, 1988). In either case, given the approximate nature of the dosimetric data, it is difficult to estimate to what extent the induced current reference levels are protective of the basic restrictions.

400 kHz to 110 MHz

Figure 10 shows the Uncontrolled Environment induced current reference level of 40 mA for this frequency range, which is based on avoidance of peak spatially-averaged SAR in the ankles. A proportionate value of 90 mA for the Controlled Environment is based on the standard ratio 2.2:1 for SAR-based current or field strength quantities.

In the frequency range from 400 kHz to 110 MHz, the magnitude of induced current required to meet the basic restriction for SAR in the limbs rises slowly with frequency. This can be observed in Figure 10 where the induced currents in the ankles required to meet the Uncontrolled Environment basic restriction for SAR of 4 W/kg (averaged over 10 g) are plotted. The data from Gandhi et al. (1986) was calculated using the relationship between SAR and induced current I : $SAR = I^2 / (A_e^2 \sigma \rho)$, where the effective cross-sectional area estimated by Gandhi was 9.5 cm^2 (for a 1.75m adult) and conductivity data versus frequency was obtained from Dimbylow (1997). The SAR, so calculated, is effectively averaged over an approximate area of 10 cm^2 . If it is assumed that the longitudinal SAR distribution is uniform over a 1 cm vertical distance, then the SAR values can be considered to be an approximate 10 g average as well.

These values can also be compared to actual 10 g averaged SARs computed from realistic voxel models of a 1.76m male (Dimbylow, 1997) and a 1.63m female (Dimbylow, 2006). In all cases, it can be seen that the Uncontrolled Environment induced current reference level in SC6 (2015) provides sufficient protection to ensure that the basic restriction for SAR in the ankles is not exceeded. The same relationships hold for the Controlled Environment induced current reference levels in SC6 (2015), since the reference levels and the basic restrictions have the same ratio for controlled-to-uncontrolled on a power basis (5:1).

Induced Current Reference Levels in SC6 (2015)

Frequency (MHz)	Reference Level Basis	Reference Level (I_{RL}), through a single foot (mA) (rms)		Reference Period
		Uncontrolled Environment	Controlled Environment	
0.003 – 0.4	PNS	$100 f$	$225 f$	Instantaneous
0.4 – 110	SAR	40	90	6 minutes

- Frequency, f , is in MHz.
- PNS, peripheral nerve stimulation
- SAR, specific absorption rate

Contact Current

Contact current is usually termed an indirect effect of exposure to electromagnetic fields. It can be defined as the flow of current from an insulated, conductive object energized by an ambient electromagnetic field, through a body that is in physical contact with the object, to ground. Conversely, it can also be defined as the current that flows from an insulated, energized body in contact with a grounded conductive object. In either case the factor that makes contact current potentially hazardous is the current flowing through parts of the body with narrow cross-section (fingers, wrists, ankles) that can give rise to large current densities and limb SARs.

As seen from Figures 5 and 6, adherence to the electric field reference levels may not preclude contact currents that can be perceived either as a tingling sensation or if flowing long enough, as heat. Unlike all other dosimetric quantities, contact currents not only depend on the electrical parameters of the human body and the field intensity and polarization, but also on the shape and size of the conductive object being contacted as well as the type of contact (finger touch as opposed to hand grasp). Since finger touch appears to have the lowest perception thresholds (Chatterjee et al., 1986), it forms the basis for the contact current reference levels in SC6 (2015).

Finger touch can be described as touching the energized conductor with the tip of a single finger, while hand grasp implies that the conductor is gripped in a closed hand. Human volunteer experiments on perception and pain from contact current in Chatterjee et al. (1986) suggest a marked delineation of effects at ~100 kHz. Contact currents at frequencies below 100 kHz, at sufficient intensities, typically results in a tingling sensation, while sufficiently intense contact currents at frequencies above 100 kHz tend to cause heating effects. Perception of tingling or warmth during a finger touch is usually localized in the finger near the point of contact. Hand grasp, with its significantly larger surface area of contact, results in much higher perception thresholds. At frequencies below 100 kHz, the location of sensation is near the electrode being grasped while above this frequency, it is localised in the wrist where current flow is restricted to a small area of relatively high conductivity tissue (Chatterjee et al., 1986).

In terms of latency times, Chatterjee et al. (1986) observed that perception-level currents applied for only 10 to 20 seconds caused pain when the frequency was greater than 100 kHz, but painful sensations were not experienced at frequencies below 100 kHz for similar durations of exposure. This would suggest that a latency time considerably less than 6 minutes needs to be adopted for the contact current reference levels for frequencies up to 10 MHz. Therefore, as a precautionary measure, an effective reference period for contact current reference levels are specified as instantaneous for frequencies from 3 kHz to 10 MHz, and 6 minutes for frequencies from 10 MHz to 110 MHz. In view of this, overlapping PNS-based and SAR-based reference levels in the frequency range from 100 kHz to 10 MHz were deemed unnecessary.

The Uncontrolled- and Controlled-Environment contact current reference levels are plotted in Figures 11 to 14. Figures 11 and 12 depict the Uncontrolled- and Controlled Environment contact current reference levels in the 3 – 100 kHz range, while Figures 13 and 14 depict the contact current reference levels in the 100 kHz – 10 MHz frequency range. The contact current reference levels in SC6 (2015) are identical to those specified in ICNIRP (1998) and ICNIRP (2010). Also plotted are the experimentally- and dosimetrically-derived threshold contact currents required to meet the basic restrictions in SC6 (2015).

In Figure 11, it can be seen that estimated perception thresholds for children are almost one half of that for male adults. ICNIRP (2010) uses this as the rationale for setting their general public (Uncontrolled Environment) reference levels to be one half of those for the Controlled-Environment. Considering that the perception threshold data is based upon the 50th percentile of a given population group, it can be assumed that some members of the population group would perceive contact currents at the reference levels. This is also true for the Controlled Environment (Figure 12). Thus, the reference levels in SC6 (2015) for contact current in the 3 – 100 kHz frequency range provide some protection against, but do not prevent, the occurrence of perception (tingling sensation or warmth). However, these reference levels do provide protection against painful contact current exposures.

In the 100 kHz – 110 MHz frequency range, experimental perception data from Chatterjee et al. (1986) is nearly frequency independent. The Uncontrolled-Environment contact current reference level in Figure 13 appears to protect against the 50th percentile for perception by children with the proviso that some members of the child population group may perceive contact currents at reference levels.

Figure 14 demonstrates that the Controlled-Environment contact current reference level is approximately at the 50th percentile perception threshold for adult males and below the corresponding pain threshold for the same group. It is not known what percentage of adult males would experience pain at reference level contact currents. However, opportunities for mitigation of painful contact current exposures are readily available in occupational environments for the avoidance of such effects.

Wrist currents that meet the basic restriction for SAR, averaged over 10 g in the limbs and calculated from realistic voxel models, are also plotted in Figures 13 and 14. This

data is pertinent to the case of hand grasp, where the bulk of the power deposition is in the wrist. Unfortunately no similar data on SAR in the finger resulting from a finger touch could be found. The result is that the empirical data from human volunteer studies constitutes the foundation for establishing reference levels.

Contact Current Reference Levels in SC6 (2015)

Frequency (MHz)	Reference Level Basis	Reference Level (I_{RL}), (mA) (rms)		Reference Period
		Uncontrolled Environment	Controlled Environment	
0.003 – 0.10	PNS	200 <i>f</i>	400 <i>f</i>	Instantaneous*
0.10 – 10	SAR	20	40	Instantaneous*
10 – 110	SAR	20	40	6 minutes

- Frequency, *f*, is in MHz.
- PNS, peripheral nerve stimulation
- SAR, specific absorption rate

Section 3 Electric fields, Magnetic Fields and Power Density (10 MHz – 6 GHz)

Basic Restrictions

In the frequency range 10 MHz – 6 GHz, the threshold for adverse effects in SC6 (2009) was based upon the avoidance of tissue heating and basic restrictions have been specified for whole-body average SAR and peak spatially-averaged SAR. Since the last revision of SC6 (2009), no new adverse health effects have been established in this frequency range (SCENHIR 2009; ICNIRP 2009; AGNIR 2012; SCENHIR, 2013; ANSES, 2013; WHO, 2014). Therefore, the avoidance of thermal effects remains the basis for the basic restrictions in this frequency range.

Recently, the International Agency for Research on Cancer (IARC) classified RF energy as “possibly carcinogenic to humans” (Class 2B) (Baan et al., 2011). The IARC classification on RF fields reflects the fact that some (limited) evidence exists that RF fields may be a risk factor for cancer. This classification was largely based upon epidemiological investigations of brain cancer incidence in cell phone users over time. While the largest of these studies (INTERPHONE Study Group, 2010) found no overall risk among cell phone users, they identified a subset of long-term ‘heavy-users’ in which elevated odd-ratios were observed. It is unclear whether these observations were the result of methodological confounding or represent a true biological effect. The vast majority of supporting scientific information to date, from animal and cellular studies, does not support a link between RF energy exposure and carcinogenesis. Recent studies of national brain cancer incidence rates (Northern Europe, UK, US) have also reported no relative increase in glioma rates over the past 10-15 years, despite a dramatic increase in cell phone users over the same time period (Deltour et al., 2009, 2012; Frei et al., 2011; De Vocht et al., 2011; Little et al., 2012). Such information, while tentative at this time due to a possible delayed latency time for the onset of neoplasms from cell phone use, adds to the weight of evidence that does not support a causal link between cell phone use (and therefore exposure to RF fields in the 900-1900 MHz range) and brain cancer

development. At present, no national or international science-based exposure standards have established basic restrictions or reference levels for the avoidance of cancer risks from radiofrequency fields in the frequency range 10 MHz – 6 GHz, as the science supporting this health endpoint is not sufficiently well established.

Based upon the uncertainty surrounding a possible long-term risk of cancer, Health Canada recently updated its advice to cell phone users, describing practical ways of reducing exposure to radiofrequency (RF) energy from these devices (such as reducing call time, using hands-free devices or texting). This advice pertains only to cell phone use and not to RF field exposures from other wireless devices (such as Wi-Fi, Smart Meters, baby monitors), since the intensity and distribution of the RF energy absorbed within the body from these devices are very different than those from cell phones. This is deemed the most appropriate precautionary approach for dealing with the current uncertainty regarding possible long term risks from cell phone use.

As indicated in Section 1, the basic restriction against thermal effects in SC6 (2009) consists of WBA-SAR and peak spatially-averaged SAR limits. The limits outlined for the avoidance of thermal effects in the 100 kHz- 10 MHz range also apply in the 10 MHz- 6 GHz range.

WBA-SAR and peak spatially-averaged SAR in SC6 (2015):

Exposure Group	Tissue	Frequency range	Peak spatially-averaged SAR (W/kg)	WBA-SAR (W/kg)
SC6- Controlled Environment	Head, neck, trunk	10 MHz - 6 GHz	8	0.4
	Limbs		20	
SC6- Uncontrolled Environment	Head, neck, trunk	10 MHz - 6 GHz	1.6	0.08
	Limbs		4.0	

Since no additional adverse health effects have been established at exposure levels below the basic restrictions specified in SC6 (2009), no changes to the basic restrictions are recommended for SC6 (2015). Since the last revision of SC6 (2009), it is now recognized that when anatomically-derived models of children are used to assess the adequacy of the existing reference levels, the basic restrictions for WBA-SAR may not be respected in the frequency range of body resonance (~50 MHz to 6 GHz) for the Uncontrolled Environment for the WBA-SAR limit of 0.08 W/kg (Dimbylow, 2002; Wang et al., 2006; Dimbylow and Bolch 2007; Conil et al., 2008; Nagaoka et al., 2008; Kühn et al., 2009; Findlay et al. 2009; Lee and Choi, 2012). For this reason, the reference levels in SC6 (2015) have been revised in the 10 MHz- 6 GHz frequency range based upon dosimetric refinements.

Note: Ocular Effects

As mentioned in Section 1, ocular effects on cataractogenesis from intense RF field exposures have been established for many years with a threshold response of ~100-150 W/kg in experimental animals. In previous versions of SC6 (1991, 1999, 2009), basic restrictions and/or recommendations were specified for the local SAR in the eye. This guidance was not based upon the avoidance of cataractogenesis, but rather represented a conservative approach based upon observations of transient lesions in the corneal endothelium of anaesthetized monkeys following exposure to pulsed or continuous-wave 2.45 GHz RF fields at 2.6 W/kg from one laboratory (Kues et al., 1985; 1992). This effect was reported to be enhanced by pre-treatment with the ophthalmic drug timolol maleate, whereby the threshold for effect was reduced to 0.26 W/kg (Kues et al., 1992). A similar study by the same group reported transient changes in electroretinogram activity in conscious monkeys following exposure to 1.25 GHz pulsed RF fields at a SAR of 4.0 W/kg (Kues and Monohan, 1992). However, later studies by Kamimura et al. (1994) and Lu et al., (2000) found no evidence of optical (including corneal) lesions in the eyes of conscious monkeys following exposure to 1.25 or 2.45 GHz RF fields at similar or higher intensities than those employed by Kues et al. (1985, 1992). Lu et al. (2000) did observe changes in the electroretinogram response in conscious monkeys at SARs > 8 W/kg, but the authors noted that these were transient changes and that no pathological changes were observed.

The use of anaesthesia in exposed animals (rabbits and monkeys) has been suggested to have compromised heat dissipation in the eyes of RF exposed animals, potentially leading to an artificially enhanced sensitivity to thermal effects in early RF field studies (Kamimura et al, 1994). This phenomenon was observed by Kojima et al. (2004) and Hirata et al. (2006) in rabbit eyes following exposure to 2.45 GHz RF fields, where markedly increased temperatures were observed in anaesthetized animals compared to non-anaesthetized animals. Observations of corneal lesions and vascular leakage in the eyes of anaesthetized monkeys in early studies in one laboratory were not confirmed in later studies in other laboratories using conscious monkeys.

