**EMF-OFF!**
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May 15, 2019 **CRTC File No. 1011-NOC2019-0057**

Filed via GCKey

Mr. Claude Doucet
Secretary General
Canadian Radio-television and
Telecommunications Commission
1 Promenade du Portage
Ottawa, ON K1A 0N2

Dear Mr. Doucet:

**RE:Telecom Notice of Consultation CRTC 2019-57, Review of mobile wireless services– Intervention of EMF-OFF!**

1. Pursuant to paragraphs 48 and 55 of Telecom Notice of Consultation CRTC 2019-57, *Review of Mobile Wireless Services* ("TNC 2019-57"), dated 28 February 2019, and in accordance with section 26 of the *Canadian Radio-television and Telecommunications Commission Rules of Practice and Procedure*, SOR/2010-277 ("Rules of Procedure"), EMF-OFF!is pleased to submit its intervention in the above referenced proceeding.
2. In accordance with subsection 26(2)(a) of the Rules of Procedure, EMF-OFF! hereby states that it wishes to be considered as an intervener in the proceeding.
3. As required by paragraph 66 of TNC 2019-57, EMF-OFF!'s intervention includes a Summary, which precedes its detailed comments.

**SUMMARY**

4. EMF-OFF! is a not-for-profit organization engaged in promoting awareness of the effects of electromagnetic fields ("EMFs") and it seeks to raise, in the context of this consultation and throughout this proceeding, issues concerning the potential risks associated with the anticipated implementation of 5G technology in the context of mobile wireless services in Canada.
5. In particular, EMF-OFF! raises issues concerning potential risks of 5G technology and networks to privacy, human health and safety, health of flora and fauna, and the protection of the public commons, which includes the airwaves.
6. These matters must be seriously considered given CRTC's duty to regulate in the public interest and for the public good, which includes protecting health and the environment.
7. The CTRC's review therefore requires a broader approach to the needs of Canadians than is currently conceived, and must comply with the Section 7 of the Canadian *Charter* protection of Life, Liberty and Security of Person, as well as the Public Trust Doctrine.
8. Furthermore, Canadian *Charter* section 8 rights protecting against unreasonable search and seizure, would require that the CRTC investigate further likely privacy breaches concerning both

personalised (including facial recognition) and anonymized data collection and transfer connected to the utilization of 5G technology and networks.

9. Additionally, EMF-OFF! challenges both the form and content of Safety Code 6 and says there is no meaningful safety standard with regard to mobile wireless and other telecommunications infrastructure: 5G will only exacerbate those risks.

10. EMF-OFF! asserts that the health and safety, environmental and privacy-related risks raised in this submission are issues that the Commission should be aware of and potentially make determinations on as part of this proceeding, and requests to appear at the public hearing. In consequence, EMF-OFF! recommends in the strongest terms that the CRTC discourage further steps associated with the 5G rollout, and that it attach terms and conditions related to these issues in any guidance or regulation concerning the 5G rollout.

## I. INTRODUCTION AND SCOPE OF ISSUES ADDRESSED

11. EMF-OFF! is a not-for-profit organization, formed under the *Canada Not-for-profit Corporations Act*, engaged in promoting awareness of the effects of electromagnetic fields for the purposes of education, defense, protection, reduction and cessation of electromagnetic fields. Fundamentally, EMF-OFF! seeks to protect human beings from risks posed by the proliferation of EMF technologies, and to ensure that their fundamental rights fully respected. In this work, we seek to protect not only adults, but also populations who can be particularly vulnerable to the impacts of electromagnetic fields, such as children, pregnant women, the elderly, and the disabled.

12. Additionally, EMF-OFF! is an organization that “speaks for the trees” as concerns the cumulative effects of EMFs on flora and fauna.

13. EMF-OFF! has carefully reviewed TNC 2019-57 and related documents and understands that the Commission is seeking comments in relation to three main issues, described as 1) competition in the retail market, 2) the current wholesale mobile wireless service regulatory framework, with a focus on wholesale MVNO access, and 3) the future of mobile wireless services in Canada, with a focus on reducing barriers to infrastructure deployment.

14. With respect to those three issues, EMF-OFF!’s submission for this consultation includes comments concerning the future of mobile wireless services in Canada (referred to herein as the “third issue” or “Issue 3”), including infrastructure development related to the deployment of 5G-related wireless services.

15. As the Commission makes clear in its description of this third issue, the introduction and deployment of 5G technology is something that wireless carriers “will begin” to do in the coming years, and that this shift is positioned to play a major role in the future of mobile wireless services in Canada.[1] Furthermore, the Commission chose to highlight the advent of 5G technology and networks as important “context” for its review of mobile wireless services (see “Context”, TNC 2019-57).

[1] TNC 2019-57, paragraph 42.

16. EMF-OFF! also wishes to state that if, for any reason, the Commission views EMF-OFF!'s comments on potential risks of 5G technology to be somehow outside the scope of Issue 3 – a position with which we would strongly disagree -- that the Commission consider EMF-OFF!'s comments as responses to "other matters"

17. EMF-OFF! notes that TNC 2019-57 specifically invites interveners to comment on "other matters" beyond the three primary issues. Paragraph 22 states: "In addition, parties may raise other matters, issues or proposals that are relevant to and appropriate for a broad policy review of mobile wireless services."

18. The invitation to comment on "other matters" also appears in paragraph 50, in the section on specific questions for intervenors as follows:

> **Other matters**
> Q17.Are there any other matters, issues or proposals related to mobile wireless services, beyond those listed above, that the Commission should be aware of and potentially make determinations on as part of this proceeding? Identify and explain why those issues are relevant and include proposed regulatory solutions.

19. EMF-OFF! asserts that potential risks and impacts of 5G technology are, indeed, issues "related to mobile wireless services" and that they constitute issues the Commission should be made aware of and potentially make determinations on as part of this proceeding.

20. Whether as responses to the third issue, or as "other matters", EMF-OFF!'s comments on potential risks to the Public Trust, privacy, human health and safety, and to the health of flora and fauna represent critical issues in the context of 5G technology as a next phase for mobile wireless services in Canada. As such, the comments in the present submission are entirely relevant to the current consultation and the CRTC's review of mobile wireless services.

21. Lastly, EMF-OFF! underscores the observation that the issue of potential risks to privacy, human health or to flora and fauna from mobile wireless services and in particular 5G is not identified as an "issue not in the scope of the proceeding", per paragraph 47 of TNC 2019-57.

## II. PRELIMINARY AND CONTEXTUAL FRAMEWORK FOR THIS SUBMISSION

22. The Commission indicates, in TNC 2019-57, paragraph 3, what appears to be its rationale for undertaking the current review of mobile wireless services. Specifically, the Commission states:

> Given the importance of mobile wireless services, as the market continues to evolve, it is necessary to review the associated regulatory framework to ensure that (i) it remains relevant, (ii) the needs of Canadians are met, and (iii) the policy objectives set out in section 7 of the Telecommunications Act (the Act) are being achieved.

23. In this section, EMF-OFF! comments on the important connections between this rationale, particularly points (ii) and (iii), to the need to consider the potential risks of 5G technology deployment as part of the Commission's review of mobile wireless services. Prior to that

discussion, however, it is useful to go even deeper, and look at the connection between the CRTC's general mandate and mission and the need to consider potential risks of 5G technology.

24. In light of the above, this section on EMF-OFF!'s comments on the CRTC's approach to its review of mobile wireless service in Canada contains the following subsections:

    a. CRTC's mandate and mission in relation to "the public good" and "public interest"

    b. CRTC's review of mobile wireless services requires a broader approach to the "needs of Canadians"

    c. CRTC's review of mobile wireless services requires a broader approach to"social and economic" considerations in the telecommunications policy objectives of the Act

**CRTC's mandate and mission in relation to "public interest" and "public good"**

25. As stated on its website, the CRTC is "an administrative tribunal that regulates and supervises broadcasting and telecommunications in the public interest."[2] Similarly, the CRTC's *2018-19 Departmental Plan*, in the section describing its "Core responsibility", states that the CRTC "is responsible for regulating and supervising Canada's communications system in the public interest."[3] (underlining for emphasis is ours).

26. EMF-OFF! asserts that the "public interest" is a broad concept that includes not only interests such as dealing with access to telecommunications services and affordability, but also interests in being safe, being healthy, having privacy rights respected, and living in a healthy environment.

27. The CRTC is guided by three pillars that comprise its mission, captured in the words, "Create", "Connect", "Protect".[4] EMF-OFF! notes that within the "Protect" pillar, the CRTC engages "in activities that enhance the safety and interests of Canadians by promoting compliance with and enforcement of its regulations, including those relating to unsolicited communications."[5] (underlining for emphasis is ours).

28. While thus far, the CRTC's stated activities within the "Protect" pillar have been quite narrow, aimed primarily at enforcing things like the *Unsolicited Telecommunications Rules* and anti-spam legislation, it seems reasonable to expect that the CRTC should also protect the health and safety interests of Canadians when new telecommunications technologiesthat may pose potential safety and health risks are considered for implementation in Canada, through mobile wireless services or other telecommunications services.

29. The need for a broad view of "public interest" by the CRTC in respect of mobile wireless services is demonstrated by a hypothetical but possible situation. In the event that a telecommunications technology to be employed by carriers as part of their mobile wireless services was found to pose serious risks of harm to Canadians, it would obviously be absurd for the CRTC (or other government bodies) to focus solely on the "needs of Canadians" from the point of view of access

[2] CRTC, "Our Mandate, Mission and What We Do": https://crtc.gc.ca/eng/acrtc/acrtc.htm.
[3] CRTC, 2018-19 Departmental Plan, page 7, https://crtc.gc.ca/eng/publications/reports/dp2018/dp2018.pdf.
[4] CRTC, "Our Mandate, Mission and What We Do": https://crtc.gc.ca/eng/acrtc/acrtc.htm.
[5] Ibid.

and affordability to services. Put simply, the "public interest" in that case would clearly not be served by excluding consideration of the needs of Canadians to be safe from harm.

30. EMF-OFF! notes that Telecom Decision CRTC 2019-74, issued on March 14, 2019,[6] also discusses the role of the public good in certain policies and decisions of the CRTC. While issued in relation to the application of the Essentiality Test and policy considerations to the question of mandating wholesale services, the decision provides important parallels to the question of how the CRTC should approach making determinations for the public good in relation to mobile wireless services in Canada, and to the implementation of 5G technology and networks in particular.

31. Specifically, the Commission outlines three policy considerations that could inform, support or reverse a decision to mandate the provision of a wholesale service, and the first of these is public good. The Commission summarizes this consideration by stating that: "There is a need to mandate the service for reasons of social or consumer welfare, public safety, or public convenience."[7] (underlining for emphasis is ours).

32. In the same decision, at paragraph 16, the Commission observes that following the application of the Essentiality Test and the assessment of policy considerations, it may "establish the terms and conditions pursuant to which a wholesale service should be mandated or no longer mandated, depending on the outcome of its review."[8]

33. EMF-OFF! argues that a similar approach should be taken with respect to policies that the CRTC interprets, develops and enforces in relation to the transformation of mobile wireless services in Canada in connections with the implementation by carriers of 5G technology and networks. While the CRTC does not control spectrum auctions, EMF-OFF! wishes to point out that, prior to a 5G auction and granting of licenses, the CRTC should take all steps possible to ensure that expert study of issues on potential EMF-related risks to privacy, human health and safety, and flora and fauna are required as a term and condition of such licenses.

34. In any, case, paragraph 16 of the decision begs an important question that has relevance to the present consultation: if the CRTC can mandate a telecommunications service for reasons of public good – and in particular, social or consumer welfare, public safety, or public convenience – then why would the tribunal not be able to prohibit a telecommunications service, if necessary, upon the basis of those same public good considerations?

35. EMF-OFF! contends that it is firmly entrenched in the common law of Canada that the air and airwaves, like roads and highways, public forests, fauna and other natural resources, are part of the public commons, which the Government of Canada must manage for the public good.[9]

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[6] *Telecom Decision CRTC 2019-74*, File No. 8640-T66-201801184, 14 March 2019, https://crtc.gc.ca/eng/archive/2019/2019-74.htm.

[7] Ibid, paragraph 58.
[8] Ibid, paragraph 16.
[9] In *British Columbia v. Canadian Forest Products Ltd.*, [2004] 2 SCR 74, 2004 SCC 38 (CanLII), http://canlii.ca/t/1h87s, Binnie J. explains, *in obiter*, that pursuant to the public trust doctrine that various natural resources, such as air, waterways, coasts and forests, are to be considered public goods (at paras 72-82).

36. The airwaves, formally known as the radio frequency spectrum ("the spectrum"), thus, constitute a public good, which must be regulated in the public interest.

37. Although regulation of the spectrum falls to the department of Innovation, Science and Economic Development Canada (ISED), regulation and supervision of Canada's communications system -- a system dependant upon the spectrum -- falls to the CRTC.[10] Given that the CRTC was "established to develop, implement and enforce regulatory policies on the Canadian communications system,"[11] the CRTC possesses a critical oversight role in the expansion and use of mobile wireless technologies, which obviously play a central and increasingly large role in Canada's communication system.

38. In light of the above, the CRTC has the authority and duty to develop and implement policies concerning the use of 5G technology in Canada's communication system, as part of its fundamental responsibility for regulating and supervising Canada's communications system in the public interest.

39. As such, EMF-OFF! takes the view that the CRTC could develop policies concerning the use of 5G technology that incorporate considerations of privacy, health and safety, and protection of the environment, in particular flora and fauna, and in fact needs to do so in order to properly and fully carry out its mandate to regulate and supervise telecommunications (and broadcasting) in the public interest.

**CRTC's review of mobile wireless services requires a broader approach to the "needs of Canadians"**

40. With respect to the Commission's presentation of reasons for undertaking the review of mobile wireless services, statement, it states in paragraph 3 of TNC 2019-57, that reviewing the associated regulatory framework is necessary, in part, to ensure that "the needs of Canadians are met."

41. In keeping with points made in prior parts of this section of the present submission, EMF-OFF! recommends that the Commission take a broad view of "the needs of Canadians" in order to ensure that the health and safety of Canadians and their environment are carefully considered in the Commission's review of mobile wireless services, particularly in light of the "major transformation"[12] of mobile wireless technologies in Canada that deployment of 5G technologies represents.

42. Currently, it appears that the CRTC's focus on the needs of Canadians is aimed largely at the narrow approach to "protection" mentioned in description, above, of the "Protect" part of its self-described mission, as well as at "ensuring Canadians can connect to quality and innovative

[10] CRTC, 2018-19 Departmental Plan, page 7, https://crtc.gc.ca/eng/publications/reports/dp2018/dp2018.pdf.
[11] Ibid.
[12] TNC 2019-57, paragraph 18.

communication services at affordable prices", which encapsulates the "Connect" part of CRTC's mission.[13]

43. When we look at how the CRTC measures its departmental results in relation to the "Connect" part of its mission, indicators such as "% of households that have access to the latest generally deployed mobile wireless technology"[14] demonstrate strongly the CRTC's interest in access and affordability needs.