Overall, there is an inadequate body of scientific evidence upon which to support the causality of adverse health effects of RF fields on the human eye at exposure levels below the peak spatially-averaged SAR limits in SC6 (2015). Despite the widespread use of a variety of consumer devices (e.g. cell phones, push-to-talk radios) over the past 15 years by the general population in Canada and abroad, Health Canada has not received any complaints and is not aware of any ocular injuries that have occurred from RF field exposures at levels below the current basic restrictions on peak spatially-averaged SAR outlined in SC6 (2009). Since the basic restrictions and reference levels in SC6 (2015) are intended to be based upon established adverse health effects, it is not considered scientifically-justifiable to establish basic restrictions or to maintain separate 'recommendations' for peak spatially-averaged SAR for the eye, since the available scientific evidence for non-cataractogenic effects on the eye below the current peak spatially-averaged SAR limits in SC6 (2009) is extremely limited, contradictory and not

causally-established. A similar conclusion has been established by IEEE C95.1 (2005), ICNIRP (1998) and ICNIRP (2009, 2010).

Health Canada will continue to monitor the scientific literature related to this issue and will revise/create relevant basic restrictions if/when scientifically warranted.

Uncontrolled-Environment Reference Levels

Recent developments in electromagnetic dosimetry using MRI-derived voxel models of the human body have shown that for certain body dimensions and frequencies, the basic restriction of whole-body SAR may be exceeded for exposure field strengths (or power densities) at reference levels corresponding to SC6 (2009) and ICNIRP (1998) . Figures 15 and 16 depict the Uncontrolled- and Controlled-Environment reference levels in SC6 (2015), in comparison to calculated power densities required to meet the basic restriction. These reference levels are intended to provide a full 50-fold margin of safety for all members of the population under worst-case exposure scenarios.

Reference Levels for Electric Field Strength, Magnetic Field Strength and Power Density in Uncontrolled Environments in SC6 (2015) are:

Frequency (MHz)	Electric Field Strength (E _{RL}), (V/m, RMS)	Magnetic Field Strength (H _{RL}), (A/m, RMS)	Power Density (S _{RL}), (W/m ²)	Reference Period (minutes)
10 – 20	27.46	0.0728	2.00	6
20 – 48	$58.07 / f^{0.25}$	$0.1540 / f^{0.25}$	$8.944 / f^{0.50}$	6
48 – 300	22.06	0.05852	1.291	6
300 – 6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000 – 15000	61.4	0.163	10	6
15000 – 150000	61.4	0.163	10	$616000 / f^{1.2}$
150000 – 300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000 / f^{1.2}$

- Frequency, *f*, is in MHz.

Lee and Choi (2012) show from their calculations that for the same aged voxel model, the “arms up” posture has the effect of increasing the WBA-SAR for the same incident power density and slightly decreasing the whole-body resonance frequency. The data in both Lee and Choi (2012), Findley et al. (2009) and others confirm that WBA-SARs at the whole-body resonance frequency are greatest for grounded conditions as opposed to isolated conditions.

The question therefore arises as to what other postures may possibly increase the resonant WBA-SAR further? Some clarity on this question is found in Hirata et al. (2012) where an empirical relationship between the WBA-SAR at grounded, whole-body resonance and body mass index (BMI) is derived. Their analysis shows that the ratio of the WBA-SAR to incident power density (at grounded, whole-body resonance) is directly proportional to the square of the individuals height divided by his or her body mass. Since BMI is defined as the mass divided by the square of the height, the maximum WBA-SAR attained at grounded, whole-body resonance is entirely proportional to the inverse of the BMI. This would suggest that thin individuals (low BMI) have the highest

WBA-SARs at resonance per unit incident power density than heavier persons of the same height.

This relationship also helps to explain the results of Lee and Choi (2012), since raising the arms can be seen as a means of increasing the overall body height without increasing the mass (i.e. lowering the effective BMI). In terms of answering what other postures may increase the WBA-SAR at grounded resonance, the relationship observed by Hirata et al. (2012) suggests that postures that reduce the overall height are likely to reduce the WBA-SAR and that the posture with arms up is likely the worst-case scenario.

Having a formula for predicting the WBA-SAR for grounded, whole-body resonance allows the use of population BMI statistics to predict an upper bound WBA-SAR for a given percentile of the population's BMI distribution. Hirata et al. (2012) presents the upper bound of WBA-SAR per incident power density level for the 2.5th percentile of the Japanese population versus age (Figure 8 in Hirata 2012). The ages with the lowest BMI are in the 5yr to 7yr age range and result in an upper bound of approximately 0.06 W/kg per W/m². This value, when translated to a power density reference level, implies that over the grounded whole-body resonance frequency range and with an "arms down" posture, the power density limit should be 1.3 W/m².

A final point to consider is what happens when an individual with low BMI is standing either isolated or grounded with the arms up posture. Lee and Choi present calculations for 1yr, 5yr and 20yr old models that have arms up and have been modified to approximately conform to the 10th percentile of the US population in terms of BMI (Figure 2 in Lee and Choi, 2012). The highest WBA-SAR at whole-body resonance is for the isolated 5yr model. The value of reference level power density that would confer compliance to the 0.08 W/kg basic restriction for this case is 1.29 W/m².

Applicability of induced current reference levels as a proxy for meeting WBA-SAR basic restriction:

Reliance on meeting the induced current reference level to ensure compliance with the WBA-SAR basic restriction may be unjustified considering the paucity of data available. Data in Hirata et al. (2012) allows this assumption to be tested for a limited number of grounded body models with their hands at their sides (normal posture; these body models are somewhere near the 50th percentile BMI in their respective age classes). Hirata et al. (2012) presents values of the "vertical component of the conduction current ... at their respective resonance frequencies" for 3yr, 7yr, adult female and adult male (all Japanese models). If the induced current (i.e. leg current) is assumed to be primarily made-up of the vertical conduction current then the response of this reference level quantity can be compared to the WBA-SAR basic restriction at the same exposure level. The results are tabulated in Table 3.

Table 3. Grounded, whole-body (WB) resonance frequencies, power density RLs, fraction of the induced current RL and fraction of the WBA-SAR basic restriction (BR) for 3yr, 7yr, adult female and adult male body models from Hirata et al. (2012).

	Grounded WB resonance frequency (MHz)	SC6 (2015) Power Density RL (W/m^2)	Fraction of Induced Current RL (0.08A, both feet)	Fraction of WBA-SAR BR (0.08W/kg)
Adult male	39	1.43	169%	72%
Adult female	45	1.33	122%	60%
7yr	61	1.29	90%	79%
3yr	85	1.29	65%	77%

Note: Induced current is proportional to the electric field strength or the square root of the power density while WBA-SAR is proportional to the square of the electric field strength or to power density directly.

Adult male and Adult female: The fraction of the induced current reference level exceeds the fraction of the WBA-SAR basic restriction for exposure to reference level power densities. Thus, the induced current is the more restrictive quantity for power density reference levels and complying with the induced current reference level confers compliance to the WBA-SAR basic restriction.

7yr: For the power density reference level, compliance is respected at the reference level power density, however, if the exposure level is increased such that the induced current reference level is reached, the WBA-SAR will still be in compliance. Thus, for this case, compliance to the induced current reference level confers compliance to the WBA-SAR basic restriction.

3yr: For power density reference levels, both the induced current and WBA-SAR are in compliance for exposures equal to their respective reference level power densities. However, if the exposure level is increased such that the induced current reference level is reached, the WBA-SAR will not be in compliance. Compliance to the induced current reference level does not confer compliance to the WBA-SAR basic restriction.

To summarize these findings, for grounded adults and probably larger children at their respective resonance frequencies, compliance to the WBA-SAR basic restriction does not confer compliance to the induced current reference level (or likely the spatial-peak 10g average SAR in the lower limbs for which the induced current reference level is intended to protect against). For this reason, induced current measurements are advised at whole-body resonance frequencies of adults and large children when the exposure field levels

begin to be an appreciable fraction of the reference level. Conversely, if the induced current limits are respected then the WBA-SAR basic restrictions will also likely be respected.

For smaller children under the same type of exposure conditions, both the WBA-SAR and induced current are likely to be in compliance at reference level power densities. This can partly be explained by the relationship between induced current and body height as pointed out in Gandhi et al. (1985) where the induced current is proportional to the square of the height. Shorter subjects will experience dramatically lower induced currents than taller ones for the same exposure conditions unlike WBA-SAR, which is dependent only on the reciprocal of the BMI. Height plays only a partial role in determining the WBA-SAR at resonance. For small children, there is probably no need to measure the induced current if the power density limits are respected. However, these conclusions are based on a small data set pertaining to average BMI subjects.

Isolated Newborn

The power density reference levels required to produce the WBA-SAR basic restriction are plotted in Figure 15 as purple squares. The data is a composite of the worst case (i.e. lowest power density) of a number of polarizations and incidences (i.e. front-to-back, side-to-side, top-to-bottom etc.). There is a primary resonance at approximately 240 MHz and a secondary one at approximately 900 MHz. The primary resonance is a case of isolated, whole-body resonance where the electric field is parallel to the long axis of the body (Dimbylow et al., 2010).

Since isolated whole-body resonance occurs at higher frequencies than grounded whole-body resonance, isolated whole-body resonance of newborns will likely form the upper frequency limit for this phenomenon. It has been demonstrated that the frequency of isolated whole-body resonance occurs when the body height is equal to $0.39 (\pm 0.01)$ of the free space wavelength (Hirata, 2010). Thus shorter newborn models could potentially have higher resonant frequencies than the one in Dimbylow et al. (2010). The flat portion of the revised reference levels in SC6 (2015) extend to 300 MHz, which could accommodate a model 20% shorter than the one in Dimbylow et al. (2010).

In terms of the WBA-SAR at resonance, Hirata et al. (2010) has developed a formula for estimating WBA-SAR for isolated whole-body resonance that is similar to the one derived for grounded whole-body resonance (Hirata 2012). The main feature of this formula is that WBA-SAR per unit incident power density is again proportional to the reciprocal of the BMI (specifically, $\text{WBA-SAR}/S_{\text{inc}} = 0.752/\text{BMI}$ where S_{inc} is the incident power density). The resonant WBA-SAR for the Dimbylow et al. (2010) newborn predicted by this formula is 11% lower than the calculated value for the voxel model. Thus newborn models with lower BMI may possibly yield higher WBA-SAR at resonance. This might also include newborn models with an “arms up” posture.

To gain some insight on how much the “arms up” posture might increase the WBA-SAR of the newborn, the data in Lee and Choi (2012) was used to calculate the increase in

WBA-SAR caused by raising the arms for isolated resonance amongst the 4 voxel models used in that study. The WBA-SAR increase was 13%, 20%, 19% and 36% for the 1yr, 5yr, 7yr and 20yr models, respectively. The revised limits shown in Figure A-1 can accommodate an increase in WBA-SAR of the newborn of 10% before a state of non-compliance arises. This is commensurate with the increase in WBA-SAR with “arms up” for the 1yr model in Lee and Choi (2012), but below those for the larger models.

More importantly than accommodating for the “arms up” posture, the SC6 limits can only accommodate a 10% reduction in BMI of the newborn. To investigate further, data for the 5th percentile BMI of newborns versus gestational age were obtained from Brock et al. (2008) and are given in Table 4. Also shown in the table are the WBA-SAR per unit incident power density calculated using the estimation formula in Hirata (2010) for isolated, whole-body resonance and the power density reference level that would be required to comply with the 0.08 W/kg basic restriction.

Table 4. Fifth percentile BMI of Brazilian newborns (male and female) for gestational ages 29, 36 and 42 weeks, WBA-SAR per unit incident power density (S_{inc}) estimated using the formula in Hirata (2010) for isolated, whole-body resonance and power density RL to comply with the 0.08 W/kg BR.

Gestational age (weeks)	5 th percentile BMI (male) (kg/m ²)	5th percentile BMI (female) (kg/m ²)	Greater of the Male or female WBA-SAR/ S_{inc} W/kg per (W/m ²)	Required PD RL to maintain 0.08 W/kg BR (W/m ²)
29	7.31	7.32	0.103	0.78
36	11.14	11.30	0.0675	1.19
42	12.56	12.25	0.0614	1.30

The Uncontrolled Environment power density reference level in the whole-body resonance frequency range is 1.29 W/m² in SC6 (2015), which is compliant with the 0.08 W/kg basic restriction for 42 week gestational age (5th percentile BMI). For the younger gestational ages (29 and 36 weeks), the power density reference levels do not afford the same level of safety margin (e.g. less than 50-fold). Using the Hirata (2010) formula, a critical value of BMI can be calculated such that the 0.08 W/kg basic restriction is complied with at the power density reference level of 1.29 W/m². This value is 12.13 kg/m². The data in Brock et al. (2008) was searched to find the percentile BMI that is compliant at the various gestational ages. The results for males is plotted in Figure 17 (female results are similar). Note that some interpolation of the data in the tables in Brock et al. (2008) was necessary.

The interpretation of the curve in Figure 17 is that, for a given gestational age, the curve defines the smallest percentile of BMI that is still compliant. All percentile BMI values below the curve are non-compliant in the sense that the WBA-SAR will exceed 0.08 W/kg at an exposure equal to 1.29 W/m² for isolated, whole-body resonance at the

resonant frequency. For instance, at 35 weeks gestational age, newborns having BMI equal to or greater than the 50th percentile value will be in compliance.