44. EMF-OFF!, however, believes that ensuring that "the needs of Canadian are met" requires more than simply ensuring access and affordability of technology. It requires that the privacy, health, and safety needs of Canadians, as well as the needs of the environment, are also met. As well, constitutional and *Charter* rights must be respected.

**CRTC's review of mobile wireless services requires a broader approach to "social and economic" considerations in the telecommunications policy objectives of the Act**

45. In addition to ensuring that the needs of Canadians are met, the CRTC's rationale for the review of mobile wireless services[15]also indicates that through its review of the associated regulatory framework, it wishes to ensure that the policy objectives set out in section 7 of the *Telecommunications Act* ("the Act")[16] are being achieved.

46. EMF-OFF! recommends that in its approach to the telecommunications policy objectives in section 7, the Commission takes a broad view of "social and economic" effects on and requirements of Canadians in order to ensure that the health and safety of Canadians and their environment are properly taken into account in the Commission's review of mobile wireless services.

47. With respect to Canada's telecommunications policy, subsection 7(a) in the *Telecommunications Act*, includes the telecommunications policy objective of facilitating a telecommunications system "that serves to safeguard, enrich and strengthen the social and economic fabric of Canada and its regions". (emphasis added). It goes without saying that the "social and economic fabric" of Canada includes within it – and constitutes perhaps its most essential elements -- the health, safety and well-being of Canadians and the environment in which they live.

48. Furthermore, and in relation to economic considerations, subsection 7(f) states the telecommunications policy objective of fostering "increased reliance on market forces for the provision of telecommunications services…". An accurate view of the economic impact of technologies like 5G on Canada would require full cost accounting that accounts for externalities related to Canadian health and safety as well as aspects of the environment flowing from costs otherwise borne by Canadians for harmful impacts from such technology.

[13] CRTC, "Our Mandate, Mission and What We Do": https://crtc.gc.ca/eng/acrtc/acrtc.htm.
[14]CRTC, 2018-19 Departmental Plan, page 18, https://crtc.gc.ca/eng/publications/reports/dp2018/dp2018.pdf.
[15] TNC 2019-57, paragraph 3.
[16]*Telecommunications Act,* S.C. 1993, c. 38.

49. Similarly, the telecommunications policy objective in subsection 7(h) speaks of responding "to the economic and social requirements of users of telecommunications services," which in practice means all Canadians. For reasons explained in relation to subsections 7(a) and 7(f), the economic and social requirements of Canadians necessarily include requirements related to health, safety and well-being.

50. Additionally, subsection 7(i) states the telecommunications policy objective: "to contribute to the protection of the privacy of persons." Despite the fact that, by its very nature, the pervasive quality of 5G technology will increase exposure to privacy issues for individuals and companies alike, privacy issues are not mentioned at all in TNC 2019-57. This is a serious lacuna and constitutes an issue that, like the health, safety and environmental issues raised above, the Commission should include in its review of mobile wireless services.

## III COMMENTS ON THE FUTURE OF MOBILE WIRELESS SERVICES IN CANADA

51. In this section, EMF-OFF! provides comments on the issue of the future of mobile wireless services in Canada, and responds to certain matters within the general issue as described in TNC 2019-57, paragraphs 42 – 46, as well with respect to certain specific questions related to this issue in paragraph 50 (specifically, questions Q14, Q15 and Q16).

52. Prior to providing specific responses on this issue, however, EMF-OFF! must necessarily provide some context for its responses, all of which touch on or relate directly to potential risks of 5G technology – a technology highlighted in the "Context" section of TNC 2019-57. Thus, our comments on the future of mobile wireless services in Canada are prefaced by a brief subsection on context.

53. In light of the above, this section on EMF-OFF's comments on the future of mobile wireless service in Canada contains the following subsections:

    a. Preface to comments on Issue 3 -- 5G wireless technology is a key issue for future mobile wireless services and its potential risks should be part of CRTC's review
    b. Comments in response to Issue 3 –general
    c. Comments in response to Issue 3 -- specific questions(Q14, Q15 and Q16)

### Preface to comments on Issue 3 -- 5G wireless technology is a key issue for future mobile wireless services and its potential risks should be part of CRTC's review

54. Telecommunications companies seek to roll out the fifth-generation (5G) wireless network. This is advertised to bring unprecedented societal change on a global scale, paving the way for "smart" homes, "smart" businesses, "smart" highways, "smart" cities and self-driving cars.

55. The Commission describes some of these applications in TNC2019-57, and in fact discusses the rollout of new wireless technologies, and in particular 5G, as key context for its current review of mobile wireless services. In particular, within the section labelled "Context" in TNC2019-57, the Commission states at paragraph 18:

> Today, the mobile wireless service market is on the verge of a major transformation, since wireless carriers are poised to begin introducing 5G wireless technology into their networks. This technology upgrade will mean that wireless networks will become exponentially faster, more pervasive, and more versatile. With a predicted maximum throughput of 10 gigabits per second (Gbps), this technology will support innovative and bandwidth-intensive services, including self-driving cars, smart cities, and a multitude of interconnected devices that form the IoT.

56. Unfortunately, however, the implementation of the requisite technologies for a functioning 5G network will almost inevitably result in increased exposure to radio frequency ("RF") radiation for humans, flora and fauna, as is outlined in various subsequent paragraphs of this submission.

57. For at least fifty years, it has been known that radio frequency ("RF") radiation, even at extremely low levels of exposure, is bioactive and injurious to human health and safety, flora and fauna and the environment, and that the continuous expansion of wireless telecommunications would endanger its population, and the ecosystems and natural resources upon which they depend for their wellbeing and survival.

58. After implementation of a 5G network, virtually everything we own and buy, from refrigerators and washing machines to milk cartons, hairbrushes and infants' diapers, could contain antennas and microchips and be connected wirelessly to the Internet, leading to the commodification of citizens' private information and unprecedented breaches of privacy and confidentiality, in breach of fundamental human rights and their reasonable expectations of privacy, in particular, in the home.

59. EMF-OFF! contends that installation of 5G technology and associated infrastructure, with its deeply embedded connection to IoT and thus to devices in homes, schools, public places and a myriad of other physical locations, will enable a greatly augmented level of RF radiation as compared with present levels.[17]

60. As a result, EMF-OFF contends that 5G wireless technology is a key issue for future mobile wireless services and its potential risks should be part of CRTC's review.

61. In the next two sections, EMF-OFF! elaborates on these concerns in the context of Issue 3 in TNC 2019-57 – namely, the future of mobile wireless services in Canada.

**Comments in response to Issue 3 - general**

62. In order to transmit the enormous amounts of data required for the Internet of Things, 5G technology, when fully deployed, will use millimeter waves, which are poorly transmitted through solid material. This will likely require every carrier to install base stations (also referred to as "cell towers") every 150 meters[18], often on public thoroughfares and highways, in urban areas as well

[17] See e.g., Louis-Gilles Francoeur, "438 antennes sur les toits de 21 etablissements de santé, 4103 antennes de communications on ete installees dans la vallee du Saint-Laurent", Le Devoir, 23 February 2012, https://www.ledevoir.com/societe/sante/343435/438-antennes-sur-les-toits-de-21-etablissements-de-sante.

[18] *5G Deployment, State of Play in Europe, U.S. and Asia*, European Parliament, Policy Department of Economic, Scientific and Quality of Life Policies, April, 2019, pages 9 and 13. (add internet link if possible).

as within domiciles. The existence of, often on public thoroughfares and highways, multiple competing carriers means there will be a base station in front of every third to fifth house.

63. Unlike previous generations of wireless technology, in which a single antenna broadcasts over a wide area, 5G base stations and 5G devices will have multiple antennas arranged in "phased arrays", that will work together to emit focused, steerable, laser-like beams that track each other. Due to the poor penetration of the beam, antennas will inevitably be inside our homes, as the myriad of inter-communicating devices known as the "Internet of Things" ("IoT") proliferates in the average Canadian home.

64. All 5G cell phones will likely need to contain dozens of tiny antennas, all working together to track and aim a narrowly focused beam at the nearest base station and to other inter-communicating devices.

65. Each 5G base station will contain hundreds or thousands of antennas aiming multiple laser-like beams simultaneously at all cell phones and user devices in its service area. This technology is called "multiple input multiple output" or MIMO.[19] This is not well understood, unpredictable and could easily result in unacceptable levels of EMF exposure humans, flora and fauna.

66. As a result of the changes envisioned with 5G just described, and which are outlined in the description of Issue 3 in TNC 2019-57[20], EMF-OFF! contends that the implementation of a 5G wireless network will result in unprecedented and extraordinary human and environmental impacts given that the reportedly planned density of radio frequency ("RF") transmitters, in particular on public roadways and highways.

67. In light of the fact that the Public Trust Doctrine is clearly recognized in Canada as concerns public roads and highways,[21] and should reasonably be logically extended to include hospitals,

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[19] *5G Deployment, State of Play in Europe, U.S. and Asia,* European Parliament, Policy Department of Economic, Scientific and Quality of Life Policies, April, 2019, page 27: Unusual propagation phenomena with MIMO have neither been studied nor tested on real equipment. "Long-term technology research is essential." The number one recommendation of the report is stated as follows: "Long-term technology research to solve multiple propagation unknowns with the new technology (e.g. measuring and controlling RF EMF exposure with MIMO at mmWave frequencies." (at page 27-8).

[20] TNC 2019-57, paragraphs 42 – 46.

[21] In Canada the "strongest expression of the public trust is that concerning highways". (Kate Smallwood, Smallwood, *Coming Out of Hibernation: The Canadian Public Trust Doctrine*, (Unpublished Masters thesis, University of British Columbia, p. 93). The duty of the Municipality to protect trust to protect lands and its' environment has been recognized by the courts. In *Re. J. F. Brown Co. Ltd. and City of Toronto* (1916) 36 O.L.R. 189 (confirmed by the Supreme Court (1917) 55 S.C.R. 153), the Court found Toronto liable to pay compensation for seepage smoke and misconduct of men at public lavatories built on the highway. The Supreme Court noted in *obiter* at page 176 that an injunction would be available. Masten, J .stated: "it remains the right of all subjects to pass over the highway without obstruction, and that this right is paramount and cannot be infringed, even by the municipal authority itself except under express statutory powers."

In *Chavigny de la Chevrotiere v Montreal (City of)* 1886 12 App. Cas. 149 at 159, the court similarly held that in Canadian law, public highways carry with them a trust in favour of the public, a concept which it went on to apply in relation to a public market. The municipal corporation is no less than a fiduciary for the public. (see also Andrew Gage, "Highways , Parks and the Public Trust Doctrine", 18 J. Env. L. & Prac. 1 (2007): "The clearest consequence of the public trust doctrine is that the trustee is prevented from using public property in a manner inconsistent with the public purpose for which it was dedicated, absent legislation to the contrary. This obligation can resemble the legal consequences of pubic rights, preventing the trustee from directly interfering with the public's use of the public space (which would amount to a public nuisance)." (p. 22). Dangerous public nuisances were recognized as illegal on roadways and enjoined in *Big Point Club v. Lozon* [1943] O.R. 491 (Shooting across the roadway), *Hagel and Hagel v. Municipal District of Yellowknife* 35 D.L.R. (2d) 110 (proposed construction of 70,000 gallon Bunker C fuel tank) and in *Goudreau v. Township of Chandos* 14 O.R. (3d)

schools, CEGEPS and universities, EMF-OFF! asserts that 5G transmitters and other EMF emitting devices should be barred from all of those locations and in close proximity thereto.

68. In general, EMF-OFF! asserts that the installation and deployment of 5G technology and activation of the 5G wireless network will create potential risks in the areas of privacy, human health and safety, and flora and fauna, and these risks are summarized in the context of EMF-OFF's responses to specific questions Q14, Q15 and Q16, in the subsection below.

**Comments in response to Issue 3 - specific questions (Q14, Q15 and Q16)**

69. In paragraph 50 of TNC 2019-57, Q14 asks: "What are the challenges facing carriers as they continue to deploy their networks, particularly with respect to small cells?"

70. In paragraph 50 of TNC 2019-57, Q15 poses the following query: "Identify any expected changes or new technologies that are likely to be deployed in Canadian wireless networks that will have regulatory implications in the near term. How can the Commission ensure that its regulatory frameworks account for market and technological changes?"

71. In paragraph 50 of TNC 2019-57, the opening part of Q16 asks: ''What are the issues associated with wireless carriers obtaining access to infrastructure, including towers, sites, structures, and fibre transport? Discuss whether the Commission's existing rules are sufficient to address these issues and what changes, if any, could be made to improve these rules under the Commission's current statutory framework."

72. Due to the fact that many of the "challenges facing carriers" (in Q14) in the future of mobile wireless services in Canada flow directly from the "expected changes or new technologies that are likely to be deployed in Canadian wireless networks that will have regulatory implications in the near term" (in Q15) as well as the "issues associated with wireless carriers obtaining access to infrastructure" (in Q16), EMF-OFF!'s responses to these three questions will be presented together, in a way that reflects the interconnections of these three questions in relation to EMF-OFF!'s concerns.

73. As stated in the previous subsection, EMF-OFF! contends that installation and deployment of 5G technology and activation of the 5G wireless network will create increased risks to humans in the areas of privacy and human health and safety, and to the environment, in relation specifically to flora and fauna.

74. As a result, this section on EMF-OFF's comments on other issues relating to mobile wireless service contains the following subsections:

    a. Potential risks to privacy from implementation of 5G technology and networks

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636 (unauthorized cutting of trees on highway causing damage to the environment). In *Sarnia* (1861) the courts had no ability to set up obstructions on public roads.

Canadian courts have recognized the public trust is offended and breached by pollution of its land and/or air. That same trust should be extended to the airwaves, the air itself and other natural resources; *B.C. Forest Product*s; Kate Smallwood, *supra*, Chavigny de la Chevrotière v. Montreal (City) (1886) 12 App. Cas 149; Re R.F. Brown Co. Ltd and City of Toronto (1916)36 O.R.L. 159; Vancouver (City) v Burchill [1932] S.C.R. 620.

b. Potential risks to human health and safety from 5G technology and networks
c. Potential risks to flora and fauna from 5G technology and networks
d. Failure to respect the highways Public Trust

**a. Potential risks to privacy from implementation of 5G technology and networks**

75. Installed and emerging smart devices that log and wirelessly transmit information about usage patterns and activities: collectively known as the Internet of Things, obviate privacy rights.