It should be pointed out that the estimation formula in Hirata (2010) is approximate and that the discrepancy of it versus the SAR calculation of the newborn model in Dimbylow et al. (2010; having a BMI of 14.8 kg/m²) is an underestimation of 11%. Thus the information in Table A-4 and Figure A-3 should be treated with some caution. However, it can be used to arrive at some qualitative conclusions, the most important of which, is the likelihood that any future calculations of WBA-SAR on models of premature newborns will likely produce non-compliance of the power density reference levels to the basic restriction. This cannot be prevented without a further reduction of the power density reference levels at the frequencies of isolated, whole-body resonance. Thus, the power density reference levels in SC6 (2015) provide the full margin of safety (50-fold) for most of the population, but not for all population sub-groups (e.g. low BMI newborns) in all worst-case exposure scenarios. The portion of the population that does not receive the full measure of the intended safety margin (50-fold) is a small one, consisting of low BMI, premature newborns who would be unlikely to be exposed to levels of power density anywhere near the SC6 (2015) reference levels under any conceivable scenario.

Controlled Environment Reference Levels

The same data that was used to justify the revisions to the uncontrolled environment reference levels can also be used as a basis for revisions to the controlled environment reference levels. In this case, however, it was decided to exclude data pertaining to body sizes smaller than 7 yr old children since it was felt that this body height (and associated BMI) was a conservative lower bound for adults of short stature. Figure 16 shows much of the same data in Figure 15 except scaled to a WBA-SAR of 0.4 W/kg, the controlled basic restriction. The only exceptions are that the data from Findley (2009) and Lee and Choi (2012) only include data for body sizes for ages 7 yrs and up. Plotted points for the other references contain some data for smaller size bodies but their inclusion does not impact the changes to the reference levels required for the whole-body resonance region below 100 MHz.

Reference Levels for Electric Field Strength, Magnetic Field Strength and Power Density in Controlled Environments in SC6 (2015) are:

Frequency (MHz)	Electric Field Strength (E _{RL}), (V/m, RMS)	Magnetic Field Strength (H _{RL}), (A/m, RMS)	Power Density, (S _{RL}), (W/m ²)	Reference Period (minutes)
10 – 20	61.4	0.163	10.0	6
20 – 48	$129.8 / f^{0.25}$	$0.3444 / f^{0.25}$	$44.72 / f^{0.5}$	6
48 – 100	49.33	0.1309	6.455	6
100 - 6000	$15.60 f^{0.25}$	$0.04138 f^{0.25}$	$0.6455 f^{0.5}$	6
6000 – 15000	137	0.364	50	6
15000 – 150000	137	0.364	50	$616000 / f^{1.2}$

150000 – 300000	$0.354 f^{0.5}$	$9.40 \times 10^{-4} f^{0.5}$	$3.33 \times 10^{-4} f$	$616000 / f^{1.2}$
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- Frequency, f , is in MHz.

Peak Pulsed RF field levels

SC6 (2009), IEEE C95.1 (2005) and ICNIRP (1998) have all contained provisions to limit the intensity of individual or infrequent RF field pulses. This is to avoid excessive pressure waves in the head from rapid thermo-elastic expansion of tissues caused by absorption of intense RF field pulses (Elder and Chou, 2003). The limits for power density in Tables 5 and 6 of Safety Code 6 (2015) include a note (6) which limits the temporal peak power density for pulsed RF fields (in the 10 MHz – 300 GHz frequency range) to no more than 1000 times the reference level for power density. This provision was included as part of the harmonization effort with the ICNIRP (1998) exposure limits, and replaces the previous guidance on pulsed RF field power density in SC6 (2009). The following analysis demonstrates that the adoption of note 6 in Tables 5 and 6 of SC6 (2015) provides approximately equivalent protection as the specifications for peak power density of pulsed RF fields contained in SC6 (2009).

In Section 2.2.1 of SC6 (2009), the limit for the peak power density was specified as:

$$\sum S_{PK} T_p \leq (S_{RL} * T_a)/5 \quad (\text{Criterion 1})$$

where S_{PK} = peak power density limit
 S_{RL} = power density reference level
 T_p = pulse duration
 T_a = averaging time

and the summation on the left hand side is over 0.1s

Criterion 1 states that the total energy density in any 0.1s period within the averaging time should not exceed one-fifth of the total energy density permitted during the entire averaging time of a continuous field. A maximum of 5 pulses with pulse durations of less than 0.1s are permitted in any period equal to the averaging time. If it is assumed that either a single pulse occurs in the 0.1s period or 5 or fewer pulses occur all having the same amplitude, the criterion for the peak power density, S_{PK} , can be written as:

$$S_{PK} \leq (S_{RL} * 72) / \sum T_p \quad (\text{Criterion 2})$$

Here it is assumed that the frequency range corresponds to the one for which the averaging time is 6 minutes or 360s.

The criterion in note 6 of Tables 5 and 6 of SC6 (2015) can be written as,

$$S_{PK} \leq (S_{RL} * 1000) \quad (\text{Criterion 3})$$

Examination of the Criterion 2 reveals that the allowable peak power density is inversely proportional to the amount of pulse “ON” time in the 0.1s period (given by the term $\sum T_p$). Thus, the criterion for peak power density is the most restrictive (i.e. has the smallest

value) when, for a single pulse, the pulse period is the full 0.1s allowed, or in the case of multiple pulses, their “ON” times occupy almost the full 0.1s. In either case the resulting criterion for peak power density becomes: $S_{PK} \leq (S_{RL} * 720)$.

The criterion in note 6 of SC6 (2015) and that in SC6 (2009) become identical for cases where the sum of the pulse periods, $\sum T_p$, is equal to 72 ms, while for smaller pulse periods, note 6 of SC6 (2015) becomes more restrictive. In the worst case, the criterion in note 6 of SC6 (2015), allows 39% higher pulsed power density amplitudes for pulse durations between 72-100 ms, when compared to the criterion in SC6 (2009). However, SC6 (2015) still provides several orders of magnitude of protection against the pressure wave effect (Elder and Chou, 2003).

Section 4 Electric fields, Magnetic Fields and Power Density (6 GHz – 300 GHz)

Basic Restrictions

In the frequency range from 6 - 300 GHz, since measurements of whole-body SAR and peak spatially-averaged SAR are not readily achievable or appropriate due to the superficial nature of energy deposition within tissue, reference levels for electric- and magnetic-fields and power density form the basis of the human exposure limits in this frequency range. Since the last revision of SC6 (2009), no new health effects have been established in this frequency range (SCENHIR 2009; ICNIRP 2009; AGNIR 2012; ANSES, 2013; SCENIHR, 2013; WHO, 2014)). Therefore, the avoidance of thermal effects remains the basis for the reference limits in this frequency range and no changes in the basic restrictions are required.

Reference Levels

The reference levels in the 6 – 300 GHz range remain unchanged from SC6 (2009).

Uncontrolled Environment Reference Levels for Electric- and Magnetic-field strength and Power Density in the 6 – 300 GHz frequency range in SC6 (2015).

Frequency (GHz)	Electric Field Strength, E_{RL} (V/m) (rms)	Magnetic Field Strength, H_{RL} (A/m) (rms)	Power Density, S_{RL} (W/m ²)	Reference Period (minutes)
6 – 15	61.4	0.163	10	6
15 – 150	61.4	0.163	10	$616000 / f^{1.2}$
150 – 300	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000 / f^{1.2}$

Frequency, f , is in MHz.

Controlled Environment Reference Levels for Electric- and Magnetic-field strength and Power Density in the 6 – 300 GHz frequency range in SC6 (2015).

Frequency (GHz)	Electric Field Strength, E_{RL} (V/m) (rms)	Magnetic Field Strength, H_{RL} (A/m) (rms)	Power Density, S_{RL} (W/m ²)	Reference Period (minutes)
6 – 15	137	0.364	50	6
15 – 150	137	0.364	50	$616000 / f^{1.2}$
150 – 300	$0.354 f^{0.5}$	$9.40 \times 10^{-4} f^{0.5}$	$3.33 \times 10^{-4} f$	$616000 / f^{1.2}$

Frequency, f , is in MHz.

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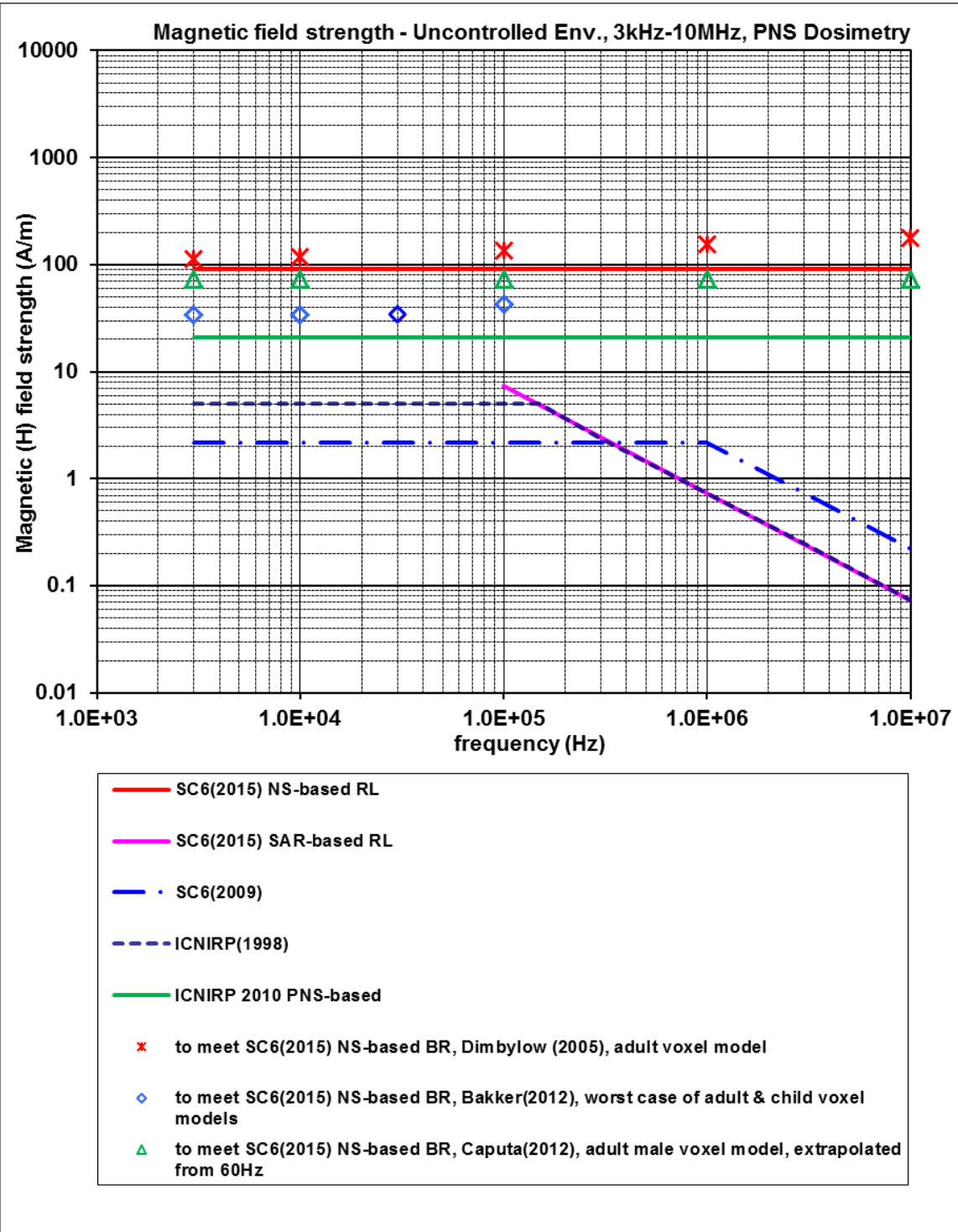


Figure 1(a). Magnetic field strength reference levels for Uncontrolled Environments in SC6 (2015) and other standards. Also shown are magnetic field strengths required to meet the NS-based Uncontrolled Environment basic restrictions in SC6 (2015) for different PNS dosimetric analyses under worst-case conditions.