76. As a result, it Is respectively submitted that the CRTC must carefully consider the privacy implications of 5G telecommunications as concerns private citizens both in public places and in their homes. The *Canadian Charter of Rights and Freedoms* protects privacy rights under section 7 (life, liberty and security of person) and Section 8 (unreasonable search and seizure).

77. EMF-OFF! claims that Canadians will be the victim of extensive breaches of their right to life, liberty and security of person privacy breaches as well as the threat of additional privacy breaches as a result of installed and emerging smart devices that log and wirelessly transmit information about usage patterns and activities: collectively known as the Internet of Things or IoT. It is the crux of 5G.

78. In addition, given that the CRTC is listed in the Schedule to the *Privacy Act* (c. P-21), EMF-OFF! submits that the Directive on Privacy Impact Assessment requires the CRTC to ensure the privacy protection of personal information to be collected via 5G telecommunications systems, and that a Personal Information Bank (P.I.B.) or its functional equivalent is mandated. As well, private-sector privacy legislation, both federal and provincial[22], apply to both personalized and anonymous data collection – which data collection is the *raison d'etre* of the proposed 5G scheme.

79. Additionally, EMF-OFF! challenges the notion that service provider notices, both as concerns operating instructions and implied privacy waivers, are legal and binding. Companies may not presume any waiver to *Charter* or Fundamental rights by simply texting a self-serving message[23].

80. Data, whether nominative or anonymized, cannot be collected without a *subpoena* or the express written consent of a citizen. Clearly this also applies as concerns facial recognition and biometrics. Such privacy is, in particular, protected in the home.

81. In connection with this point, EMF-OFF! notes that the 2018 *Report to the Clerk of the Privy Council: A Data Strategy Roadmap for the Federal Public Service*, contains a statement on the role of the federal government in relation to protection of private data, that while presented in the context of the use of data in the federal public service, is instructive here:

> "How the Government of Canada collects, manages and governs data—and how it accesses and shares data with other governments, sectors and Canadians—must

[22] An Act Respecting the Protection of Personal Information in the Private Sector (c. P-39.1) as well as B.C. and Alberta statutes.

[23] For example, a link to the "Bell Privacy Agreement", stating "always on" technologies are recording without customer knowledge or consent. Notice of a breach of Charter rights is not a remedy for such a breach.

change. The government has a responsibility to ensure its workforce has the skills and tools it needs to ethically leverage data to support the public good, while protecting the sensitive and personal data of Canadians."[24]

**b. Potential risks to human health and safety from 5G technology and networks**

82. Even before 5G was proposed, scientists working in this field presented declarations, petitions and appeals to their governments calling for a halt to the expansion of wireless technology and a moratorium on new base stations. In 2002, the Freiburger Appeal, signed by over 3,000 physicians, warned that radiation from cell phones and cell towers was causing serious health impacts including "heart attacks and strokes among an increasingly younger population."[25]

83. In 2015, 215 scientists from 41 countries, all researchers engaged in the study of biological and health effects of electromagnetic fields, communicated their alarm to the United Nations and World Health Organization ("WHO"). They stated that "numerous recent scientific publications have shown that EMF [electromagnetic fields] affects living organisms at levels well below most international and national guidelines."

84. A myriad of peer-reviewed scientific studies[26] demonstrate harm to human health from low-level RF radiation, including effects such as:

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[24]Report to the Clerk ofthe Privy Council: A Data Strategy Roadmap for the Federal Public Service, 2018, online at: https://www.canada.ca/content/dam/pco-bcp/documents/clk/Data_Strategy_Roadmap_ENG.pdf

[25]FrieburgerAppell, *Umwelt·medizin·gesellschaft*, Vol 16, 1/ 2003, p. 36. http://freiburger-appell-2012.info/media/downloads/Freiburger%20Appell%202002%202s%20umg.PDF.

[26]Depression/suicide,van Wijngaarden E, Savitz DA, Kleckner RC, Cai J, Loomis D. Exposure to electromagnetic fields and suicide among electric utility workers: a nested case-control study. *West J Med*. 2000;173(2):94–100. doi:10.1136/ewjm.173.2.94; Retarded memory, learning, cognition, attention, and behavioral problems, autism and attention deficit hyperactivity disorders,Sage, C. and Burgio, E. (2018), Electromagnetic Fields, Pulsed Radiofrequency Radiation, and Epigenetics: How Wireless Technologies May Affect Childhood Development. Child Dev, 89: 129-136. doi:10.1111/cdev.12824; Cardiac function, arrythmia,Bortkiewicz, Alicja&Gadzicka, Elzbieta&Zmyslony, Marek &Szymczak, Wiesław. (2019). The impact of EMF on the cardiovascular function: basic methodological problems and study results; Sperm impacts,Zalata A, El-Samanoudy AZ, Shaalan D, El-Baiomy Y, Mostafa T. In vitro effect of cell phone radiation on motility, DNA fragmentation and clusterin gene expression in human sperm. *Int J FertilSteril*. 2015;9(1):129–136. doi:10.22074/ijfs.2015.4217; Gene expression, stem cells (therapy), Jazayeri M, Shokrgozar MA, Haghighipour N, Bolouri B, Mirahmadi F, Farokhi M. Effects of Electromagnetic Stimulation on Gene Expression of Mesenchymal Stem Cells and Repair of Bone Lesions. *Cell J*. 2016;19(1):34–44. doi:10.22074/cellj.2016.4870; Metabolism, free-radicals, tissue damage, Kıvrak EG, Yurt KK, Kaplan AA, Alkan I, Altun G. Effects of electromagnetic fields exposure on the antioxidant defense system. *J MicroscUltrastruct*. 2017;5(4):167–176. doi:10.1016/j.jmau.2017.07.003; Cancer,Lennart Hardell&Michael Carlberg - Comment on NTP study & EMF Carcinogenicity Assessment, March 12, 2018, https://ntp.niehs.nih.gov/ntp/about_ntp/trpanel/2018/march/publiccomm/hardell20180312.pdf; Fatigue, depressive tendency, sleeping disorders, concentration difficulties, cardio-vascular problems, general well-being, Oberfeld, Gerd & Navarro, Enrique &Portoles, Manuel &Maestu, Ceferino& Gómez-Perretta, C. (2002). The Microwave Syndrome - Further Aspects of a Spanish Study; Diabetes, Havas M. Dirty electricity elevates blood sugar among electrically sensitive diabetics and may explain brittle diabetes. *Electromagn Biol Med*. 2008;27(2):135–146. doi:10.1080/15368370802072075; DNA damage, Lai H, Singh NP. Magnetic-field-induced DNA strand breaks in brain cells of the rat. *Environ Health Perspect*. 2004;112(6):687–694. doi:10.1289/ehp.6355; Fertility, Dimitris J. Panagopoulos, Comparing DNA damage induced by mobile telephony and other types of man-made electromagnetic fields, Mutation Research/Reviews in Mutation Research, Volume 781, 2019, Pages 53-62, ISSN 1383-5742, https://doi.org/10.1016/j.mrrev.2019.03.003; Miscarriage, Li, De-Kun& Chen, Hong & R. Ferber, Jeannette &Odouli, Roxana &Quesenberry, Charles. (2017). Exposure to Magnetic Field Non-Ionizing Radiation and the Risk of Miscarriage: A Prospective Cohort Study. Scientific Reports. 7. 10.1038/s41598-017-16623-8; Neurological damage, Martin L. Pall, Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects

- Addiction and addictiveness
- Alteration of heart rhythm
- Altered gene expression
- Altered metabolism
- Altered stem cell development
- Cancers
- Cardiovascular disease
- Cataracts
- Cognitive impairment
- Diabetes
- DNA damage
- Impacts on general well-being
- Increased free radicals
- Learning and memory deficits
- Impaired sperm function and male infertility
- Miscarriage
- Neurological damage
- Obesity
- Oxidative stress
- Tissue damage

85. Effects in children include autism, attention deficit hyperactivity disorder ("ADHD"), intended addiction to "apps" leading to childhood addiction, depression and higher rates of suicide.[27]

86. The U.S. EPA has stated repeatedly that the human exposure guidelines that were adopted by the FCC on August 6, 1996 are protective only against shocks, burns, and gross heating and do not protect against chronic and low-level exposure. An EPA letter dated March 8, 2002, discussing the 1996 guidelines states that: "The FCC's current exposure guidelines, as well as those of the Institute of Electrical and Electronics Engineers (IEEE) and the International

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including depression, Journal of Chemical Neuroanatomy, Volume 75, Part B, 2016, Pages 43-51, ISSN 0891-0618, https://doi.org/10.1016/j.jchemneu.2015.08.001; Obesity, De-Kun Li, A Prospective Study of In-utero Exposure to Magnetic Fields and the Risk of Childhood Obesity, *Scientific Reports* volume 2, Article number: 540 (2012), https://doi.org/10.1038/srep00540; Oxidative stress, Martin L. Pall, "Wi-Fi is an important threat to human health," Environmental Research, Volume 164, 2018, Pages 405-416, ISSN 0013-9351, https://doi.org/10.1016/j.envres.2018.01.035; Friedman J, Kraus s, Hauptman Y, Schiff Y, Seger R. Mechanism of short-term ERK activation by electromagnetic fields at mobile phone frequencies. *Biochem J*.2007; 405 [3]:559-568. Doi: 10.1042/BJ20061653. "…complete biochemical signalling pathways have been elucidated to explain exactly how just two minutes of cellphone radiation precipitates massive oxidative stress in living humans cells…").

[27]Ra, Chaelin & Cho, Junhan & Stone, Matthew & De La Cerda, Julianne & I. Goldenson, Nicholas & Moroney, Elizabeth & Tung, Irene & Lee, Steve & Leventhal, Adam. (2018). Association of Digital Media Use with Subsequent Symptoms of Attention-Deficit/Hyperactivity Disorder Among Adolescents. *JAMA*. 320. 255. 10.1001/jama.2018.8931. See also Sage, C. and Burgio, E. (2018), Electromagnetic Fields, Pulsed Radiofrequency Radiation, and Epigenetics: How Wireless Technologies May Affect Childhood Development. Child Dev, 89: 129-136. doi:10.1111/cdev.12824.

Commission on Non-Ionizing Radiation Protection, are thermally based, and do not apply to chronic, nonthermal exposure situations."[28]

87. Similarly, a June 17, 1999 letter, signed by the entire Radiofrequency Interagency Work Group ("RFIAWG"), whose members represented the FCC, EPA, Food and Drug Administration, National Institute of Occupation Safety and Health, Occupational Safety and Health Administration, and National Technical Information Agency, stated that the FCC's guidelines are based on "thermal effects" and "acute exposures" and do not consider "chronic exposure to RF radiation, including exposures having a range of carrier frequencies, modulation characteristics, peak intensities, exposure duration, etc., that does not elevate tissue temperature on a macroscopic scale."[29]…and cumulative effects of multiple sources and their interactions.

88. Peer-reviewed studies have recently been published, predicting thermal skin burns in humans from 5G radiation and resonant absorption by insects, which absorb up to 100 times as much radiation at millimeter wavelengths as they do at wavelengths presently in use. Since insect populations have declined by 75 to 98 percent since the 1970s, even in protected nature areas, 5G radiation could have catastrophic effects on insect populations as well as birds and other species that depend on them. A 1986 study by Om Gandhi at the University of Utah warned that millimeter waves are strongly absorbed by the cornea of the eye, and that ordinary clothing, being of millimeter-size thickness, increases the absorption of energy by the skin by a resonance-type effect.

89. Specifically, EMF-OFF! challenges the government's purported safety standard referred to in footnote 2 of TNC-2019-57, being ISED's "Facts about towers". Expert reports filed in support of this intervention by Drs. Magda Havas and Dominique Belpomme clearly indicate that "Safety Code 6", which serves as the basis for the claim that neither towers nor telecommunication infrastructure pose a credible risk to public health, is based on incorrect and incomplete science. Those experts prove, to the contrary, significant risks to humans, flora and fauna already exist and will be exacerbated by the proposed 5G rollout. EMF-OFF! will prove that Safety Code 6, when read properly, is nothing more than an elaborate definitional tautology.

90. In order to further inform the Commission of the basis for these and similar concerns, EMF-OFF! is attaching two expert reports as appendices to this submission (Appendix A and Appendix B).

91. Specifically, Dr. Magda Havas, an expert in biology and retired professor of electromagnetic pollution, has prepared a summary for EMF-OFF! on the recent science on the impacts of 5G and other EMF exposure to humans, flora and fauna, and this report, as well as her curriculum vitae, are attached to this submission as APPENDIX A. Additional information on potential risks to flora and fauna are also included in the body of this submission, below.

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[28]Norbert Hankin, Center for Science and Risk Assessment, Radiation Protection Division, United States Environmental Protection Agency, Letter to Ms. Janet Newton, President, The EMR Network, July 16, 2002,http://electromagnetichealth.org/wp-content/uploads/2014/09/USEPA_Letter.pdf.

[29]Radiofrequency Interagency Work Group (RFIAWG), Letter to Mr. Richard TellChair, IEEE SCC28 (SC4) Risk Assessment Work Group, dated June 17, 1999, http://www.emrpolicy.org/litigation/case_law/docs/exhibit_a.pdf.

92. Furthermore, Dr. Dominique Belpomme, Professor in Clinical Oncology in Paris and Director of the European Cancer and Environment Research Institute and President of the Association pour la Recherche Thérapeutique Anti-Cancéreuse, has written a response to the Institut National de Santé Publique du Québec's report titled "Evaluation des effets sur la santé des champs électromagnétiques dans le domaine des radiofréquences", and this document and his curriculum vitae are attached to this submission as APPENDIX B.

**c. Potential risks to flora and fauna from 5G technology and networks**

93. The potential for damage from 5G technology goes well beyond the human race. There is abundant evidence of harm to diverse plant and wildlife and laboratory animals, including but not limited to:

- Ants. Exposure to cell phones, cordless phones, or WiFi in the laboratory may cause behavioral disturbances and mortality.[30]
- Birds. Proximity to cell towers may impair reproduction and diminishes populations.[31]
- Forests. RF radiation may cause forest dieback, mimicking the effects of acid rain.[32]
- Amphibians. Proximity to a cell tower in an urban laboratory caused 95 percent mortality; RF radiation has contributed to the extinction of scores of species worldwide.[33]
- Fruit flies. Exposure to a cell phone in the laboratory impairs reproduction and causes mortality and genetic abnormalities.[34]
- Honey bees. A ten-minute exposure to a cell phone in the laboratory causes digestion of food to come to a complete halt at the cellular level; RF radiation causes swarming and is a primary cause of colony collapse disorder.[35]
- Insects. Insect populations in nature preserves and rainforests plummeted when cell towers were erected nearby.[36]
- Farm Animals. Proximity to TV and radio transmitting antenna associated with various health and behavioural changes in dairy cows.[37]

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[30]Marie-Claire Cammaerts & Olle Johansson (2014) Ants can be used as bio-indicators to reveal biological effects of electromagnetic waves from some wireless apparatus, Electromagnetic Biology and Medicine,33:4, 282-288, DOI: 10.3109/15368378.2013.817336.