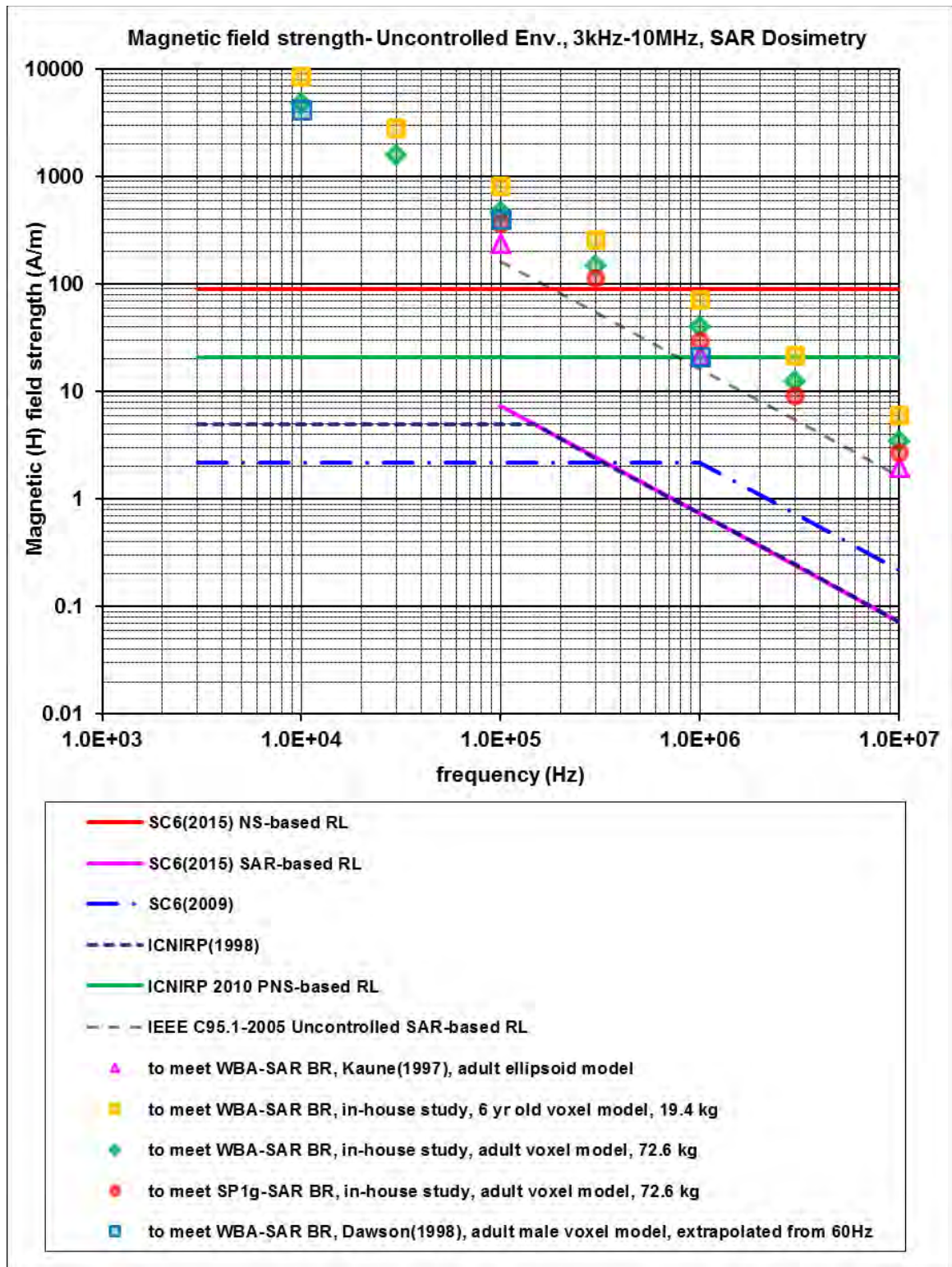


Figure 1(b). Magnetic field strength reference levels for Uncontrolled Environments in SC6 (2015) and other standards. Also shown are magnetic field strengths required to meet the SAR-based Uncontrolled Environment basic restrictions in SC6 (2015) for different SAR dosimetric analyses under worst-case conditions.

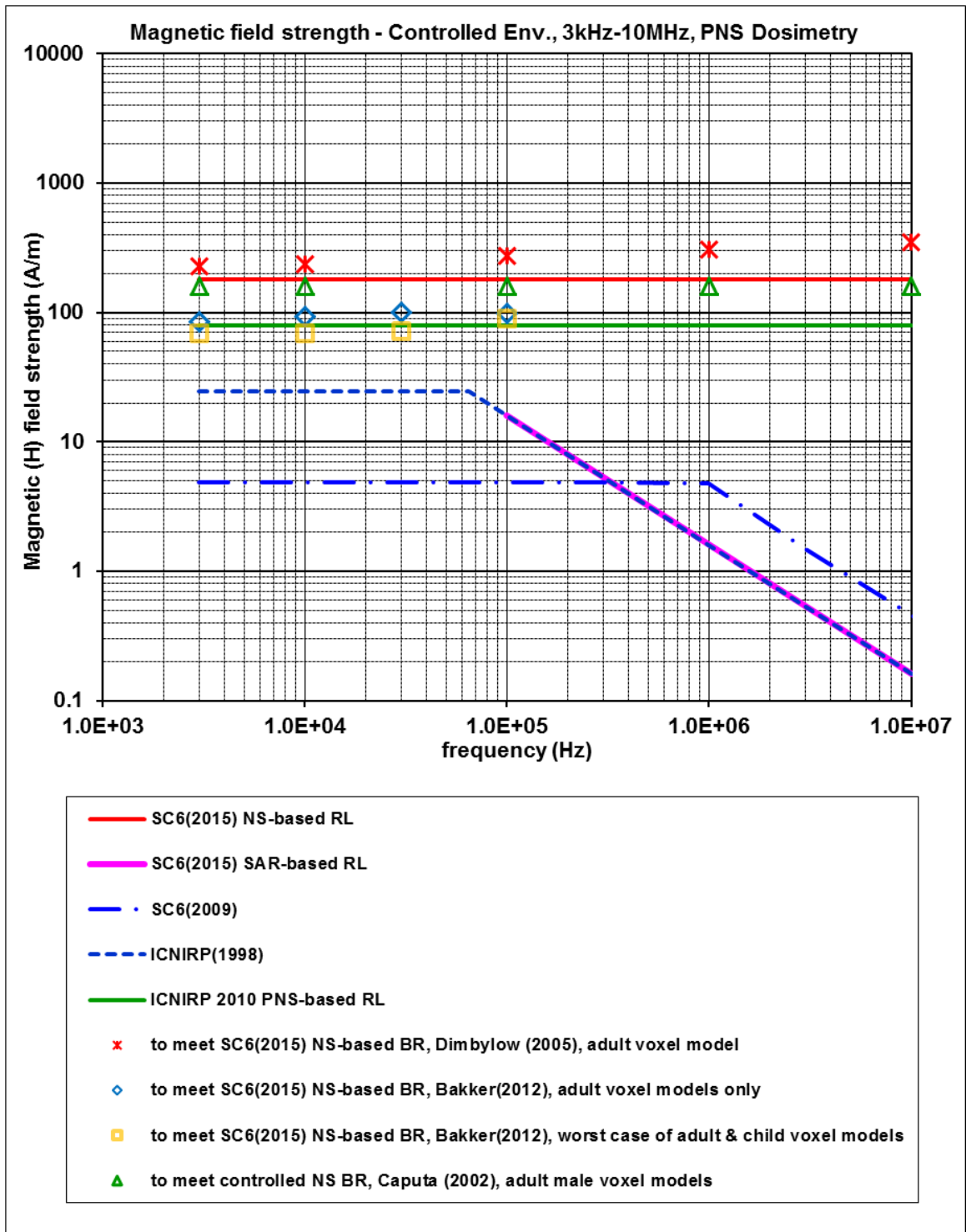


Figure 2(a). Magnetic field strength reference levels for Controlled Environments in SC6 (2015) and other standards. Also shown are magnetic field strengths required to meet the NS-based Controlled Environment basic restrictions in SC6 (2015) for different PNS dosimetric analyses under worst-case conditions.

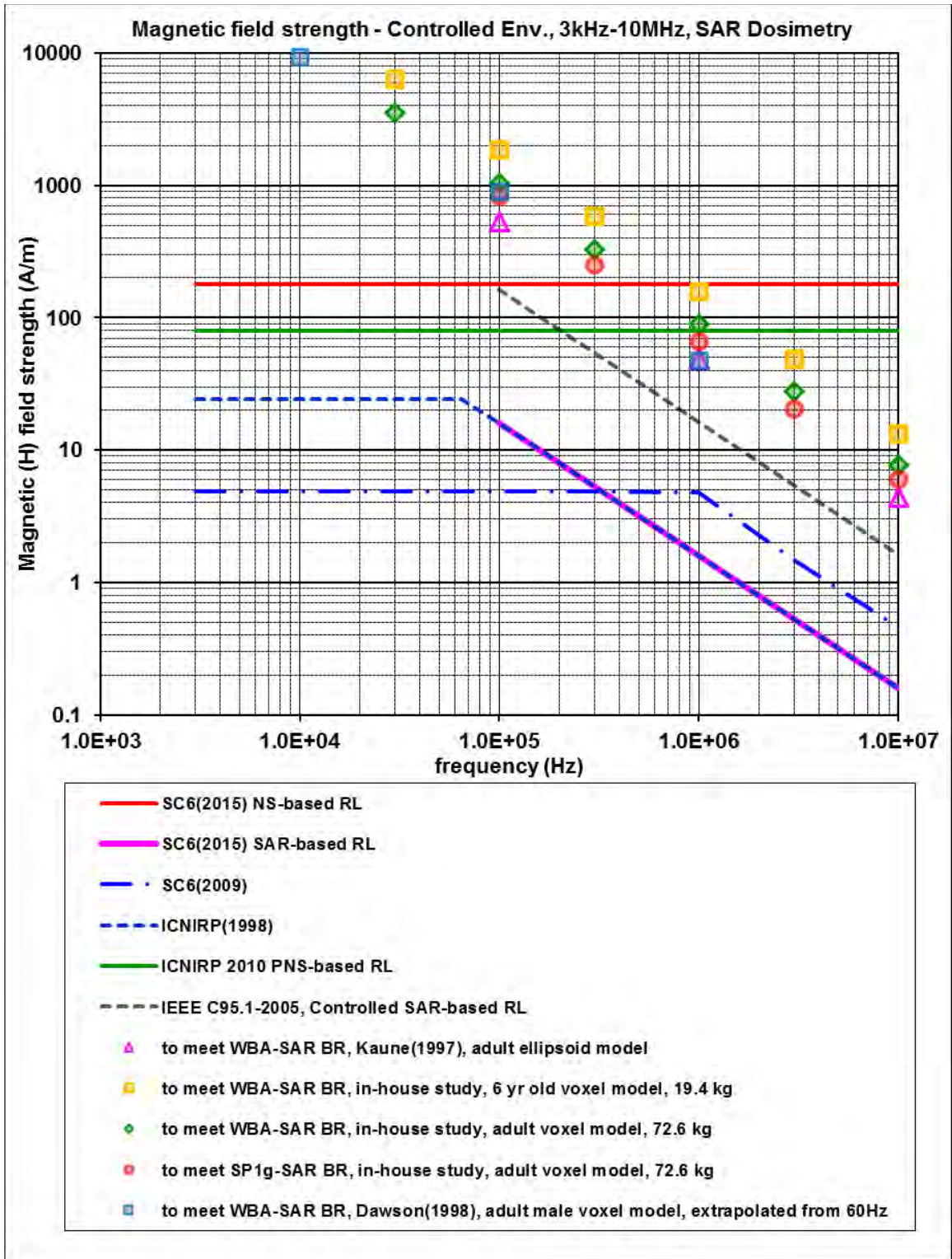


Figure 2(b). Magnetic field strength reference levels for Controlled Environments in SC6 (2015) and other standards. Also shown are magnetic field strengths required to meet the SAR-based Controlled Environment basic restrictions in SC6 (2015) for different SAR dosimetric analyses under worst-case conditions.

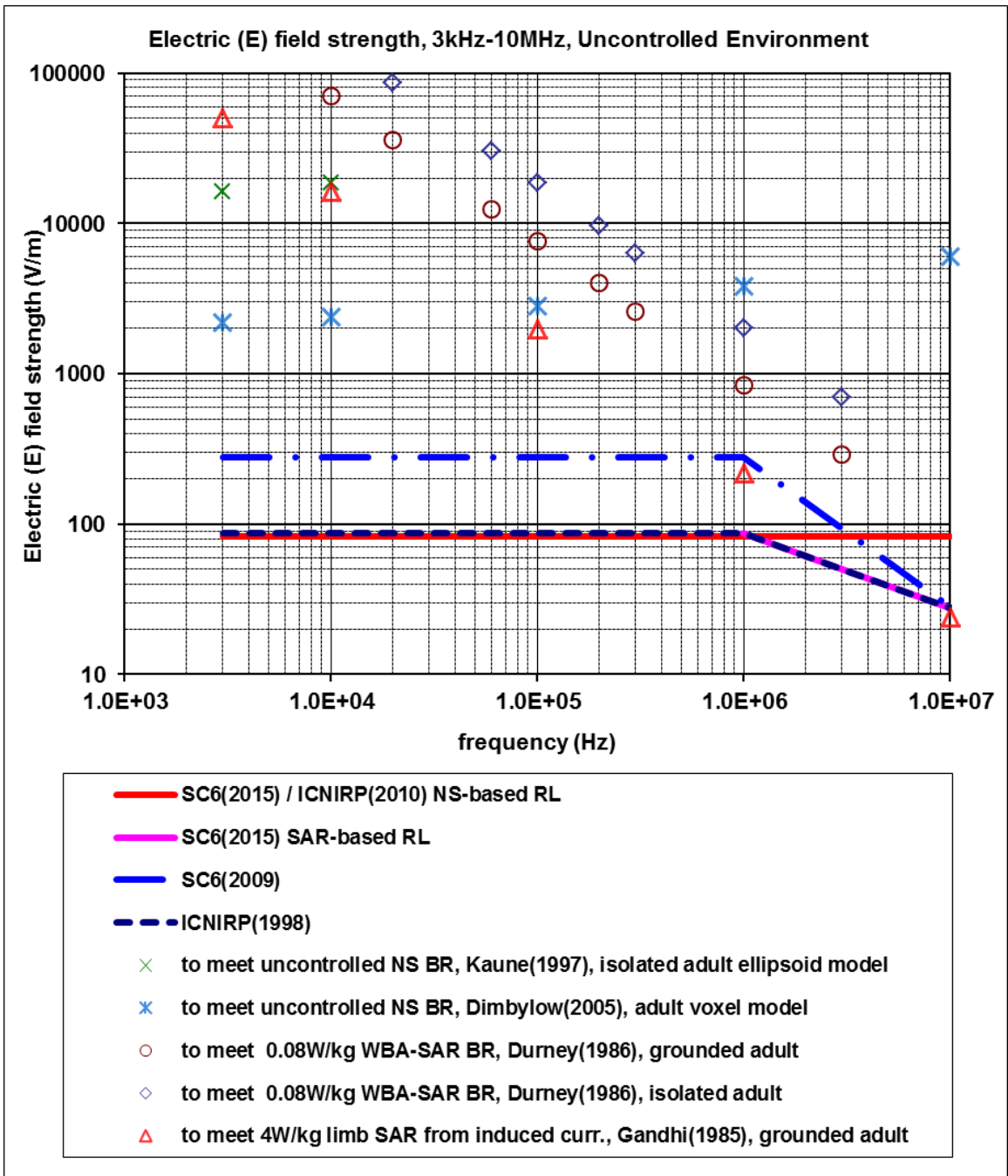


Figure 3. Electric field strength reference levels for Uncontrolled Environments in SC6 (2015) and electric field strengths required to meet the NS- and/or SAR-based Uncontrolled Environment basic restrictions in SC6 (2015) (in various numerical models exposed under worst-case conditions).

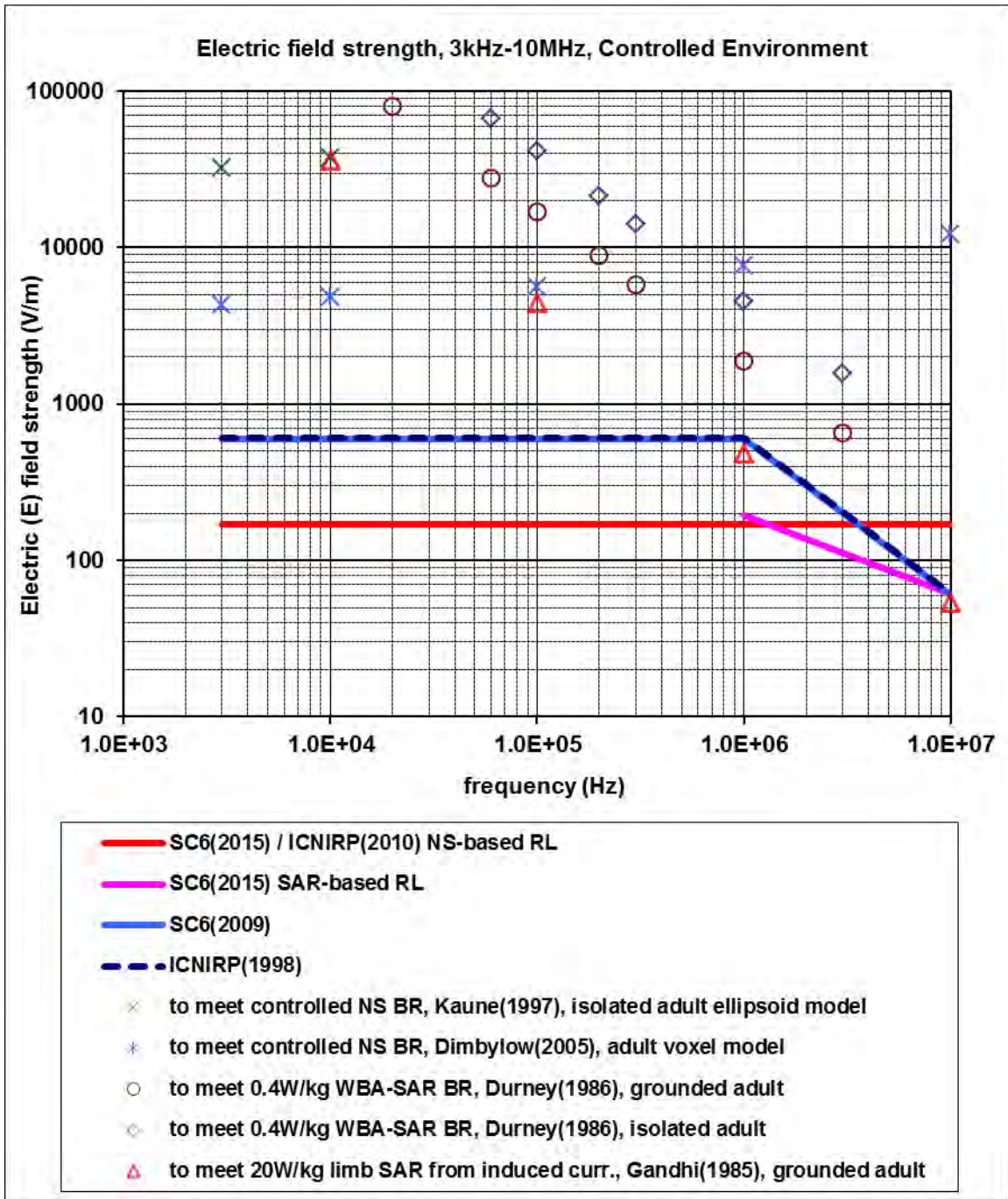


Figure 4. Electric field strength reference levels for Controlled Environments in SC6 (2015) and electric field strengths required to meet the NS- and/or SAR-based Controlled Environment basic restrictions in SC6 (2015) (in various numerical models exposed under worst-case conditions).

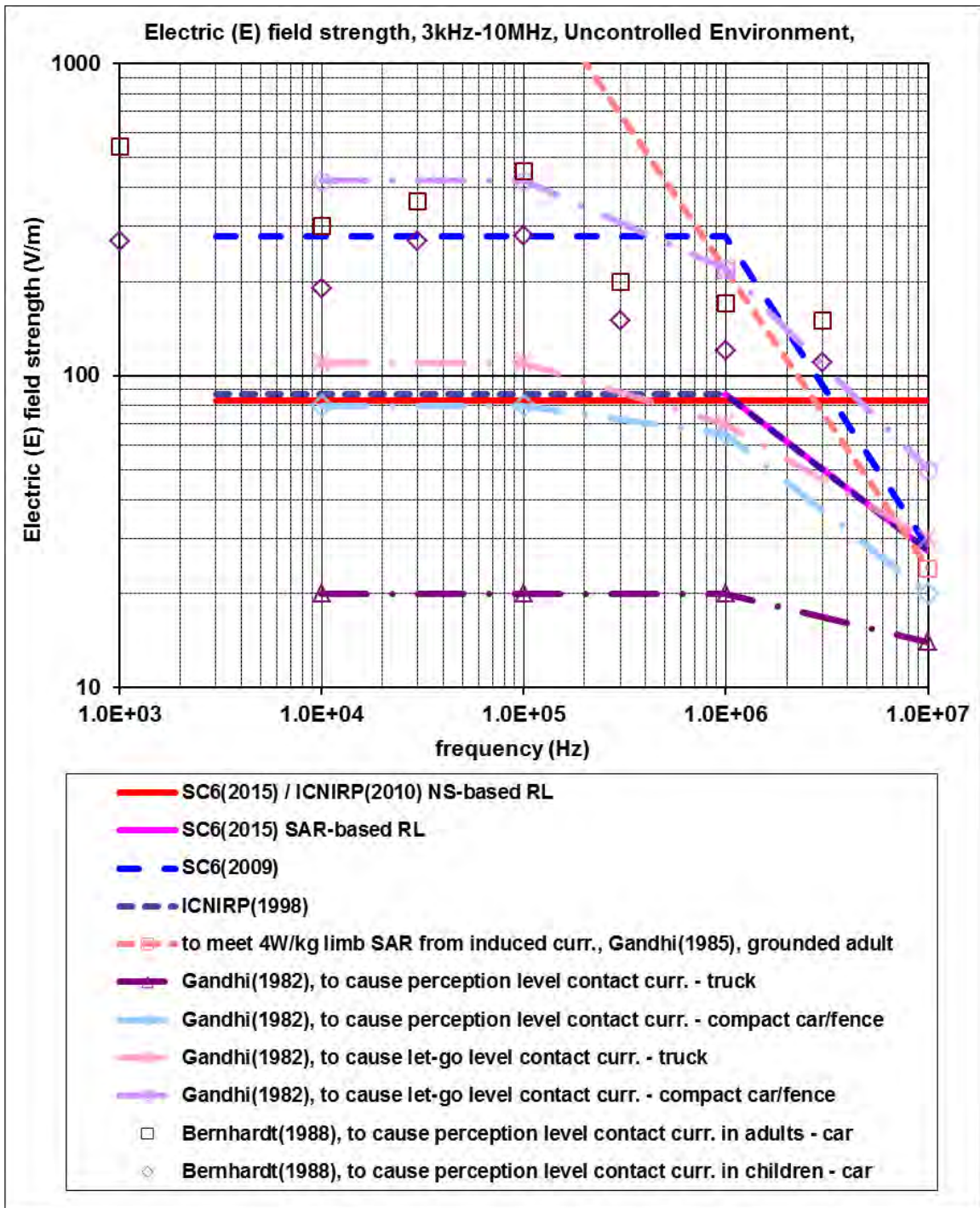


Figure 5. Electric field strength reference levels for Uncontrolled Environments in SC6 (2015) and electric field strengths of sufficient intensity to cause perception-level and let-go level contact currents for different objects under worst-case conditions.

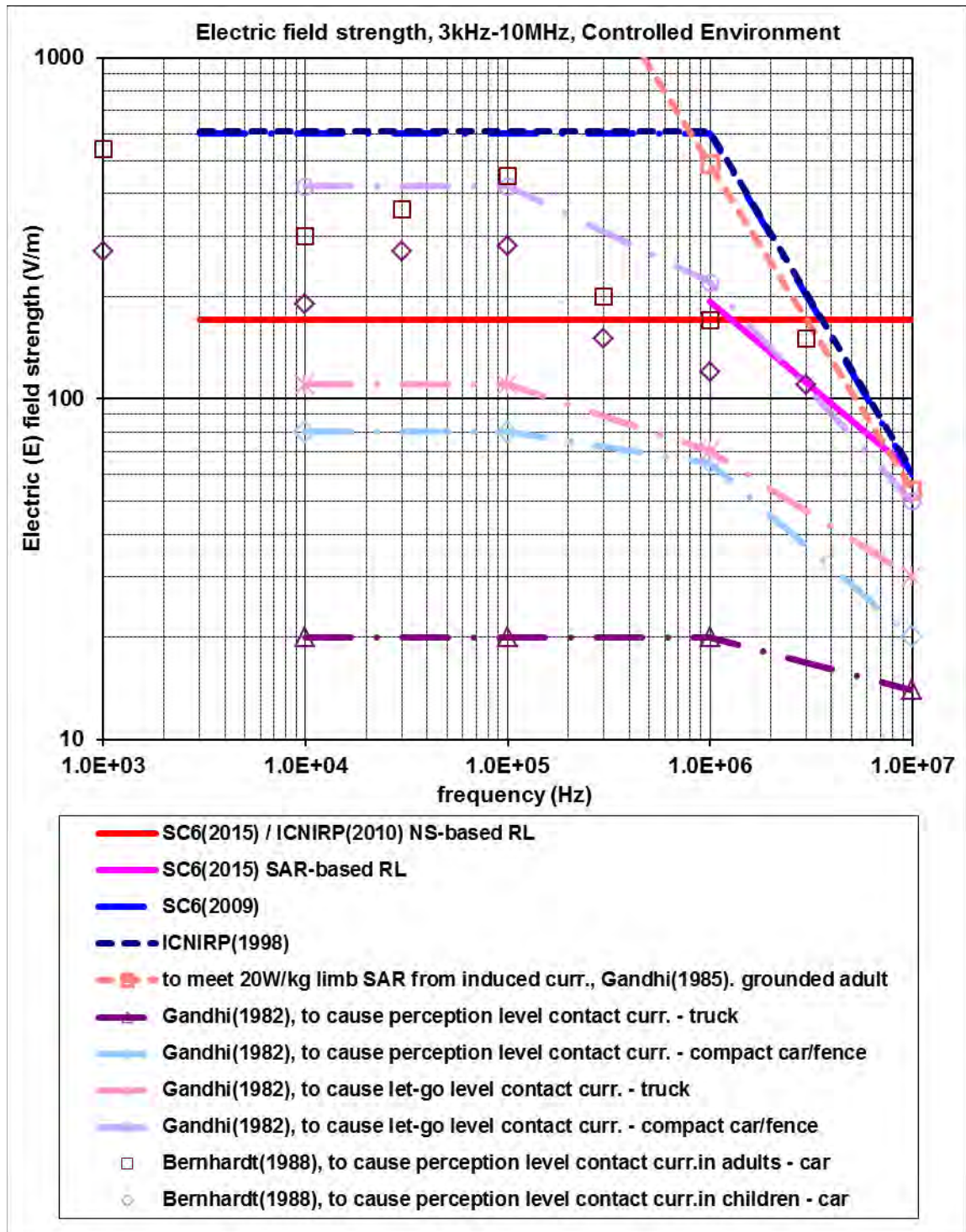


Figure 6. Electric field strength reference levels for Controlled Environments in SC6 (2015) and electric field strengths of sufficient intensity to cause perception-level and let-go level contact currents for different objects under worst-case conditions.