[31]Bhattacharya, R & Roy, Rajeshwari. (2014). Impact of electromagnetic pollution from mobile phone towers on local birds. International Journal of Innovative Research in Science, Engineering and Technology. 3. 32-36.

[32]Waldmann-Selsam, Cornelia & Puente, Alfonso & Breunig, Helmut & Balmori, Alfonso. (2016). Radiofrequency radiation injures trees around mobile phone base stations. The Science of the total environment. 572. 554-569. 10.1016/j.scitotenv.2016.08.045.

[33]Balmori, Alfonso. (2010). Mobile Phone Mast Effects on Common Frog (Rana temporaria) Tadpoles: The City Turned into a Laboratory. Electromagnetic biology and medicine. 29. 31-5. https://doi.org/10.3109/15368371003685363.

[34]Dimitris J. Panagopoulos, Comparing DNA damage induced by mobile telephony and other types of man-made electromagnetic fields, Mutation Research/Reviews in Mutation Research, Volume 781, 2019, Pages 53-62, ISSN 1383-5742, https://doi.org/10.1016/j.mrrev.2019.03.003.

[35]Sharma, vp & Kumar, Neelima R. (2010). Changes in honey bee behaviour and biology under the influence of cellphone radiations. Current science. 98. 1376-1378.

[36]Saravanamuttu, Sivani & Sudarsanam, D. (2013). Impacts of radio-frequency electromagnetic field (RF-EMF) from cell phone towers and wireless devices on biosystem and ecosystem—A review. Biology and Medicine. 4. 202-216.

- Mice. Exposure to EMFs impaired reproductive system in mice.[38]
- Plants.RF radiation shortens life-span, impairs growth, and causes developmental abnormalities in duckweed plants.[39]
- Rats.A four-week exposure to a cell phone led to brain damage in male rats.[40]
- Trees.Aspen trees throughout Colorado no longer grow normally: only when shielded from RF radiation do they display the fall colors for which they were once famous.[41]

**d. Failure to respect the highways Public Trust**

94. The Public Trust Doctrine clearly and unambiguously applies to highways and roadways in Canada. All levels of government have a fiduciary duty to the public to protect the highways commons, which must be respected as concerns as the siting of 5G infrastructure as noted in footnote 20 above. Telecommunications infrastructure therefore may not be sited on public roads or highways if the public's interest in those public roadways is substantially impaired.

**Conclusion**

e. EMF-OFF! believes that, in order to pursue responsibly certain policy objectives in section 7 of the *Telecommunications Act*, the Commission's review of mobile wireless services should include within the scope of its review, the need to examine potential health, safety and other risks associated with the implementation of 5G technology prior to implementation.

f. In particular policy objectives 7(a), 7(f), 7(h) and 7(i) of the *Telecommunications Act* are all, as explained in this submission, oriented to or otherwise related to the public interest, and the public interest must not, particularly when serious impacts from telecommunications technologies are possible, be narrowly construed.

g. In the face of serious potential human health and safety risks as well as risks to flora and fauna, it would be an absurdity to suggest that issues such as affordability and access to technology are the only issues that affect the public interest.

h. Similarly, the public interest in protecting its privacy rights are paramount, and the CRTC would be seriously remiss in protecting the public interest to privacy if it does not consider this issue in its review of wireless mobile services, which is clearly – as evidenced by the

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[37]Löscher, W & Kas, Gra. (1998). Conspicuous behavioural abnormalities in a dairy cow herd near a TV and Radio transmitting antenna. Praktische Tierarzt. 79.

[38]Asghari A, Khaki AA, Rajabzadeh A, Khaki A. A review on Electromagnetic fields (EMFs) and the reproductive system. *Electron Physician*. 2016;8(7):2655–2662. Published 2016 Jul 25. doi:10.19082/2655.

[39]Tkalec, K. Malarić, and B. Pevalek-Kozlina, "Influence of 400, 900, and 1900 MHz electromagnetic fields on Lemna minor growth and peroxidase activity," Bioelectromagnetics, vol. 26, no. 3, pp. 185–193, 2005.

[40]Obajuluwa AO, Akinyemi AJ, Afolabi OB, Adekoya K, Sanya JO, Ishola AO. Exposure to radio-frequency electromagnetic waves alters acetylcholinesterase gene expression, exploratory and motor coordination-linked behaviour in male rats. Toxicol Rep. 2017;4:530–534. Published 2017 Oct 3. doi:10.1016/j.toxrep.2017.09.007.

[41]Katie Haggerty, "Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings: Preliminary Observations," International Journal of Forestry Research, vol. 2010, Article ID 836278, 7 pages, 2010. https://doi.org/10.1155/2010/836278.

"Context" section in TNC 2019-57 – being undertaken in the context of industry plans to roll out 5G technology.

i. EMF-OFF! requests that the CRTC use this opportunity of the review of wireless mobile services to begin the conversation about negative impacts of advanced wireless technologies to be used by the carriers it regulates. It is incumbent upon all parties to take whatever steps are necessary to ensure that the potential impacts of telecommunications policies and activities that would facilitate the use by telecommunications carriers of 5G technology are examined and closely consideredprior to its implementation.

j. To conclude, EMF-OFF! asserts that the health, safety, environmental and privacy-related risks raised in this submission are issues that the Commission should be aware of and potentially make determinations on as part of this proceeding.

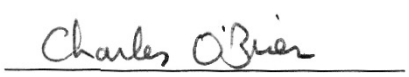
k. EMF-OFF! believes that the CRTC should discourage the 5G rollout until public health, safety, the environmental and privacy concerns are properly addressed and meaningful protective standards established. As well, the commons must be fully respected.

l. Furthermore, EMF-OFF! asserts that the CRTC should attach terms and conditions related to these issues in any guidance or regulation concerning the 5G rollout.

**Request to appear at the public hearing**

m. In accordance with paragraph 55 of TNC 2019-57 and subsection 26(2)(g) of the Rules of Procedure, I hereby state that as the attorney representing EMF-OFF!, I request to appear at the public hearing. EMF-OFF! requests appearance in order to answer any questions the Commission may have in relation to the comments presented in this submission, and to provide expert evidence on all matters raised herein.

Respectfully submitted,



Charles O' Brien

1233 Island Street
Montreal, Quebec
Canada
H3K 2N2

**May 15, 2019**

# Appendix A

# Curriculum Vitae (shortened)

## (1978–2019)

*Magda Havas, B.Sc., Ph.D.*

## PART 1: Academic History

## 1 BIOGRAPHICAL INFORMATION

### 1.1 Contact Information


| | |
|---|---|
| University Address: | Trent School of the Environment<br>Trent University, 1600 West Bank Drive<br>Peterborough, Ontario, Canada, K9J 7B8 |
| Phone: | (705) 748–1011 ext 7882 |
| Email: | mhavas@trentu.ca |
| Websites: | www.magdahavas.com<br>www.theroselab.com |
| Skype: | magda.havas |


### 1.2 Degrees

B.Sc. Honors Biology, University of Toronto, 1971–1975
Ph.D. Department of Botany & Institute for Environmental Sciences, University of Toronto, 1975-1980

### 1.3 Awards, Scholarships, Fellowships

***Academic***

- NSERC University Research Fellowship, 1983–1988
- NSERC NATO Postdoctoral Fellowship, 1981–1983
- Ann Wintercorbyn Prize, 1981, University of Toronto
- NRC Graduate Scholarship, 1975-1977, 1978-1979
- Gulf Oil Scholarship, 1975
- Bell Canada Scholarship, 1975

***Nominated for . . .***

- Symons Award for Excellent in Teaching: 2002, 2003, 2004, 2005, 2010 2011, 2012
- Award for Educational Leadership and Innovation: 2010–11

***Non-Academic***

- Certificate of Appreciation (Research), Department of Veterans Affairs, USA in collaboration with Michael E. DeBakey VA Medical Center, Texas, March 31, 2008.
- Certificate of Appreciation, Uxbridge Community Care, May 1989.

## 2 ACADEMIC HISTORY

**Employment and Positions**

| | |
|---|---|
| October 2018 | Retired, Professor Emeritus |
| 2017–present | Faculty Member, Trent School of the Environment, Trent University, Peterborough, Ontario. |
| 2015–2017 | Program Coordinator, Trent/Loyalist Journalism, Trent University, Peterborough and Loyalist College, Bellville, Ontario. |
| 2002–present | Member, Centre for Health Studies [originally Institute for Health Studies], Trent University, Peterborough, Ontario. |
| 1995–7 &1992–4 | Board of Governors, Trent University, Peterborough, Ontario. |
| July 1993–1994 | Senate, Trent University, Peterborough, Ontario. |
| Aug 1989–present | Associate Professor, Science Education and Environmental and Resource Studies, Trent University, Peterborough, Ontario. |
| June 1985–1989 | Cross Appointed to Faculty of Forestry, University of Toronto, Toronto, Ontario, Canada. |
| Sept 1983–1988 | NSERC University Research Follow/Assistant Professor, Institute for Environmental Sciences, University of Toronto, Toronto, Canada. |
| Feb 1981–1983 | NSERC NATO Postdoctoral Fellow, Section of Ecology and Systematics, Cornell University, Ithaca, New York, USA, in laboratory of Professor G.E. Likens. |

# PART 2: RESEARCH & RELATED ACTIVITIES

## 3 PUBLICATIONS

My scientific research falls into two broad categories. The first is **acid rain and metal pollution** that started in 1975 (1975–2002) with my PhD (1980) and the second is on **non-ionizing electromagnetic pollution** that began in 1995 with my first publication in 2000–a major (80–page) critical review on the biological effects of extremely low frequency electromagnetic fields (ELF EMF) published in *Environmental Reviews*, a National Research Council of Canada journal.

I study the biological effects of non-ionizing electromagnetic frequencies generated by anthropogenic sources (electricity, electronic devices, wireless technology). I also work with individuals who have developed electrohypersensitivity (EHS). I work with doctors to help them diagnose and treat this illness. Recently I turned my attention to how electromagnetic frequencies are interpreted by living organisms and now I examine not only the physiologically harmful effects of electrosmog but also the beneficial effects of PEMF (pulsed electromagnetic field) and light therapy.

Since 2001, I have been asked to provide expert testimony at hearings in Canada, United States, South Africa and the Philippines related to the potentially harmful effects of power frequency electromagnetic fields and radio frequency radiation. To date, I have been invited to write 28 expert testimony reports.

CODE: RJ = peer-reviewed journal articles; RC[1] = peer-reviewed chapters in books; ET[2] = expert testimony; G/T = government/technical report; NR = non–refereed journal article; P = popular press; L = letter; A = abstract or extended abstract.

**197 PUBLICATIONS OF WHICH 97 ARE PEER-REVIEWED (RJ, RC, ET)**

| RJ | RC-C | ET | G/T | NR | P | L | A | BOOK[3] |
|---|---|---|---|---|---|---|---|---|
| 53 | 13 - 1 | 28 | 22 | 14 | 26 | 27 | 7 | 5 |

[1] Note: only one of the 14 chapters I wrote was not peer-reviewed.
[2] Note: while expert testimony (ET) is generally not "peer-reviewed" in the same sense as a scientific publication, it goes through a rigorous review by peers during a hearing or court case and as such should be considered, for all intents and purposes, as peer-reviewed.
[3] Note: I co-edited 3 books on chemical pollutants and co-authored 1 book on electromagnetic pollution. The 5th "book" is my PhD Thesis.

| Year | # | Reference | Type |
|---|---|---|---|
| 2019 | 198 | Zarnett, D and **M Havas**. The Expansion of Wireless Technologies in Canada: Is Government doing enough to Protect Public Health? C.D. Howe Institute, in prep. | NR |
| [7] | 197 | Friesen, M and **M Havas.** Effects of non-ionizing electromagnetic pollution on invertebrates, including pollinators such as honey bees: What we know, what we don't know and what we need to know. Working Landscapes, 12th Prairie Conservation and Endangered Species Conference, Feb 19-21, 2019, Winnipeg, Manitoba (accepted). | NR |
| | 196 | **Havas, M.** Affidavit of Magda Havas, Testimony U.S. District Court for the District of New Mexico, Plaintiffs Santa Fe Alliance for Public Health and Safety, Arthur Firstenberg and Monika Steinhoff; Defendants City of Santa Fe, New Mexico, Hector Balderas, Attorney General of New Mexico and the United States of America. | ET |
| | 195 | **Havas, M.** Integrative Therapeutic Options for treating Stage 4 Breast Cancer, Clinics in Oncology, (accepted) | RJ |
| | 194 | **Havas, M**. Success Story: Stage 4 Breast Cancer Cured with Integrative Medicine. On line version, https://vitalitymagazine.com | P |
| | 193 | **Havas, M**. How I beat Stage 4 Breast Cancer with Integrative Medicine. Letter to the Editor, Vitality Magazine, February/March 2019, page 50–52;https://reader.mediawiremobile.com/VitalityMagazine/issues/204321/viewer?page=51 | L |
| | 192 | **Havas, M**, Electrohypersensitivity (EHS) is an Environmentally-Induced Disability that Requires Immediate Attention. J Sci Discov (2019); 3(1): 20 pp. http://www.e-discoverypublication.com/wp-content/uploads/2019/03/JSD18020-final.pdf | RJ |
| 2018 | 191 | **Havas, M.** Open Letter: Need to Consider Health Effects Associated with Radio Frequency and Microwave Radiation before Deployment of 5G, November 19, 2018; 10 pp. | L |
| [10] | 190 | **Havas, M**. Open Letter to Parents, Teachers, School Boards, Health and Governing Agencies Regarding Wi-Fi Networks in Schools, October 18. 2018, 7 pp. | L |
| | 189 | **Havas, M**. Supplemental Rebuttal Testimony of Magda Havas, State of Iowa, Before the Iowa Utilities Commission, Re: Interstate Power and Light Company, Docket Number SPU-2018-007, October 17, 2018, 23 pp. | ET |
| | 188 | **Havas, M.** Rebuttal Testimony of Magda Havas, State of Iowa, Before the Iowa Utilities Commission, Re: Interstate Power and Light Company, Docket Number SPU-2018-007, September 21, 2018, 37 pp. | ET |
| | 187 | **Havas, M.** Judicial Affidavit of Dr. Magda Havas, Civil Case No. 00–352, Republic of the Philippines Regional Trial Court, National Capital Judicial Region, Makati City, Branch 142, 24 pp. | ET |
| | 186 | **Havas, M.** Dr. Magda Havas' Comments Regarding: Peer Review of the Draft NTP Technical Reports on Cell Phone Radiofrequency Radiation, March 26-28, 2018, 10 pp | G/T |