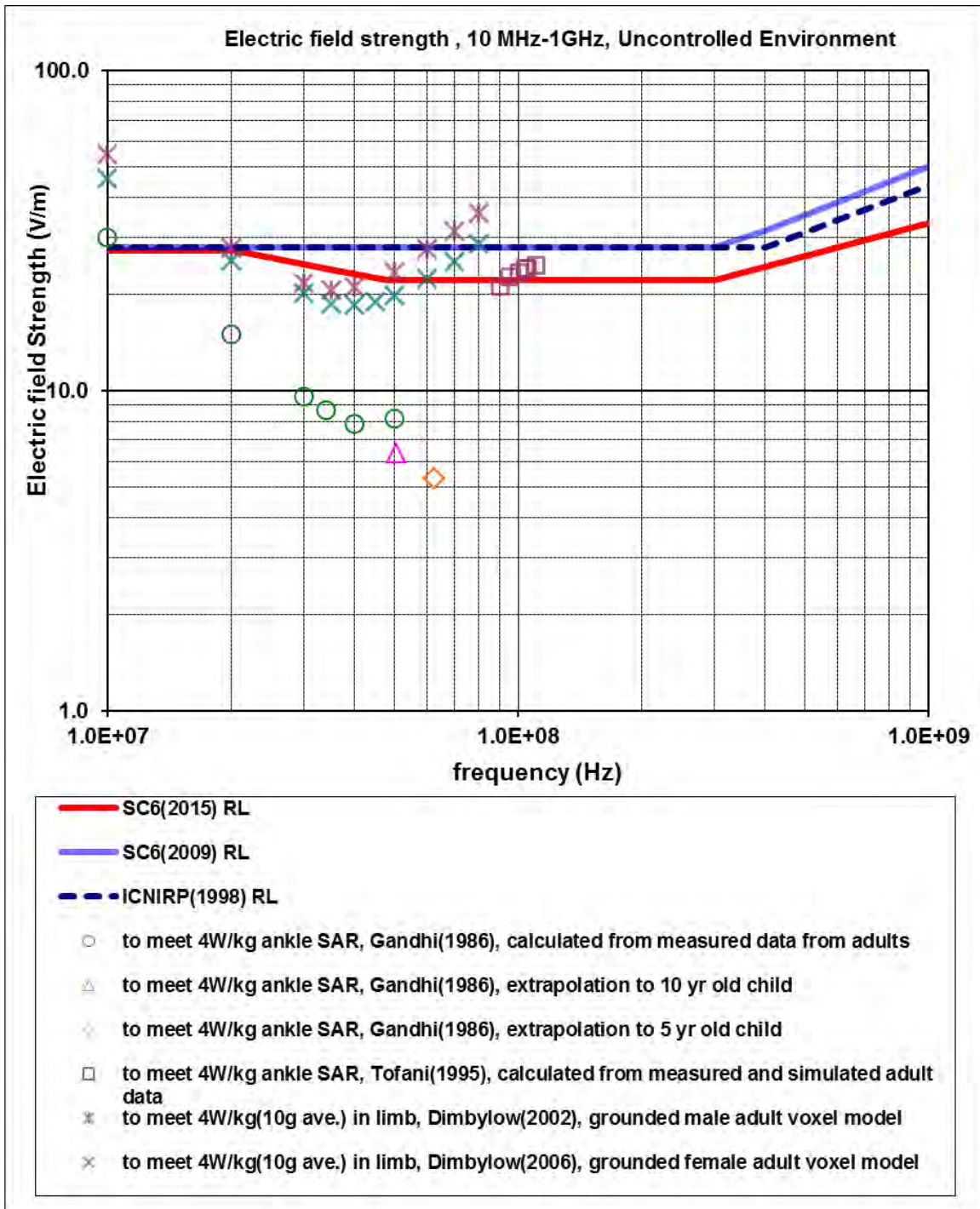


Figure 7. Uncontrolled Environment electric field strength reference levels and electric field strengths (vertically polarized, plane-wave) of sufficient intensity to produce limb SAR that meet the Uncontrolled Environment basic restriction of 4 W/kg in SC6 (2015).

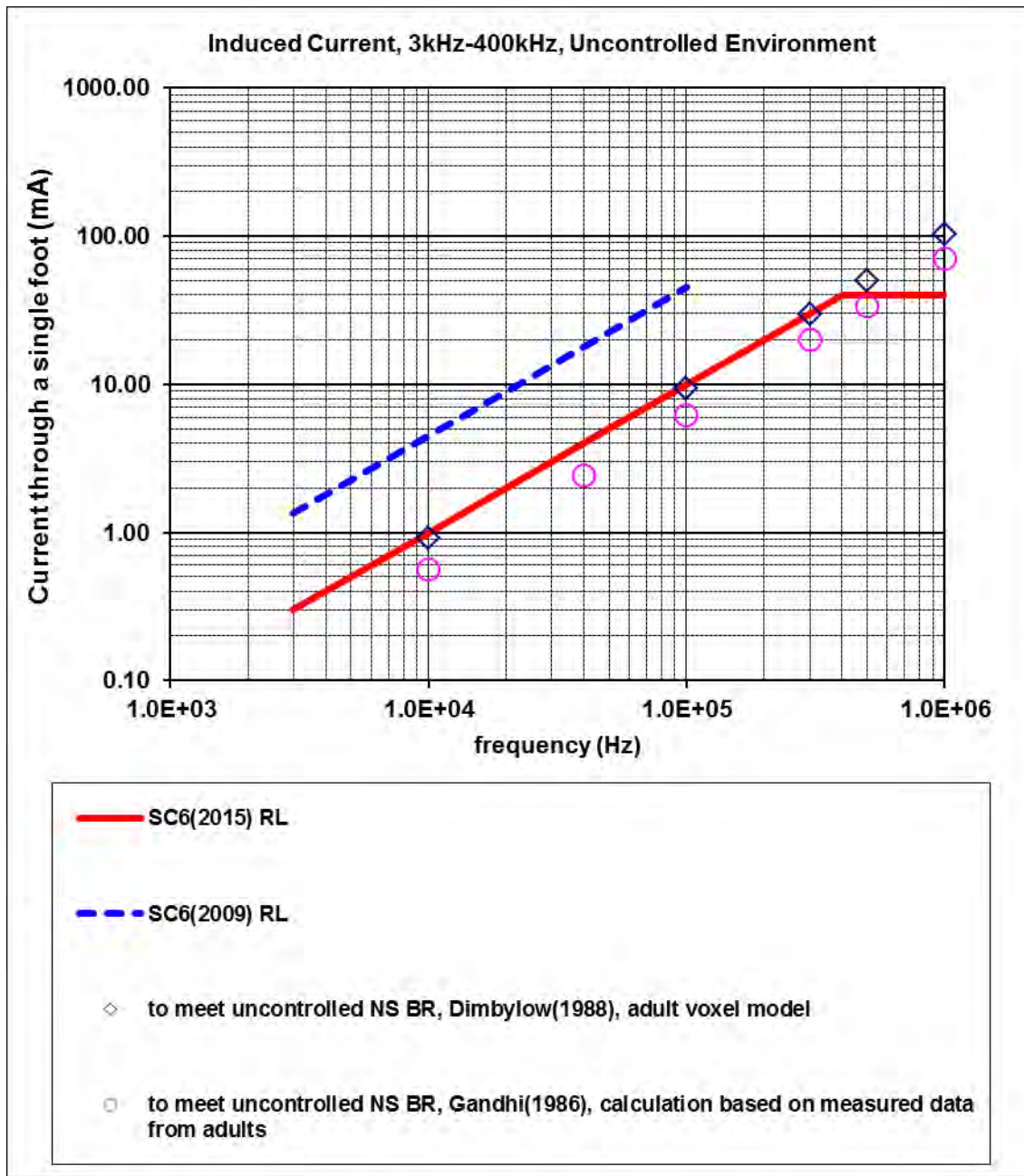


Figure 8. Induced current reference levels for Uncontrolled Environments for the frequency range 3 kHz to 1 MHz in SC6 (2015). Also shown are estimates of induced current required to meet the Uncontrolled Environment basic restriction for induced electric field.

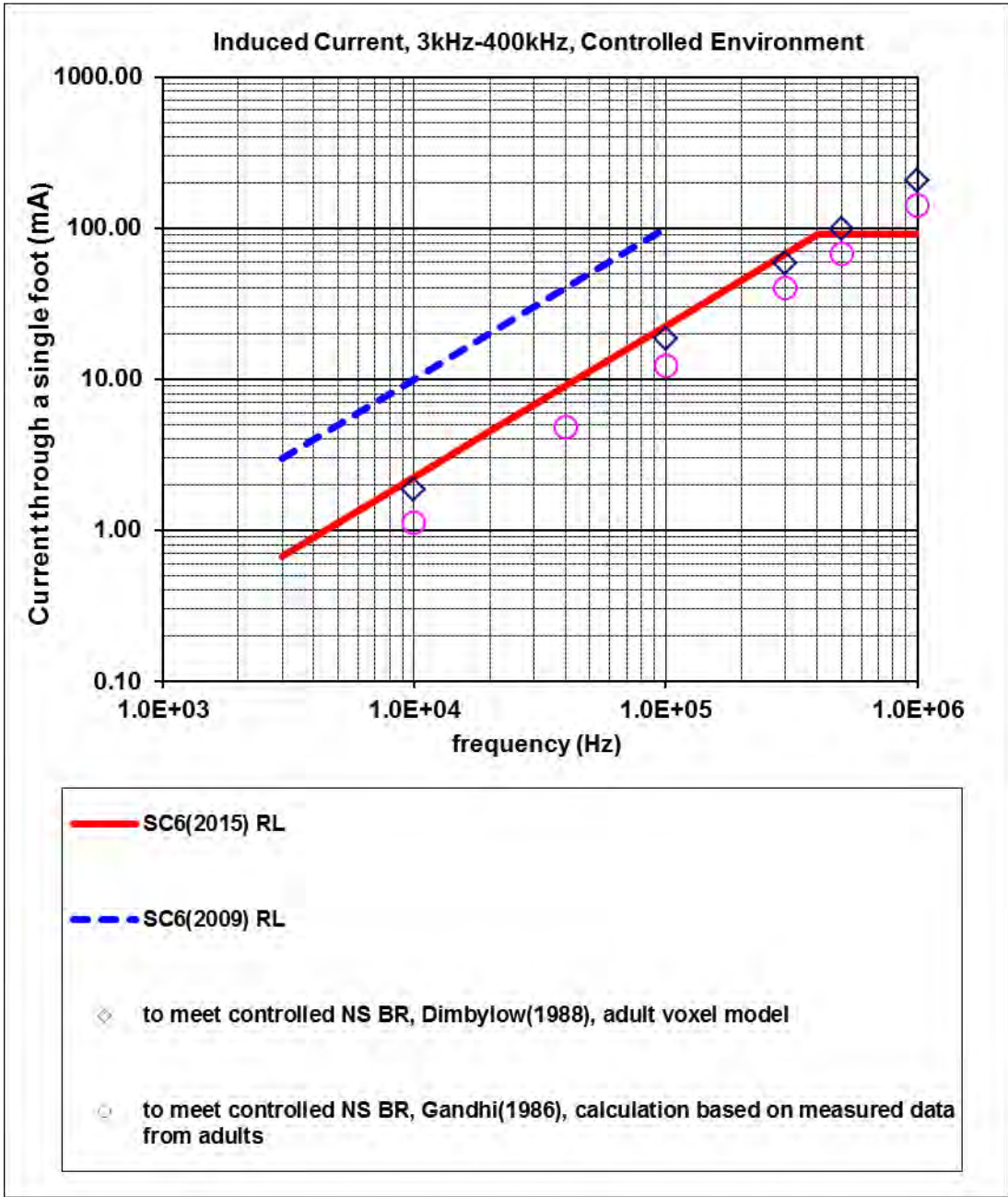


Figure 9. Induced current reference levels for Controlled Environments for the frequency range 3 kHz to 1 MHz in SC6 (2015). Also shown are estimates of induced current required to meet the Controlled Environment basic restriction for induced electric field.

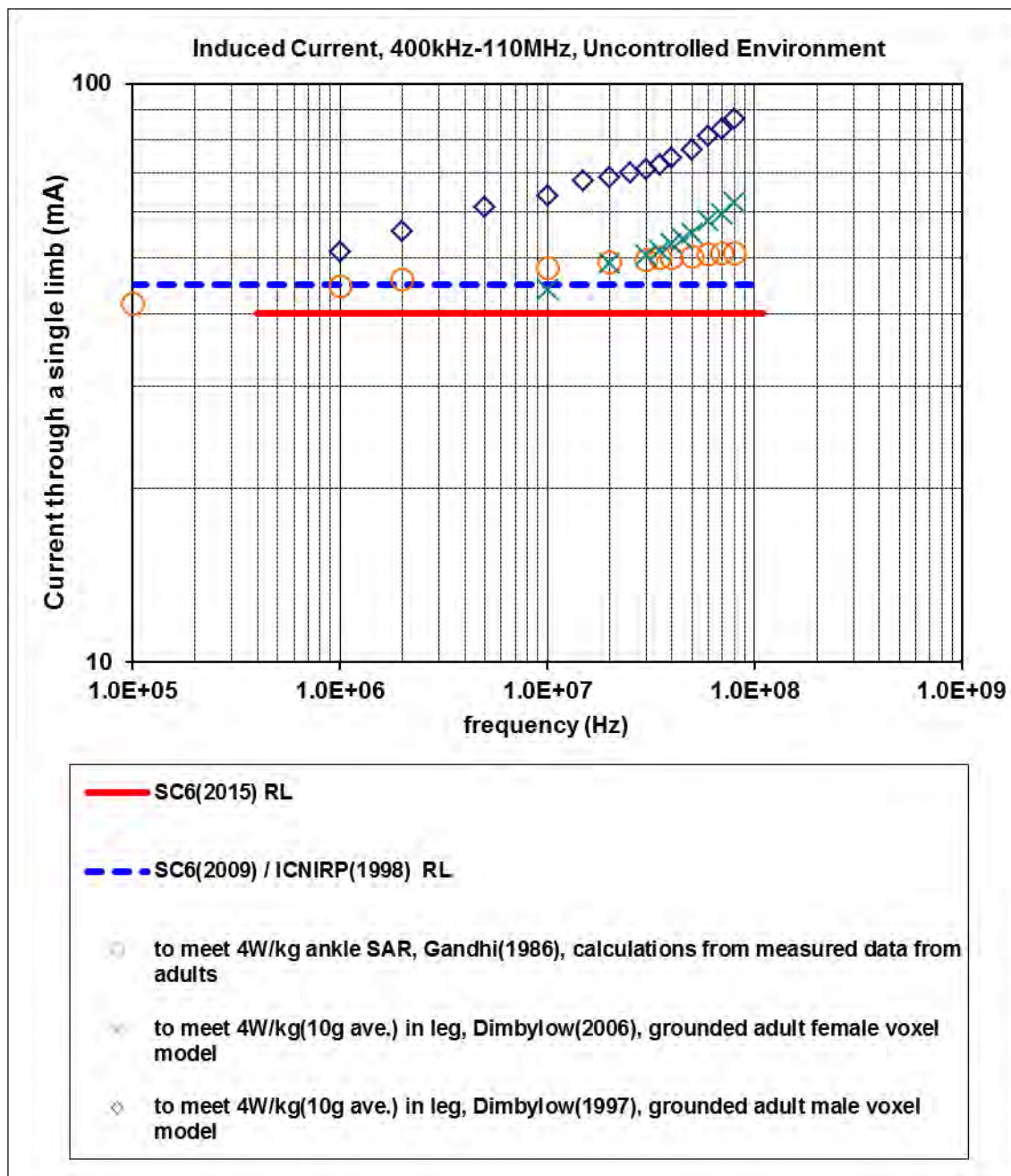


Figure 10. Induced current reference levels for Uncontrolled Environments for the frequency range 400 kHz to 10 MHz in SC6 (2015). Also shown are estimates of induced current required to meet the Uncontrolled Environment basic restriction for peak spatially-averaged SAR in the limbs (4 W/kg averaged over 10 g).

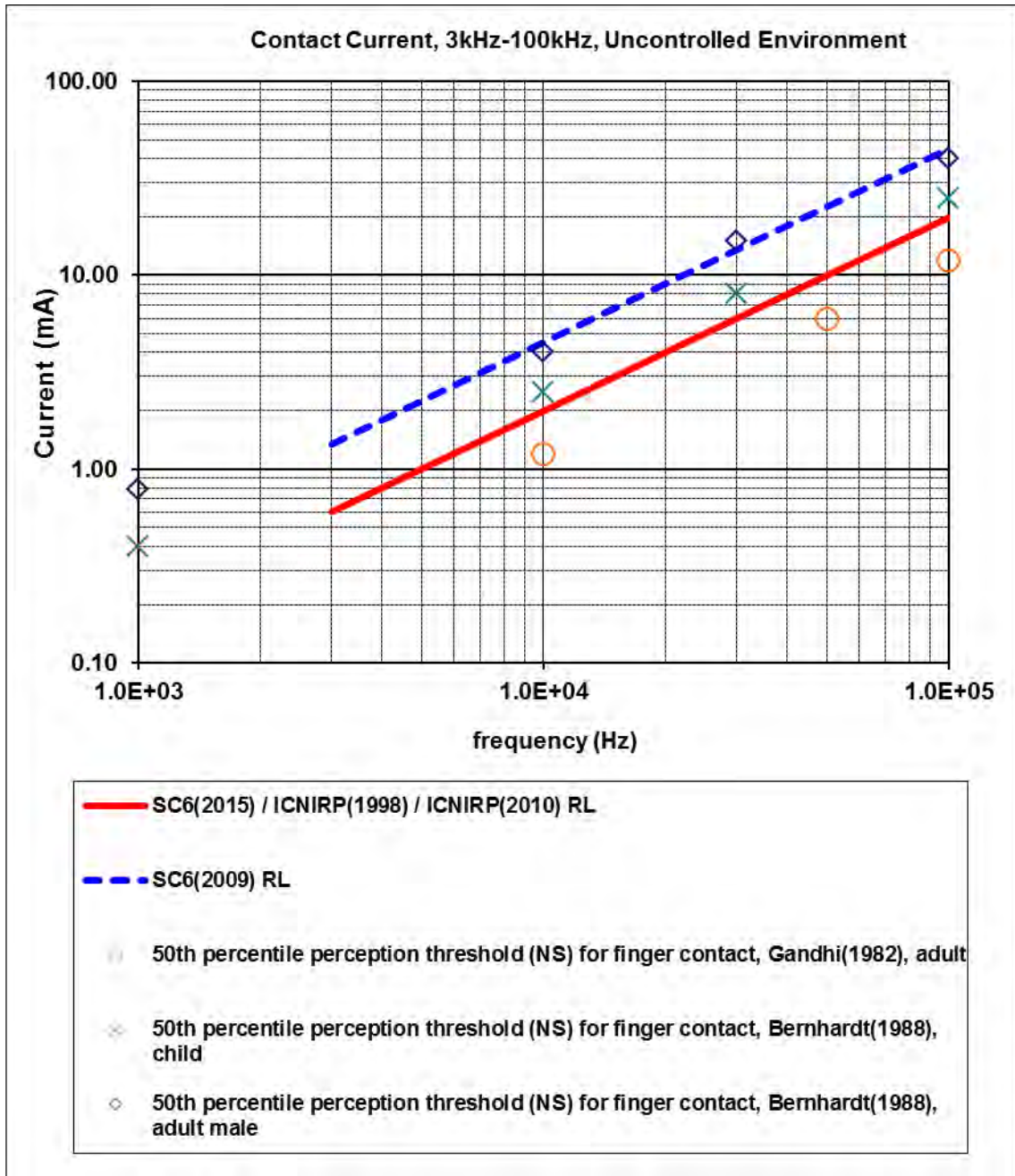


Figure 11. Uncontrolled-Environment contact current reference levels for the 3 - 100 kHz frequency range in SC6 (2015). Also depicted are the 50th percentile perception threshold currents (adult and children) for finger contact.

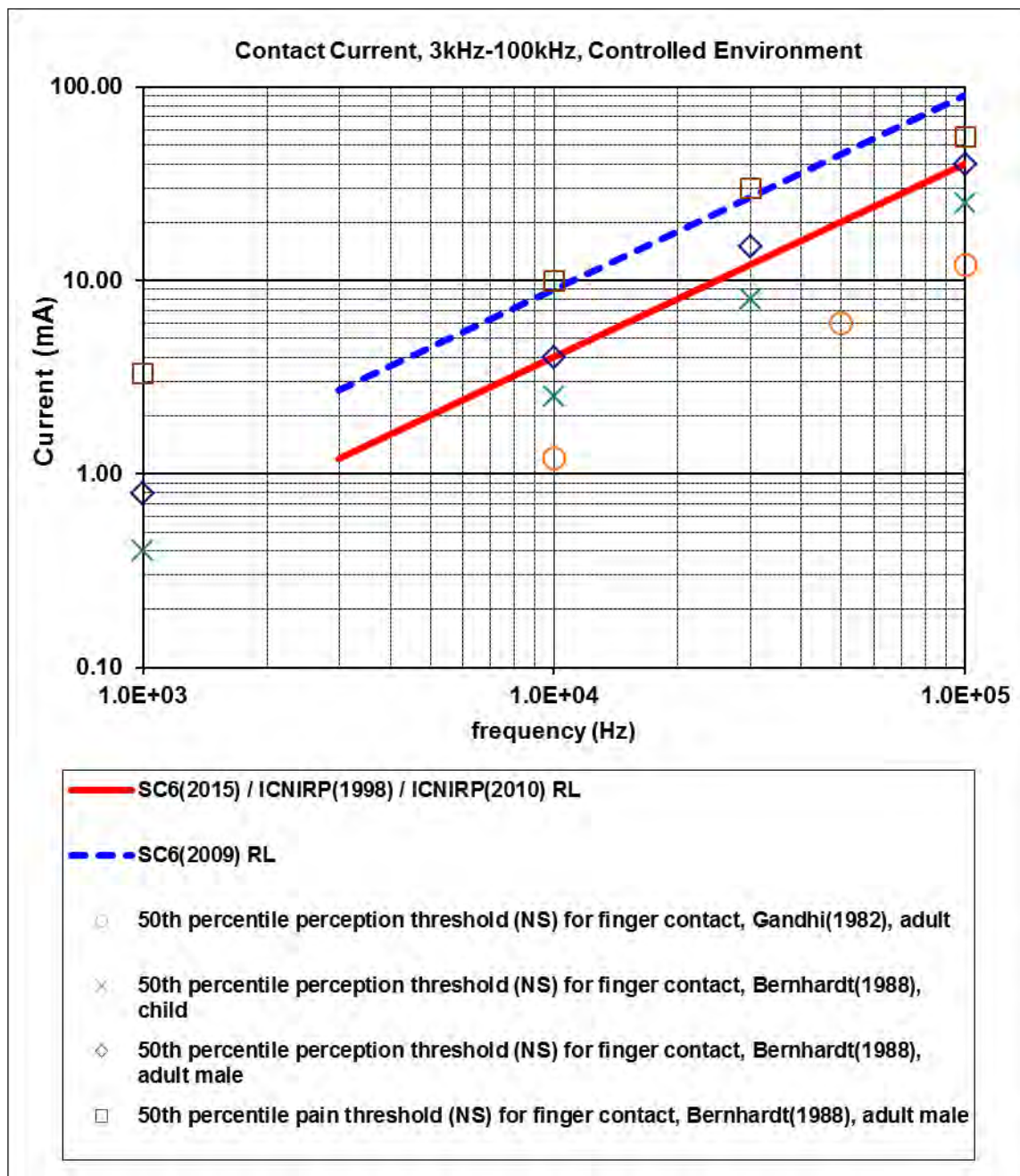


Figure 12. Controlled-Environment contact current reference levels for the 3 - 100 kHz frequency range in SC6 (2015). Also depicted are the 50th percentile perception threshold currents (adult and children) for finger contact.

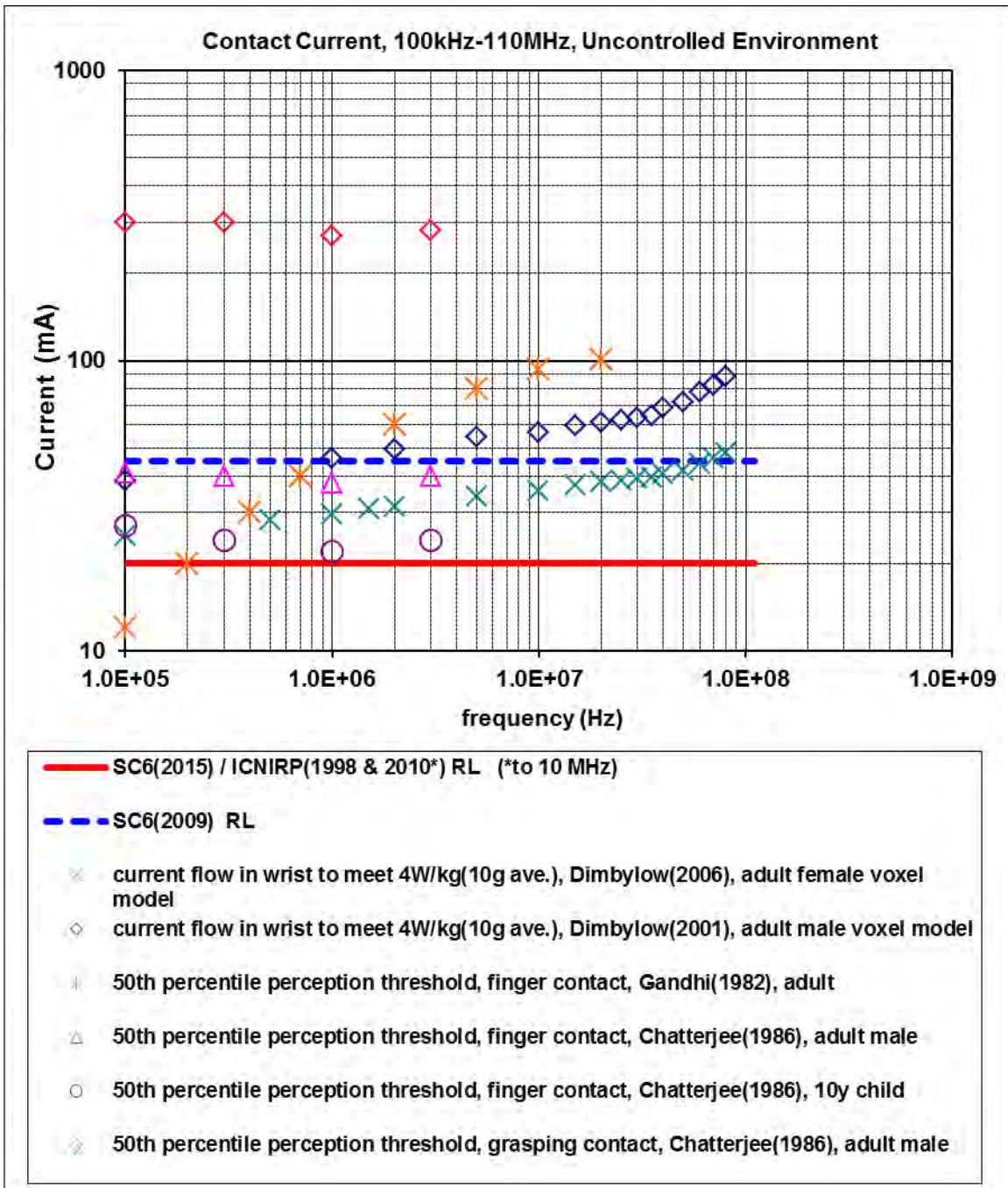


Figure 13. Uncontrolled-Environment contact current reference levels in SC6 (2015) in the 100 kHz – 110 MHz frequency range. Also plotted are the 50th percentile perception currents for finger-contact for adults and children, and the contact currents flowing in the wrist required to meet the basic restriction on peak spatially-averaged SAR in the limbs of 4 W/kg averaged over 10 g.