| | | | |
|---|---|---|---|
| | 185 | **Havas, M.** The Science Policy Gap: Reflections on the Dance between Science and Policy with Emphasis on Electrosmog, IN: de Vega, M, VM Gardoqui, and D Silvestrin (Eds). META Book, 15 pp. (*in press*) | RC |
| | 184 | **Havas, M.** Invited to write the *Afterward* to book by Timothy Schoechle. *Re-Inventing Wires: The Future of Landlines and Networks*, National Institute for Science, Law & Public Policy, Washington, DC | P |
| | 183 | Martel, AA, W Burwell, **M Havas**. Chapter 21: Healing with Light, Aruna Bakhru (Ed.), *Nutrition and Integrative Medicine: A Primer for Clinicians,* CRC Press. 483–509. | RC |
| | 182 | **Havas, M**. Chapter 23: Electromagnetic Hygiene, Aruna Bakhru (Ed.), *Nutrition and Integrative Medicine: A Primer for Clinicians,* **CRC Press.** 533–559. | RC |
| 2017 | 181 | **Havas, M.** Carcinogenic effects of Non-Ionizing Radiation: A Paradigm Shift. JSM Environ Sci Ecol 5(2): 1045. | RJ |
| [10] | 180 | **Havas, M.** Case Study: Pulsed Electromagnetic Field (PEMF) Therapy Relieves Pleural Effusion Following Open Heart Surgery, Surgery 29 (2), 135-143. | RJ |
| | 179 | **Havas, M.** When theory and observation collide: Can non-ionizing radiation cause cancer? Environmental Pollution 221, 501-505. | RJ |
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| | 176 | **Havas, M.** and S Symington. Dirty Electricity, Radiofrequency Radiation, Flicker, and Spectral Quality generated by Different types of Energy Efficient Lighting. Wismar, Germany, Light Conference. Appeared as chapter in book on lighting. | RJ |
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| 2016 | 171 | **Havas, M.** The Role of Electrosmog and Electrotherapy in Diagnosing and Treating Diabetics with Electrical Hypersensitivity. BAOJ Diabetes Vol. 2(2):014 | RJ |
| [6] | 170 | **Havas, M** and MS Symington. Effects of Wi-Fi Radiation on Germination and Growth of Broccoli, Pea, Red Clover and Garden Cress Seedlings: A Partial Replication Study. Current Chemical Biology 10 (1), 65-73. | RJ |
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| | 164 | Havas, M. Open Letter re: ABC Catalyst Wi-Fried Documentary, Australia, July 5, 2016. | L |
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| | 155 | **Havas, M.** Smart Meters: Expert Testimony, prepared for Public Hearing on December 12th, 2014 for the Arizona Corporation Commission, 8 pp. | ET |
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| | 147 | **Havas, M**. Châteauguay v. Rogers. Update of Expert Report from Dec. 15, 2010 to January 30, 2013, regarding 411 Saint-Francis Blvd., Châteauguay. Quebec, Superior Court of Quebec. 30 pp. | ET |
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| 2008 | 119 | **Havas, M**. Dirty Electricity Elevates Blood Sugar Among Electrically Sensitive Diabetics and May Explain Brittle Diabetes. Electromagnetic Biology and Medicine, Vol. 27( 2), pp. 135-146. | RJ |

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| | 111 | **Havas, M**. Are Cell Phones Safe? An Ounce. Prevent Cancer Now. Fall 2008, page 1 | P |
| | 110 | **Havas, M.** Letter to the Editor, Walrus Magazine, comment on Cellphone Games, September 11, 2008 article by Melinda Wenner. | L |
| | 109 | **Havas, M.** Letter to the Editor, BBC News, UK, RE: The bulb hoarders. http://news.bbc.co.uk/2/hi/uk_news/magazine/7480958.stm | L |
| 2007 | 108 | **Havas, M**. Supplemental Evidence by Magda Havas, Alberta Energy and Utilities Board Application No. 1478550 by Altalink Management Ltd. ("Altalink"); Proposed Routing for 500 kV Transmission System Reinforcement Project in the Edmonton–Calgary area. May 2007, 7 pp. | ET |
| [4] | 107 | **Havas, M.** Expert Testimony by Magda Havas, Alberta Energy and Utilities Board Application No. 1478550 by Altalink Management Ltd. ("Altalink"); Proposed Routing for 500 kV Transmission System Reinforcement Project in the Edmonton–Calgary area. Feb 2007, 40 pp. | ET |
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| | 102 | **Anon.** *Ground Current Pollution Act, 2006*. Mpp2006.080.e5-CW, Private Member's Bill, First Reading October 3, 2006. *Helped draft Private Member's Bill on Ground Current Pollution.* | G/T |
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| | 99 | **Havas, M** and D Stetzer. 2006. *Electromagnetic Pollution and your Health. Centre for Health Studies,* Trent University, Peterborough, ON September 2006. | NR |
| | 98 | **Havas, M.** *Dirty Electricity: An Invisible Pollutant in Schools.* Feature Article for Forum Magazine, OSSTF, Fall, 2006. | P |
| | 97 | **Havas, M.** *Response to: Evaluation of the Stetzer Filters.* Open Letter to Health Canada. October 2006. 5 pp. | L |
| | 96 | **Havas, M.** Open letter to Mayor and Aldermen, Milwaukee Wisconsin. Health Concerns of Wi–Fi. | L |
| 2005 | 95 | **Havas, M.** 2005. *Response to BCTC (British Columbia Transmission Corporation) information request to TRAHVOL,* British Columbia Transmission Corporation ("BCTC") Certificate of Public Convenience and Necessity Application for the Vancouver Island Transmission Reinforcement Project, 20 pp, November 10, 2005. | ET |
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| | 92 | **Havas, M.** *Health Effects Associated with Radio Frequency Radiation.* Quasi-Judicial Hearing for Z-01-05, Mt. Ulla FM Transmitter. Salisbury, North Carolina, October 13, 2005. | ET |
| | 91 | Stetzer, D and **M Havas**. High frequency electrical pollution in the homes of residents in South Bend, Mishawaka and Roseland Indiana, Mary 2005. 5 pp plus waveforms. | T |
| | 90 | IAFF, Position on the Health Effects from Radio Frequency/Microwave (RF/MW) Radiation in Fire Department Facilities from Base Stations for Antennas and Towers for the Conduction of Cell Phone Transmissions. International Association of Fire Fighters, Division of Occupational Health, Safety and Medicine. 29 pp, March 2005. [**M Havas** contributed to this report] | T |
| | 89 | **Havas, M**. *Studies point to concerns about radiation from towers*. Salisbury Post, Salisbury, NC, October 20, 2005. | P |
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| | 80 | **Havas, M**. 2004. *Don't put cell towers on school property*. Northern Virginia Journal, November 16, 2004, page 12. | P |
| | 79 | **Havas, M.** *Cleaner power keeps schools healthy*. View from Trent, Peterborough Examiner, Peterborough, Ontario, February 12, 2004 | P |
| 2003 | 78 | **Havas, M**. *Health Effects Associated with Power Lines*. Expert Testimony presented at Sumas 2 Hearing in Abbottsford B.C. July 2003. | ET |
| 2002 | 77 | Woodfine, DG, **M. Havas**, and J. Acreman. 2002. *Nickel and copper tolerance of phytoplankton isolated from a recovering lake near Sudbury, Canada.* Geochemistry, Exploration, Environment, Analysis, Vol. 2 203-207. | RJ |
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| | 75 | **Havas, M.** *Wired and Wireless Energy. An overview of health concerns and a call for action.* Presented to the Environmental Committee on Sustainable Development. House of Commons, Ottawa, ON. May 21, 2002 | ET |
| | 74 | **Havas, M**. *Cell phone headaches, cell tower blues.* View from Trent, Peterborough Examiner, August 9, 2002. | P |
| | 73 | **Havas, M.** *Corporate support can weaken foundation*. View from Trent, Peterborough Examiner, April 12, 2002. | P |
| | 72 | **Havas, M.** *Children at risk in hospital from transformer magnetic fields.* The Act, Australia. | P |
| 2001 | 71 | **Havas, M.** Review of Expert Document *The Workshop Report: Review of Electric and Magnetic Fields (EMFs)*, produced by the Manitoba Clean Environment Commission, March 2001., Winnipeg, Manitoba, letter September 2001. | ET |
| [5] | 70 | **Havas, M.** *Rebuttle, Peter Valberg*, Mendota Heights, Public Hearing on Transmission Lines, April 2001. | ET |
| | 69 | **Havas, M**. *Expert Testimony, Xcel Energy*, Mendota Heights, Public Hearing on Transmission Lines, April 2001. | ET |
| | 68 | **Havas, M**. *Electricity's role in cancer an eye opener.* View from Trent, Peterborough Examiner, October 12, 2001 | P |
| | 67 | **Havas, M.** *Electromagnetic fields linked to childhood cancer according to two new studies.* View from Trent, Peterborough Examiner, March 9, 2001 | P |

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| 2000 | 66 | **Havas, M**. Biological effects of non-ionizing electromagnetic energy: A critical review of the reports by the U.S. National Research Council and the U.S. National Institute of Environmental Health Sciences as they relate to the broad realm of EMF bioeffects. Environmental Reviews 8:173-253. | RJ |
| [4] | 65 | **Havas, M** and D Hanna. *Magnetic Fields in Peterborough Schools: the findings and strategies to reduce exposure*. Presented to the Peterborough-Kawartha-Pine Ridge School Board, Health and Safety Committee, October 2000. | T |

Earlier publications do not deal with electromagnetic frequencies and have been omitted from this version of my CV.

## 4. Lectures – workshops – Conferences

I have presented **more than 370 lectures/workshops** (in addition to my normal teaching load) most of which were by invitation. The vast majority of these presentations are in the area of electromagnetic pollution. While this is generally a higher than normal invited speaker commitment than most university professors take on, I did this because of my interest and commitment to science communication.

I have lectured in …

**30 countries** [Australia (via Skype), Austria, Barbados, Bermuda, Brussels, Canada, Denmark, France, Germany, Greece, Hungary, Israel, Italy, Jamaica, Malta, Mexico, Nassau, Nepal, Norway, Poland, South Africa (via Skype), Soviet Union, Spain, Sweden, Switzerland, Trinidad, Tobago, United Kingdom, United States, and Venezuela];

**7 provinces** [Yukon, British Columbia, Alberta, Ontario, Quebec, PEI, Nova Scotia];

**27 states** [Arizona, California, Colorado, Connecticut, Florida, Hawaii, Illinois, Maryland, Michigan, Minnesota, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Utah, Vermont, Washington DC, Washington State, West Virginia, and Wisconsin];

**25 universities/colleges**

- in **Canada** [Brock University, St. Catharines, ON; Carlton University, Ottawa, ON; Centennial College, Toronto, ON**;** Dalhousie University, Halifax; Fleming College, Peterborough, ON; Georgian College, Barrie, ON; Guelph University, Guelph, ON; Lakehead University, Thunder Bay, ON; McMaster University, Hamilton; McGill University, Montreal QC; Ontario College of Arts and Design, Toronto, ON; Queens University, Kingston, ON; Royal Roads University, Victoria, BC; Trent

University, Peterborough, ON; University of Ottawa, Ottawa, ON; University of Prince Edward Island, PEI; University of Toronto, Toronto, ON]

- in **U.S.** [College of Santa Fe, New Mexico; Cornell University, Ithaca NY; Johns Hopkins University, Baltimore, Maryland; State University of New York, Cortland, NewYork; Lock Haven State College, Pennsylvania; University of Arizona, Tucscon, Arizona]

- in other countries: **Norway** – Institute for Water Research; **Nepal** – Tribhuvan University; **Italy** – University of Bologna.

I have been invited to present to various government agencies at the **municipal** (City of Toronto Board of Health; Mendota Heights, Minnesota), **state/provincial** (Partners in Prevention, Workers Health and Safety in Ontario; Legislative Assembly, Queen's Park Minnesota; **federal** (HESA House of Commons Committee, Ottawa; Standing Committee on Environment and Sustainability, Parliament Hill, Ottawa; National Institute for Environmental Health Sciences in North Carolina); and **international level** (World Health Organization, Royal Academy of Medicine, Belgium). I have also been invited to brief Senate and Congressional Staff in the U.S. and members of the Liberal, Conservative and Green Party in Canada on the harmful effects of electromagnetic pollution.

I am regularly invited to give talks and workshops at medical and health related conferences where those in attendance receive professional accreditation.

In the area of **acid rain** I was internationally recognized as an expert in my field and was invited as a Plenary Speaker to the last acid rain conference I attended, *Acid Reign '95 Conference*, Gothenburg, Sweden, June 1995. Many of my publications are still cited despite being published more than 20 years ago.

In the field of **non-ionizing electromagnetic pollution** I am recognized internationally as the numerous speaking invitations, expert testimony requests, invitations to review papers, and media interviews would indicate. I am part of a small group of international scientist who drafted the International Scientist Appeal presented to the World Health Organization and the United Nations (www.emfscientist.org).

My presentations are provided below and on the following pages.

| YEAR | # | LECTURES – WORKSHOPS – CONFERENCES |
|---|---|---|
| 2019 | 373 | Beneficial effects of electrotherapy and the harmful effects of electrosmog, Women's College Hospital, Toronto, May 5, 2019. |
| [7] | 372 | Inflammation and Electromagnetic Pollution: Health Problems & Solutions, CSNN Alumni Association, 12th Annual Holistic Nutrition Conference, Ontario Science Centre, North York, May 4, 2019. |

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| | 371 | 5G Technology – An Impending Health Tsunami, Toronto Total Health Show, Toronto, April 13, 2019. |
| | 370 | Tesla Medicine and the healing properties of UV light, Toronto Total Health Show, Toronto, April 13, 2019. |
| | 369 | The Good, The Bad and The Ugly - Our love affair with wireless technology, Jewish Community Centre, Tucson, Arizona, March 28, 2019. |
| | 368 | Environmentally Acquired Illnesses, University of Arizona, Tucson, Arizona, March 27, 2019 |
| | 367 | Town Hall, Tucson, Arizona, March 25, 2019. |
| 2018 | 366 | What is 5G and is it Harmful? Renfrew County Private Landowners Association, Cobden, ON, June 23, 2018. |
| [6] | 365 | Electrosmog & Electrosensitivity: A Tsunami in the Making. Electro 7 Quimico Sensibles por el Derecho a la Salud, Segovia, Spain, June 16, 2018. |
| | 364 | Panel Presentation: Wholistic Health for the Whole Family, Total Health Show, Toronto, May 11-13, 2018. |
| | 363 | Q & A on Breast Cancer & the Role of Complementary Health Care, Total Health Show, Toronto, May 11-13, 2018. |
| | 362 | Breast Cancer & the Role of Complementary Health Care, Total Health Show, Toronto, May 11-13, 2018. |
| | 361 | Electrosmog, Electrosensitivity, Electrotherapy & Dental Health. Holistic Dental Association (HAD), Enhancing Biocompatible Dentistry using Latest Technologies & Materials, 41st Annual Symposium, April 12–14, 2018, San Diego, CA. |
| 2017 | 360 | Lecture: Radiation from Wireless Technology Affects the Blood, the Heart, & the Autonomic Nervous System, Regional Meeting of Chiropractors, Peterborough, Ontario, November 13, 2017. |
| [8] | 359 | Lecture: Treat the Person, Treat the Environment. Klinghardt Academy Lyme Conference, Washington, May 7, 2017. |
| | 358 | Lecture: Not all Light Bulbs are Created Equal. International Light Association Conference, Fort Lauderdale, Florida**.** May 1, 2017. |
| | 357 | Panel Discussion with George Nori: Total Health Show, International Conference Centre, Toronto, Ontario, April 22, 2017. |
| | 356 | Lecture: Healing with Light, Total Health, International Conference Centre, Toronto, Ontario, April 22, 2017. |
| | 355 | Lecture: Electrosmog on the Brain, Klinghardt Academy Brain Solutions Conference, Warren, N.J., March 16–19, 2017 |
| | 354 | Lecture: Is microwave radiation generated by Wi-Fi, mobile phones and cell phone antennas harmful? **Nassau**, February 20, 2017. |
| | 353 | Lecture: Importance of Electromagnetic Hygiene to Promote Optimal Health. Salzburg, Austria, February 4, 2017. |

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| 2016 | 352 | Lecture: Elettrosmog & Elettroipersensibilità: Cos'è questo e perché dovremmo preoccuparci? (translation: Electrosmog and Electrosensitivity: What is this and why should we care?), Trento, Italy, October 20, 2016. |
| [9] | 351 | Lecture: Electromagnetic Hygiene: The Missing Link to Vibrant Health. Societa Italiana Di Biofisica Electrodinamica V Congresso Nazionale (SIBE), University of Bologna, Italy, October 22, 2016. |
| | 350 | Lecture: Electrosmog, Electrohypersensitivity and LED Light Bulbs Future of Healthy Light and Lighting in Daily Life, LSW Light Symposium 2016, Wismar, Germany, October 12-14, 2016. |
| | 349 | Lecture: Ground Current Pollution: Issues, Sources, Effects, Solutions (ISES), Ontario Electrical League, **Brantford, Ontario**, September 20, 2016. |
| | 348 | Lecture: Electromagnetic Field Dangers in the Modern World, Nourish Vermont, Shelbourne Farms, Vermont, June 3, 2016. |
| | 347 | Lecture: Electrohypersensitivity: An Emerging Health Issue. Electrosmog: the missing link. NIEHS (National Institute of Environmental and Health Sciences), Triangle Park, North Carolina, May 9, 2016. |
| | 346 | Lecture: From Grounding to Ground Current, Divining Common Unity Convention 2016, Canadian Society of Dowsers, Peterborough, Ontario, April 29, 2016. |
| | 345 | Lecture: From Grounding to Ground Current, Total Health, International Conference Centre, Toronto, April 9, 2016. |
| | 344 | Lecture: Our Love Affair with Wireless Technology, 2016 Tech–Knowledge–Y Conference, Wi-Fi in Schools, Peel YES, Ontario, 35 Front St N Mississauga. February 29, 2016. |
| 2015 | 343 | Lecture: Paradigm Shift in Health and Health Care: Using Electromagnetic Energy for Assessment and Treatment, A4M Conference, Las Vegas, December 10, 2015 |
| [25] | 342 | Lecture: Electromagnetic Hygiene: The Missing Link to Vibrant Health, A4M Conference, pre-conference workshop, Las Vegas, December 9, 2015 |
| | 341 | Workshop (6 hour): The Perils of Electro–smog and the Promise of Electro–therapy, Nature's Emporium, Newmarket, Ontario, Havas Academy, Dec 7, 2015 |
| | 340 | Lecture: The Perils of Electro–smog and the Promise of Electro–therapy, Nature's Emporium**,** Newmarket, Ontario**,** Havas Academy, Dec 6, 2015 |
| | 339 | Lecture: Electrosmog and Electrosensitivity: What doctors need to know to help their patients heal, Electropollution and Electrosensitivity–the wireless threat to your health, Summerhill Pyramid Winery, Kelowna, B.C., November 14, 2015 |
| | 338 | Lecture: The Good, the Bad, and the Ugly about Wireless Technology, Kelowna, B.C., November 13, 2015 |
| | 337 | Lecture: Electrosmog & Electrohypersensitivity: What doctors need to know to help their patients heal. ICIM 60th Congress, Chicago, IL, The |

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| | | Martin, October 29 to November 1, 2015 |
| | 336 | Workshop (3-hour): The Good the Bad and the Ugly about Electromagnetic Exposure. ICIM (International College of Integrative Medicine) 60th Congress, Chicago, IL, The Martin, October 29 to November 1, 2015 |
| | 335 | Electrosmog, SOPMED (Society of Progressive Medical Education), Snowbird, Utah, Jun 24-27, 2015 |
| | 334 | Healing Issues that you are Missing, SOPMED, (Society of Progressive Medical Education), Snowbird, Utah, Jun 24-27, 2015 |
| | 333 | Workshop (3-hour): Electromagnetics 101, SOPMED, (Society of Progressive Medical Education), Snowbird, Utah, Jun 24-27, 2015 |
| | 332 | Ground Current on Farms, Ontario SPCA (Society for the Prevention of Cruel to Animals), Educational Conference, Rama, Ontario, Jun 3, 2015 |
| | 331 | Electromagnetic Fields and your Health, Health and Wellness Weekend, Dr Steven Herr, MD, Muskoka Way, Deerhurst, Huntsville, May 30-31, 2015 |
| | 330 | Electromagnetic Fields and your Health, New Innovative Technologies for Drugless Pain Management, Ontario Association of Community Care Access Centres, Toronto, May 28, 2015 |
| | 329 | What's Zapping your Brain? The harmful effects of electromagnetic frequencies, Woodside Clinic, Oakland, Ontario, May 24, 2015 |
| | 328 | Heart Rate Variability as a diagnostic tool in electrohypersensitivity, Idiopathic Environmental Intolerance: What role for electromagnetic fields and chemicals? 5th Paris Appeal Congress, Royal Academy of Medicine, Belgium, Brussels, May 18, 2015 |
| | 327 | Electrosmog, Klinghardt Academy, Warren, New Jersey, May 1-3, 2015 |
| | 326 | Let there by light!! Klinghardt Academy, Warren, New Jersey, May 1-3, 2015 |
| | 325 | Workshop: The Return of Tesla Machine, Total Health Show, Toronto, Apr 19, 2015 |
| | 324 | Let there by light! Total Health Show, **Toronto**, Apr 18, 2015 |
| | 323 | Lecture and Panel Discussion: Live "Tesla Talks" about Ozone Therapy, Total Health Show, Toronto, Apr 17, 2015 |
| | 322 | Webinar**:** Electromagnetic Hygiene while Travelling, The Healthy Travelers Summit, Robyn Benson, pre-recorded Mar 17, 2015 |
| | 321 | Guest speaker with Bob Connolly: Ozone generator developed by Nikola Tesla, Tesla Ball, Hamilton, Feb 7, 2015 |
| | 320 | PEMF devices and your health, Nature's Emporium, Newmarket, Jan 28, 2015 |
| | 319 | Webinar: Electrosmog, Progressive Medical Education, Jan 26, 2015 |
| 2014 | 318 | Webinar: Wi-Fi in Schools, Baby Safe Project, Teachers' Union, Dec 9, 2014 |

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| [9] | 317 | Electrosmog & Electrosensitivity: What doctors need to know to help their patients heal. Doctors' Symposium, Albany Club, Women's College Hospital, Canadian College of Naturopathic Medicine. Toronto, September 12, 2014. |
| | 316 | July 13, 2014. Scientists and Physicians call Health Canada to protect the public from radiofrequency radiation exposure. |
| | 315 | Lights and RFR, Teslamania, Ontario Science Centre, Toronto, Ontario July 12, 2014. |
| | 314 | Provocation & Remediation Studies: What they tell us about electrohypersensitivity. McGill University, Montreal, June 6, 2014. |
| | 313 | Dirty Electricity: The missing link in electrosmog and Electrosensitivity. Bad Krozingen, Germany, Electrobiologie Kongress, May 23-25, 2014. |
| | 312 | The good, the bad, and the ugly about electromagnetic field exposure. Total Health Show, Toronto, April 4, 2014. |
| | 311 | Ground Current 101: Effects on livestock and farmers, Beef and Dairy Producers meeting, Hawkstone Ontario, March 25, 2014. |
| | 310 | In Memory of David Collin and his work on Ground Current. Bio-Ag Educational Meeting, Wellesley, Ontario, January 15, 2014. |
| 2013 | 309 | Health Effects of Electromagnetic Fields, AGM, Complementary & Integrative Medicine, Ontario, Med. Association, Toronto, November 16, 2013. |
| [23] | 308 | Stray Voltage and Transients on Dairy Farms, Dairy Farmers and Vet Clinic Educational Meeting, Elmira, Ontario, November 15, 2013. |
| | 307 | Electromagnetic Techniques to assess health and to promote healing. EHS workshop, American Academy of Environmental Medicine, Phoenix, Arizona, October 26, 2013. |
| | 306 | Smart Meters . . . 101, Project Ecosphere Environmental Fair, Olympic Stadium, Montreal, Quebec, May 25, 2013. |
| | 305 | Electromagnetic Energy: Part 1: The Perils of Electro-smog, Part 2: The Promise of Electro-therapy, Healing the Brain 2013: Biological Medicine & Self Help Techniques, Klinghardt Academy, New York, NY, May 10-12, 2013. |
| | 304 | Wi-Fi in Schools is Safe: True or False? Royal Canadian Legion, 35 Front Street N, Mississauga, Ontario, May 9, 2013. |
| | 303 | What do mobile phones, wireless routers, compact fluorescent light bulbs & smart meters have in common . . . and how are these devices affecting our health? Workplace Safety and Prevention Services, Annual Meeting, Partners in Prevention, Mississauga, Ontario, May 1, 2013. |
| | 302 | Our evolution from a bag of chemicals to beings of light. Total Health Show, Metro Toronto Convention Centre, Toronto, Ontario, April 7, 2013. |
| | 301 | Role electrosmog plays in stress and illness. Total Health Show, Metro Toronto Convention Centre, Toronto, Ontario, April 8, 2013 |

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| | 300 | Radiation from Wireless Technology affects the blood, the heart and the Autonomic Nervous System. Corporate Interference with Science and Health: Fracking, Food and Wireless, New York, NY, March 13-14, 2013. |
| | 299 | Provided **Expert Testimony** regarding health effects associated with cell phone base, Rogers vs. Chateqaugy Hearing, Montreal, Quebec, Justice Perrault, February 8-9, 2013. |
| | 298 | Electrosmog and Electrosensitivity: What doctors need to know to help their patients heal. Holistic Approach Professional Association (HAPA), **Toronto**, Ontario, January 31, 2013. |
| | 297 | Electrosmog and Electrosensitivity: What doctors need to know to help their patients heal. Holistic Approach Professional Association (HAPA), Toronto, Ontario, January 31, 2013. |
| | 296 | Is it chemistry or is it energy? A paradigm shift in how we view the human body and what that tells us about our electromagnetic environment. Peterborough, Dowsers, Lions Centre, Peterborough, Ontario, Jan 21, 2013. |
| | 295 | Electrosmog and Electrosensitivity: An Introduction to and Overview of the History of this Illness. The Hidden Environmental Stressors you must know about to Remediate Cancer, Heart Disease, Multiple Sclerosis, Diabetes, mood disorders, Chronic Fatigue and Failing Health: Moderator Burton Goldberg, 20th Annual World Congress on Anti-Aging and Regenerative Medicine, American Academy of Anti-Aging Medicine, Las Vegas, Nevada, December 14, 2014. |
| | 294 | Ground Current 101: Effects on Livestock and Farmers, Uncontrolled electricity/ground current livestock Impacts Seminar, Federation of Agriculture, Perth County, Listowel Ontario, November 29, 2012. |
| | 293 | Radio Frequency Radiation and Health Effects, Occupy Teleconference, November 8, 2014 |
| | 292 | Wi-Fi and Associated Dangers: Hype vs. Facts? Partners in Prevention, Workers Health and Safety, Kitchener, Ontario, October 30, 2012. |
| | 291 | Electrosmog and Health, Health and Wellness Event, Hockley Valley Resort, Hockley Valley, Ontario, October 28, 2012. |
| | 290 | Wi-Fi and Associated Dangers: Electromagnetic Hygiene. Seminars on Wi-Fi, health effects, standards, measurements, exposure controls. Occupational Hygiene Association of Ontario (OHAO), Toronto Congress, Pearson Airport. Toronto, Ontario, October 25, 2012 |
| | 289 | Wi-Fi and Associated Dangers: Hype vs. Facts? Partners in Prevention, Ontario Workers Health and Safety, Hampton Inn Ottawa and Conference Centre, Ottawa, October 18, 2012. |
| | 288 | Replication of Heart Rate Variability (HRV) Provocation Study with 2.4 GHz Cordless Phone, 7th International Workshop on the Biological Effects of Electromagnetic Fields, Malta, October 8-12, 2012. |
| | 287 | Electrosmog & Electrosensitivity, American Academy of Environmental Medicine, St. Petersburg, Florida, October 6, 2012. |