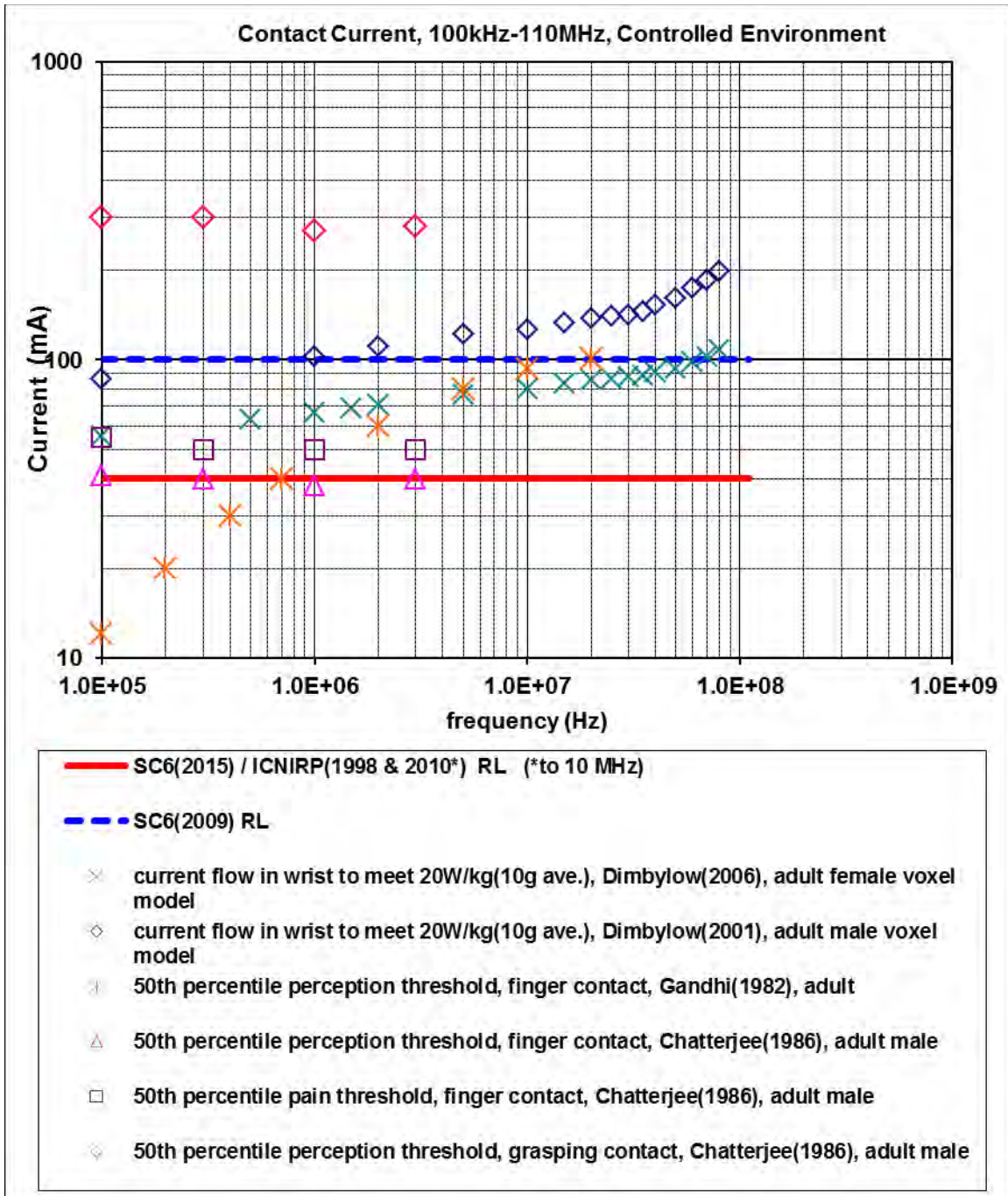


Figure 14. Controlled-Environment contact current reference levels in SC6 (2015) in the 100 kHz – 110 MHz frequency range. Also plotted are the 50th percentile perception currents for finger-contact for adults and children, the pain threshold for adults for finger contact, and the contact currents flowing in the wrist required to meet the basic restriction on peak spatially-averaged SAR in the limbs of 20 W/kg averaged over 10 g.

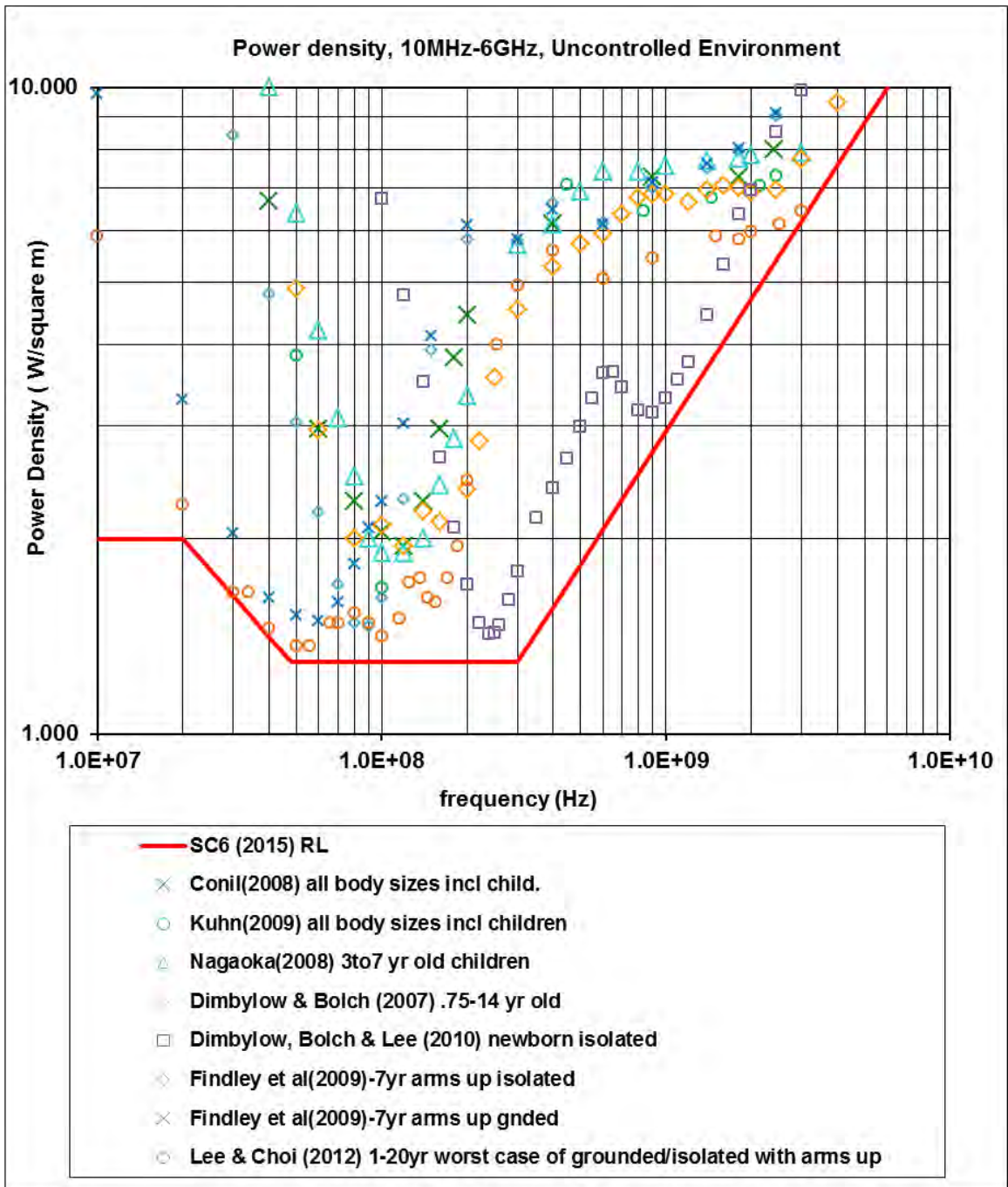


Figure 15. Plane-wave power densities necessary to produce the WBA-SAR basic restriction of 0.08 W/kg in different voxel models under various exposure conditions. Also plotted are the SC6 (2015) Uncontrolled Environment power density reference levels (red line).

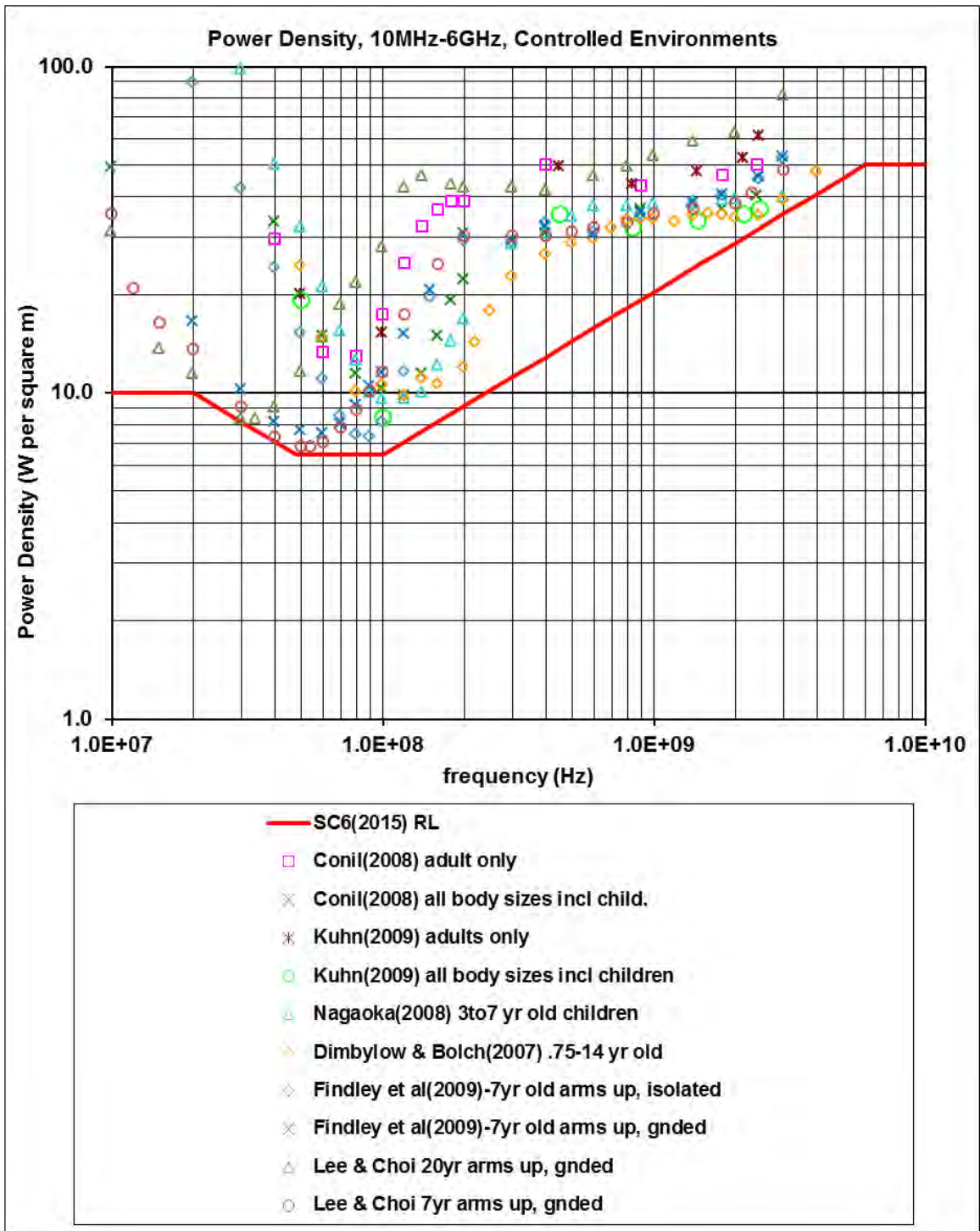


Figure 16. Plane-wave power densities necessary to produce the WBA-SAR basic restriction of 0.4 W/kg in different voxel models under various exposure conditions. Also plotted are the SC6 (2015; red line) Controlled Environment power density reference levels.

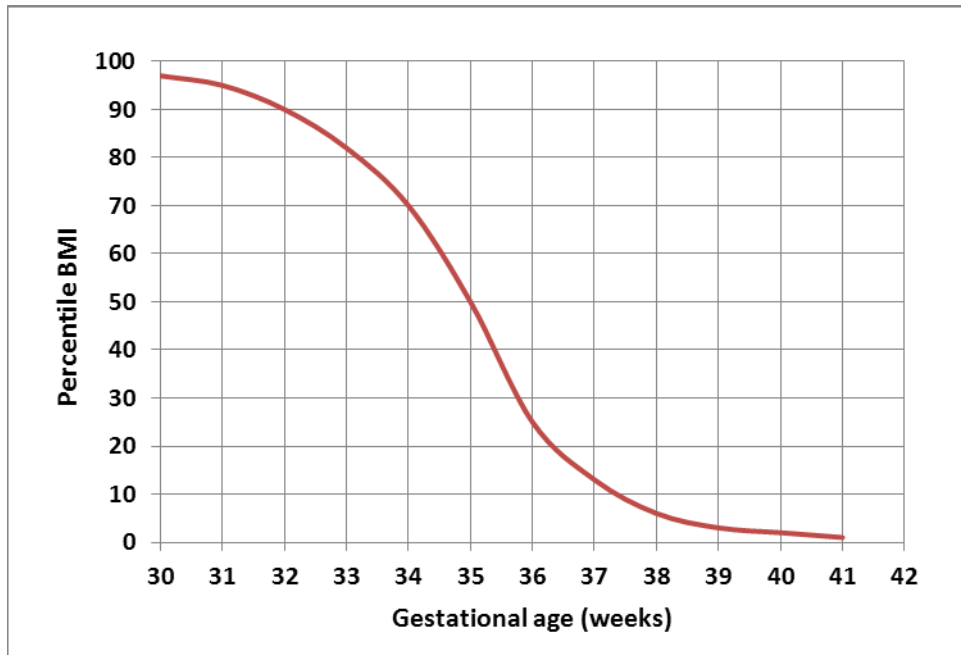


Figure 17. Percentile BMI versus gestational age for which the power density reference level of 1.29 W/m^2 is compliant with the 0.08 W/kg basic restriction, based on the isolated, whole-body resonance formula in Hirata (2010).