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| 2012 | 286 | Rapid Aging Syndrome (electro-hyper-sensitivity). Grail Springs, Bancroft, Ontario , June 28, 2012. |
| [19] | 285 | Electrosmog & Electrosensitivity: Are you at risk?, Grail Springs, Bancroft, Ontario , June 25, 2012. |
| | 284 | Electrosmog & Electrosensitivity: Are you at risk?, Grail Springs, Bancroft, Ontario, June 23, 2012. |
| | 283 | Expert Testimony, Re: Application 7305883 Ontario Inc regarding Tenant Ms. Veronica Ciandre, Landlord Tenant Board, Toronto, Ontario, June 20, 2012. |
| | 282 | Radio Frequency Radiation (RFR): Is it safe? Invitation of Conservative MP for Oakville, Terence Young, Parliament Hill, Ottawa, Ontario, June 11, 2012. |
| | 281 | Electromagnetic Hypersensitivity: Is it physiological or psychological? Environmental Health Clinic, Women's College Hospital, Toronto, Ontario, May 23, 2012. |
| | 280 | Electromagnetic Radiation and Illness. Medical Research Institute, Vall d'Hebron Hospital, Barcelona, Spain, May 9, 2012. |
| | 279 | Dirty electricity chronic fatigue and fibromyalgia. Chronic Fatigue Conference, Vall d'Hebron Hospital, Barcelona, Spain, May 9, 2012. |
| | 278 | Dirty electricity and health effects. Research Institute, Barcelona, Spain, May 8, 2012, with Spanish Translation. |
| | 277 | Wi–Fi: Hype vs. Fact, International Centre, Terry Boorne, Ontario Workplace Safety & Prevention, Mississauga, Ontario, May 1-2, 2012. |
| | 276 | Centennial College, Interview with Journalism Students, April 23, 2012. |
| | 275 | Part 2. Electromagnetic Energy: The Promise of Electrotherapy, Total Health Show, Toronto, Ontario, April 21, 2012. |
| | 274 | Part 1. Electromagnetic Energy: The Perils of Electrosmog, Total Health Show, Toronto, Ontario, April 22, 2012. |
| | 273 | Cellular Antennas in your Neighbourhood. Are they Safe? Mississauga, Ontario, April 19, 2012. |
| | 272 | Cellular Antennas in your Neighbourhood. How close is too close? Balsam Community, Oakville, Ontario, April 18, 2012 |
| | 271 | Wi-Fi in Schools is Safe. True or False? Sir Sanford Fleming College, Lindsay, Ontario, March 7, 2012. |
| | 270 | Cellular Antennas in your Neighbourhood. Are they Safe? Bronte Tower, Oakville, Ontario, March 1, 2012. |
| | 269 | Electromagnetic Radiation and Illness. Biological Medicine, New York, February 17-19, 2012. |
| | 268 | Deposition in NY regarding Wi-Fi in Schools, Portland Oregon, Jan 26, 2012. |
| 2011 | 267 | Presentation via Skype with South Africa on Radio Frequency Radiation and Biological Effects, December 1, 2011. |

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| [24] | 265 | Wi-Fi in Schools–Is it Safe? Ontario English Catholic Teachers' Association, Toronto, Ontario, November 3, 2011 |
| | 264 | Zoomer Radio, Toronto, October 27, 2011. |
| | 263 | Symptoms of Electrohypersensitivity. MediConsult Convention, Museum of Contemporary Art, San Diego, California, October 2, 2011. |
| | 262 | Therapeutic pulsed magnetic fields travelogue. MediConsult Convention, Museum of Contemporary Art, San Diego, California, October 2, 2011. |
| | 261 | Electrosensitivity and Electrosmog Exposure, MediConsult Convention, Museum of Contemporary Art, San Diego, California, October 1, 2011. |
| | 260 | The History of RF Microwave Radiation, MediConsult Convention, Museum of Contemporary Art, San Diego, California, October 1, 2011. |
| | 259 | and R. Connolly. Therapeutic pulsed magnetic fields travelogue. MediConsult Convention, Science Centre, Toronto, Ontario, Sept 25, 2011. |
| | 258 | Electrosensitivity and Electrosmog Exposure, MediConsult Convention, Science Centre, Toronto, Ontario, September 24, 2011. |
| | 257 | The History of RF Microwave Radiation, MediConsult Convention, Toronto, Ontario, September 24, 2011. |
| | 256 | Smart Meters, Broadband and WHO, Milagro, Tucson, Arizona, Jul 17, 2011. |
| | 255 | Workshop on EHS and various diagnostic technologies, Joshua Creek, Oakville, Ontario, July 9, 2011. |
| | 254 | Magda Havas and S. Symington. Wi-Fi in Schools, Community Centre, Bobcaygeon, Ontario, May 30, 2011. |
| | 253 | 2-hour Lecture on low EMF buildings, course at Fleming College, Peterborough, Ontario, May 18, 2011. |
| | 252 | How to minimize your exposure to potentially harmful electrosmog, Peterborough Wellness Expo, Evinrude, Peterborough, Ontario, May 7, 2011 |
| | 251 | Women's Business Network, Speakers Group, Peterborough, Ontario, May 5, 2011. |
| | 250 | Electrosmog & Electrosensitivity, Der 8. Nationale Kongress, Elektrosmog-Betroffener, Bern, Switzerland, April 25 to 30, 2011 |
| | 249 | Wind turbines, dirty electricity, and ground current, Lakeville, Connecticut, April 16, 2011. |
| | 248 | Havas, M., D. Davis, and S. Sinatra, Panel Discussion, Total Health Show, Toronto, Ontario, April 8-10 |
| | 247 | Taming the Microwave Dragon, How to survive in a Wireless world, Total Health Show, Toronto, Ontario, April 8-10 |
| | 246 | Electrosmog: Our Love Affair with Wireless Technology, Atlanta, Georgia, April 1-4, 2011. |
| | 245 | Havas and Symington, Wi-Fi in Schools, Buckhorn Community Centre, Buckhorn, March 1, 2011. |

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| | 244 | Health Committee Toronto, Wi–Fi in Schools: Health Issues, **Toronto**, Ontario Feb 14, 2011 |
| | 243 | Ground Current, Ripley Ontario, February 11 to 13, 2011. |
| 2010 | 242 | Dirty Electricity, Microwaves and Ground current Joshua Creek, Oakville, December 4, 2010. |
| [35] | 241 | Workshop, HRV and live blood, Joshua Creek, Oakville, December 4, 2010. |
| | 240 | 2010, Introduction to Devra Davis, University of Toronto, **Toronto**, November 23, 2010 |
| | 239 | History of Microwave Research. San Francisco, California, Commonwealth Club, November 18, 2010 |
| | 238 | Microwave Exposure in Schools. San Francisco Commonwealth Club, November 18, 2010 |
| | 237 | Electrosmog and electrohypersensitivity, Weston A Price Conference, Pennsylvania, November 14, 2010. |
| | 236 | Dirty Electricity: The Missing Link, Israel, Tel Avive, October 27, 2010. |
| | 235 | Our love affair with wireless technology. Israel, Tel Avive, October 26, 2010, |
| | 234 | Electrosmog and electrohypersensitivity. Israel, Tel Avive, October 26, 2010 |
| | 233 | Evenrude Centre talk on Wi–Fi in Schools, Peterborough, Ontario, October 20, 2010. |
| | 232 | Kingston Club of the Canadian Federation of University Women, Queens University, Kingston, October 13, 2010. |
| | 231 | Electrosmog & Electrohypersensitivity, Montreal, Best Western Europa, September 26, 2010. |
| | 230 | Havas and Cline, 2010. Webinar, September 10, 2010. |
| | 229 | LA Cancer Conference**,** Los Angeles, California, September 5, 2010. |
| | 228 | Talk, Los Angeles, California, September 2, 2010. |
| | 227 | Havas, M. and Barry Trower and History of EMFs, University of Toronto, Toronto, Ontario, Aug 24, 2010. |
| | 226 | Crystal Beach, Ontario, August 9, 2010. |
| | 225 | Webinar with Dr. John Cline in BC via Skype. June 11, 2010. |
| | 224 | Wi–Fi in Schools. Collingwood, Ontario, June 10, 2010. |
| | 223 | William Rae Conference, Dallas Texas, May 3-6, 2010. |
| | 222 | Havas, M. and C. Rees. 2010. Full Signal. Long Island, NY, May 5, 2010 |
| | 221 | Havas, M. and C. Rees. 2010. Full Signal. New York City, NY, May 4, 2010 |
| | 220 | Havas, M. and C. Rees. 2010. Electrosensitivity, How do diagnose it. Kinghardt Academy, Madison, NY, May 1, 2010 |

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| | 219 | Havas, M. and C. Rees. 2010. Full Signal. New York City, NY, April 29, 2010 |
| | 218 | Havas, M. and C. Rees. 2010. Congressional Briefing, Washington, DC, April 28, 2010 |
| | 217 | Lecture: Electrosmog and Electro-Sensitivity, Johns Hopkins University, Baltimore, Maryland, April 27, 2010 |
| | 216 | HESA House of Commons Committee, Ottawa, presentation via phone from Baltimore, Maryland, April 27, 2010 |
| | 215 | Workshop on Monitoring Electrosmog at Johns Hopkins University, Baltimore, Maryland, April 26, 2010 |
| | 214 | Proposed Roger's Antennas on Condominiums in Brampton, Ontario. April 7, 2010. |
| | 213 | Kroh, C. and Havas, M. 2010. Is the government doing enough to protect our health? Panel Discussion. Total Health 10, Toronto Metro Convention Centre, Toronto, Ontario, March 14, 2010. |
| | 212 | Mobile Phones, Antennas, Computers, and Compact Fluorescent Lights . . . What you need to know to protect your health. Total Health 10, Toronto, Ontario Metro Convention Centre, Toronto, March 14, 2010. |
| | 211 | Electro-hyper-sensitivity (EHS): An emerging health issue. University of Ottawa, Ottawa, Ontario, March 3, 2010. |
| | 210 | Electrosmog and Electrosensitivity. Health Impacts of Exposure to Wireless Radiation, Lakehead University, Thunder Bay, Ontario, February 22, 2010. |
| | 209 | Electrosmog and Electrosensitivity: What you need to know to protect your home environment. Electrosmog: Introduction and Training. Toronto, January 23, 2010. |
| | 208 | Ground Current in Urban Environments. Electrosmog: Introduction and Training. Toronto, January 23, 2010. |
| 2009 | 207 | Electro-hyper-sensitivity and the Nerve Express and Electro-Interstitial Scans. LD Symposium 2009, Miami, Florida, December 10-12, 2009. |
| [27] | 206 | Health Effects of Low Frequency Electromagnetic Fields. RETA, Edmonton Alberta, November 24, 2009. |
| | 205 | Live Blood Analysis. MRS 2000 Meeting, Toronto, Ontario, November 21, 2009. |
| | 204 | Evidence of Harm from Electromagnetic Radiation. Electromagnetic Radiation Impacts on Human Health. EMR Policy Institute Scientific Conference. Colorado School of Mines, Golden Colorado, November 8, 2009. |
| | 203 | Havas, M. and J. Marrongelle. Heart Rate Variability (HRV): A diagnostic tool fro detecting chronic fatigue, adrenal exhaustion, and electrical hypersensitivity (EHS). Holistic Health Now Conference, American Holistic Medical Association. Cleveland Ohio, November 6, 2009. |

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| | 202 | Live Blood Analysis. A Public Lecture, Frequency Matters. Bridgenorth, Ontario, September 26, 2009. |
| | 201 | Cigarettes and Cell Phones: What do they have in common? Stinson Beach, California, September 20, 2009. |
| | 200 | Cell Phones and Cigarettes. What do they have in common? San Leandro High School, San Leandro California, September 18, 2009. |
| | 199 | Havas, M. and D. Fancy. Conference call with Health Canada regarding Standards. Ottawa, August 31, 2009. |
| | 198 | Public Meeting regarding Rogers Tower. Marmora, Ontario, August 27, 2009. |
| | 197 | Havas, M. and D. Fancy. Meeting with Health Canada regarding Radio Frequency Radiation Standards, Ottawa, Ontario, August 5, 2009. |
| | 196 | The Truth about Wired and Wireless Technology. Royal Roads University, Victoria, BC, July 22, 2009. |
| | 195 | An Inconvenient Truth: Climate Change. Consequences of Convenience: Electrosmog. Gabriola Island, BC, July 20, 2009 |
| | 194 | Consequences of Convenience. Langley, BC, July 17, 2009. |
| | 193 | Transmission Lines and Health. Sto:Lo Nation. BC, July 14, 2009. |
| | 192 | Wireless Technology-the tobacco of the 21st Century. Ontario Health Promotion Summer School, University of Toronto, Toronto, Ontario. July 9, 2009. |
| | 191 | Public Health SOS: The Shadow Side of the Wireless Revolution. Ontario Health Promotion Summer School, University of Toronto, Toronto, Ontario. July 8, 2009. |
| | 190 | What Health Care Professionals need to know about Electro-Smog and Electro-Sensitivity. Integrating Biophysics-based Technologies in Clinical Practice, Phoenix Arizona, May 8, 2009. |
| | 189 | What Health Care Professionals need to know about Electromagnetic Pollution and Health. Rural Life and the Healthy Employee, IHLP, Education Symposium, Medical Laboratory Technologists, Stratford, Ontario May 6, 2009. |
| | 188 | Our love affair with wireless technology and the consequences. U-Links Centre for Community-Based Research, Haliburton County, April 20, 2009. |
| | 187 | Our love affair with wireless technology and the consequences. Women's Institute Bailieboro-Cavan-Milbrook-North Monaghan, Ontario, April 7, 2009. |
| | 186 | Electrical Pollution on Farms: Poor power quality and stray voltage effects on humans and animals. National Mutual Insurance Convention, Toronto, Ontario, March 26, 2009. |

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| | 185 | Electro-smog and Electro-hyper-sensitivity: How to protect yourself, your family, and your community. University Women's Club, Toronto, Ontario, March 12, 2009. |
| | 184 | When "green" is not enough. What do windmills and CFL bulbs have in common? Sir Sanford Fleming College, Lindsay Ontario, January 30, 2009. |
| | 183 | Rapid Aging Syndrome & Electrosmog: Part 2. Physicians Meeting, Renfrew Ontario, January 23, 2009. |
| | 182 | Electrical Sensitivity. University of Ottawa, Ottawa, Ontario, January, 23, 2009 |
| | 181 | Wind Turbines & Health: The effect on Individuals, Prince Edward County, Picton Ontario, January 15, 2009. |
| 2008 | 180 | Hearing on Breast Cancer and Magnetic Field Exposure, Bell Canada, Expert Testimony, Toronto, Ontario, December 16-17, 2008. |
| [31] | 179 | When "green" is not enough. Lecture, First Year Environmental Science Course (ERSC 100), Trent University, Peterborough, Ontario, December 2, 2008. |
| | 178 | Poor Power Quality & Stray Voltage Effects on Human and Animal Health, Ontario Mutual Insurance, Annual Meeting, University of Guelph, Ridgetown Campus, Ridgetown, Ontario, November 27, 2008. |
| | 177 | Why do residents near wind turbines get sick? Wind Turbines Make Waves. Township Council Public Meeting, Dawn-Euphemia Township, Florescent & District Community Centre, Florence Ontario, November 17, 2008. |
| | 176 | EMFs Electromagnetic fields–an emerging health issue. CAUT Health and Safety Conference, Ottawa, Ontario, November 7-9, 2008. |
| | 175 | Electro-smog & Electro-sensitivity: what you need to know to protect yourself. RCEN, Canadian Environmental Network, Annual General Assembly, Richmond Hill, Ontario, October 23-26, 2008. |
| | 174 | Electromagnetic Factors in Health: What do Scientists know about the effects of wireless technologies about humans, animals, and nature? Panel on Health & Environmental Concerns of the Wireless Revolution. Bioneers, Boulder, Colorado, October 18, 2008. |
| | 173 | Electrosmog & Electrosmogitis (Electro-hyper-sensitivity). HRV & EIS Workshop, Mississauga, Ontario, October 9-11, 2008. |
| | 172 | Health Effects of Electrosmog. Round Table Discussion, Budapest, Hungary, September 26-28, 2008. |
| | 171 | Rapid-Aging Syndrome and Electrosmog. Renfrew United Church, Renfrew, Ontario, 10:30 am, August 29, 2008. |
| | 170 | Electrosmog and Electrohypersensitivity. Ottawa Area Physicians, Kanata Ontario, 7 pm, August 28, 2008, |

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| | 169 | Electromagnetic Fields: Best Kept Secret. Ontario English Catholic Teachers' Association. The Way Forward: Putting the Act into ACTion. Biennial Conference on Health, Safety and the Environment. Toronto, August 13-15, 2008. |
| | 168 | Rees, C and M Havas. Meeting with Marc Sorenson regarding design of a Health Spa for those with EHS, Nevada Fitness Institute, Hidden Canyon, Nevada. July 30-Aug 2, 2008. |
| | 167 | Ripple, J, M Havas, and R Lear. Meeting with Senator Boxer's Staff--Megan Miller regarding Health Concerns of Wi–Fi and WiMax, Marin County, California, July 25 2008, noon-2 pm. |
| | 166 | Ripple, J, M Havas, and R. Lear. Meeting with Assemblyman Huffman's Staff regarding the Banning of Compact Fluorescent Lights. 3501 Civic Center Drive, Suite 412, Marin County, California, July 25, 2008, 3-4 pm. |
| | 165 | Public Forum, Cell/Transmission Towers, Colwood Pentecostal Church, Colwood, Vancouver Island, BC, June 25, 2008. |
| | 164 | Cell Towers and Your Health. PACT Precautionary Approach to Cell Towers, Richmond Hill, Ontario, May 12, 2008. |
| | 163 | Wind Farms and Health. Community Centre, Summerside, PEI, noon, May 3, 2008. |
| | 162 | Transmission Lines and Health, Duffy Theatre, University of PEI, Charlottetown, PEI, 7 pm, May 2, 2008, |
| | 161 | Transmission Lines and Health, Members of the Legislative Assembly, Charlottetown, PEI, noon, May 2, 2008, |
| | 160 | Transmission Lines and Health, French School, Summerside, PEI, 7 pm, May 1, 2008. |
| | 159 | A Tale of Two Pollutants: Dirty Electricity & Wi–Fi. Natural Building, Health Building, Building Biology Conference, Nashville, TN, April 19-20, April 19, 2008. |
| | 158 | Electromagnetic Pollution & Health. Natural Building, Health Building, Pre-Conference Seminar, Building Biology Conference, Nashville, TN, April 19-20, April 18, 2008. |
| | 157 | Best Kept Secret. Women's institute, Warsaw Town Hall, Warsaw, Ontario, April 16, 2008. |
| | 156 | Dialogue on Electromagnetic Fields and Health. THINK2: A Symposium on Academic Safety and Risk, Brock University, St. Catharines, Ontario April 8-9, 2008. |
| | 155 | Cell Towers and Schools: Tip of the Iceberg. Coalition for Healthier Schools, 90-minute Conference Call, April 4, 2008. |
| | 154 | Electro-hyper-sensitivity (EHS): An Emerging Public Health Issue. Michael, E. DeBakey Veterans Affairs Medical Center, Houston Texas, March 31, 2008. |

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| | 153 | Lai, H., S. Milham, M. Havas, and L. Kelley. We are all exposed! Biological and Health Effects of Electromagnetic Fields (EMF), Radio Frequency Radiation (RFR), and Dirty Electricity (DE). City Club, San Francisco, Panel Discussion, Sponsored by Council on Wireless Technology Impacts, March 21, 2008. |
| | 152 | Havas, M., C. Sage, D. Carpenter, C. Rees. The Shadow Side of the Wireless Revolution. A Health Policy Discussion on an Emerging Global Public Health Issue. Panel Discussion, Commonwealth Club, San Francisco, California, March 19, 2008. |
| | 151 | Electromagnetic Radiation, Peterborough, March 3, 2008. |
| | 150 | An Inconvenient Truth, Part 2: Our Love Affair with Wireless Technology, Lecture Sponsored by The Lewis School, Princeton Public Library, New Jersey, February 12, 2008. |
| 2007 | 149 | Newton, J. and M. Havas, Meetings with Congressional and Senate Staff about EMR Regulations and Guidelines. Washington DC, December 3-7, 2007. |
| [17] | 148 | Health Concerns associated with Electromagnetic Pollution. Gave talks at 5 Churches, Jamaica, October 29-30, 2007. |
| | 147 | Radio Frequency Radiation & Health. New Mexico Bioneers Conference, Santa Fe, New Mexico, College of Santa Fe, October 19-21, 2007. |
| | 146 | Newton, J. and M. Havas. Meetings with Congressional and Senate Staff about EMR Regulations and Guidelines. Washington, DC, October 15-18, 2007. |
| | 145 | Ground Current on Farms, Ecological Agriculture Course, Trent University, Peterborough, Ontario, October 4, 2007. |
| | 144 | The link between cancer and exposure to electromagnetic energy. Cancer Conference, Ottawa, Ontario. May 25-26, 2007. |
| | 143 | Panel Discussion on Wi–Fi, RFR, and our Health. World Congress on Integrated Medicine, Santa Fe, New Mexico, May 4-6, 2007. |
| | 142 | Electromagnetic Hygiene in Schools. Pegasus School, California, April 23, 2007. |
| | 141 | Ground Current Pollution Act Bill 154: Why should we care? Chattam, Ontario, April 18, 2007. |
| | 140 | Radio Frequency Radiation, Cell Phone Towers and your Health. Public Meeting, Charlottetown, PEI, April 17, 2007. |
| | 139 | Electromagnetic Hygiene in the Home. Holistic Health, SSF, Lindsay, Ontario, March 20, 2007. |
| | 138 | Radio Frequency Health Concerns and Wi–Fi at Trent. Committee on Technology for Teaching and Learning (COTTL), Trent University, Peterborough, Ontario, March 8, 2007. |

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| | 137 | Shifting Paradigms: Flat earth/round earth and our concept of electromagnetic power. Ontario College of Art and Design, Toronto, March 7, 2007. |
| | 136 | Dirty Electricity in Schools. Teacher Education Program, Trent University, Peterborough, Ontario March 7, 2007. |
| | 135 | Is the electricity in your home making you sick. Health Freedom Expo, Long Beach, California, March 2-4, 2007. |
| | 134 | Havas, M., B. Fraser, and R. Frederick. 2007. Ground Current Pollution Act 154, Council Chamber**,** Toronto City Hall, Toronto, Ontario, January 29, 2007. |
| | 133 | Havas, M. Gilbert, F, Macfarlane, R., and R. Bradley. 2007. Panel discussion on Wi–Fi. Wireless Communities Summit, Toronto, Ontario. January 23 & 24, |
| 2006 | 132 | Radio Frequency Health Concerns and Wi–Fi at Trent. COTTL, Trent University, Peterborough, Ontario, December 18, 2006 |
| [19] | 131 | Electromagnetic Pollution and Your Health. Bermuda, October 14, 2006. |
| | 130 | Ground Current on Farms. Guest Lecture: Ecological Agriculture, Trent University, Peterborough, Ontario, October 5, 2006. |
| | 129 | Health Effects of Dirty Electricity. Dane County Chapter, Save Our Unique lands Coalition Against Electromagnetic Pollution, Pitchburg, Wisconsin, July 27, 2006. |
| | 128 | Electromagnetic Pollution and Your health. Trent/Shad Valley Program, Trent University, Peterborough, Ontario, July 6, 2006. |
| | 127 | Electromagnetic Pollution and Electrical Hypersensitivity. American Society of Dowsers, Vermont, June 22, 2006. |
| | 126 | Electromagnetic pollution: What can you do to have a cleaner environment and protect your health? Aurora, Ontario, June 14, 2006. |
| | 125 | Health Effects of Dirty Electricity. Nassau, Bahamas, June 8, 2006. |
| | 124 | Radio Frequency Antennas. Simcoe, Ontario, June 6, 2006. |
| | 123 | Simcoe Cell Tower Rogers, Simcoe, Ontario**.** Public Meeting, Town Hall, April 19, 2006. |
| | 122 | Part 2: No Place to Hide: Wireless Technology. Total Health Show, **Toronto**, Ontario, April 1, 2006. |
| | 121 | Panel Discussion: Energy Medicine. Total Health Show, Toronto, Ontario, April 1, 2006. |
| | 120 | Part 1: Electromagnetic Hygiene: Dirty Electricity in homes and schools. Total Health Show, Toronto, Ontario, April 1, 2006. |
| | 119 | Biological Effects of Dirty Electricity with Emphasis on Diabetes and Multiple Sclerosis. Precautionary EMF Approach: Rationale, Legislation and Implementation, 5th ICEMS International Workshop, Benevento Italy, 22-25, 2006. |

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| | 118 | Biological Effects of Dirty Electricity. Peterborough Public Library, Peterborough, Ontario, February 16, 2006. |
| | 117 | Electromagnetic Pollution: No place to hide! Markham Ontario, February 15, 2006. |
| | 116 | Dirty Electricity, Electrical Hypersensitivity and your Health. Toronto, Ontario, February 13, 2006 |
| | 115 | Electromagnetic Pollution and Your Health. Sir Sanford Fleming College, Peterborough, Ontario, February 6, 2006. |
| | 114 | Dirty Electricity, Diabetes and Multiple Sclerosis. Centre for Health Studies Research, Trent University, Peterborough, Ontario, January 25, 2006 |
| 2005 | 113 | Electrical Pollution & the Need for Better Health Guidelines. Meeting with Belinda Stronach, Aurora, Ontario, December 14, 2005. |
| [29] | 112 | Electromagnetic Sensitivity and Electromagnetic Pollution, Faculty of Medicine, University of Toronto, Toronto, Ontario, December 9, 2005. |
| | 111 | Dirty Electricity, what it is, what it does, and what we can do to protect ourselves. Nutritionists Network Group Meeting, Richmond Hill, Ontario, November 15, 2005. |
| | 110 | Cell Tower Radiation and Fire Fighter Exposures. Health and Safety for the Professional Fire Fighter, The IAFF John P. Redmond Foundation Symposium on the Occupational Health and Hazards of the Fire Service. Honolulu Hawaii, October 23-27, 2005. |
| | 109 | Health and Safety Round Table Question Period, Health and Safety for the Professional Fire Fighter, The IAFF John P. Redmond Foundation Symposium on the Occupational Health and Hazards of the Fire Service. Honolulu Hawaii, October 23-27, 2005. |
| | 108 | Dirty Electricity, Diabetes, Multiple Sclerosis, Electrical Hypersensitivity and Sick Building Syndrome . . . Is there a connection? Occupational Hygiene Association of Ontario, Toronto, October 20, 2005 |
| | 107 | Electrical Pollution: No Place to Hide. SWEEP, Safe Wireless Electromagnetic and Electrical Policy, Breast Cancer Research and Education Fund and the Niagara Healthy Environment Initiative, St. Catharines, Ontario, October 15, 2005. |
| | 106 | Radio Frequency Radiation and Adverse Biological Effects. Salisbury, North Carolina, October 13, 2005. |
| | 105 | Earth Energy, Life Energy, and Techno Energy Interactions. How is electromagnetic Technology affecting Life on our Planet? It's a Shocker! Toronto Dowsers, Latvian Centre, Toronto, October 11, 2005. |
| | 104 | Electromagnetic Pollution. Ontario Ministry of Health, Toronto, September 20, 2005 |
| | 103 | Health Effects of Dirty Electricity. Bermuda, September 3, 2005. |
| | 102 | Radio Frequency Radiation: Cell Phone and Cell Towers. Bermuda, September 3, 2005. |

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| | 101 | Cell Phones, Electricity and your Home. Trent-Shad Valley Program, Trent University, Peterborough, Ontario, July 18, 2005. |
| | 100 | Effects of Electrical Pollution and Radio Frequency Radiation. STOP (Stop Transmission lines Over People), Parent Information Session, St. Justin Martyr Parish Hall, Markham, Ontario, June 20, 2005. |
| | 99 | Health Effects of Dirty Electricity, Public Lecture, St. Johns Church, Peterborough, Ontario, June 16, 2005. |
| | 98 | Havas, M. and A. Olstad. 2005. Dirty Electricity Study at Fillmore-Central Elementary, Middle & High School. Minnesota, June 2, 2005. |
| | 97 | My research with Dirty Electricity. Dr. Tel-Ore, Minneapolis Minnesota, May 31, 2005. |
| | 96 | Electrical Pollution: A Serious Environmental Problem. Breast Cancer Research and Education Fund and the Niagara Healthy Environment Initiative, Port Dalhousie, Ontario, April 30, 2005. |
| | 95 | Electrical Pollution in the Home, Sir Sanford Fleming College, Haliburton, Ontario, April 29, 2005. |
| | 94 | Dirty Electricity. United Church, Peterborough, Ontario, April 26, 2005. |
| | 93 | 2005. Electrical Pollution in the Home. Healthy Buildings Conference, Cambridge, Ontario, April 6-7, 2005. |
| | 92 | Electrical Pollution: Part 1. Electromagnetic Fields. Medical Officer of Health, Newmarket, Ontario, April 1, 2005 |
| | 91 | Dirty Electricity and Graham/Stetzer Filters. Naturopathic Doctors, Peterborough, Ontario. March 10, 2005. |
| | 90 | Electrical Pollution. Deputy Minister of Rural Affairs, Toronto, Ontario, February 24, 2005. |
| | 89 | Electrical Pollution. Task Force, Markham, Ontario, February 23, 2005. |
| | 88 | Environmental Contaminants and Health: Dirty Electricity and Electrical Hypersensitivity. Sir Sanford Fleming College, Peterborough, Ontario, February 14, 2005. |
| | 87 | Health Effects of Dirty Electricity. Bio Ag. Conference, Wellesley, Ontario, January 27, 2005. |
| | 86 | Health Effects of Dirty Electricity. Barbados Radiation Conference, Sherbourne 2005. Conference Centre, Barbados, January 18, 2005. |
| | 85 | Radio Frequency Radiation: Cell Phone Antennas, Barbados Radiation Conference, Sherbourne Conference Centre, Barbados, January 18, 2005. |
| 2004 | 84 | Health Concerns Associated with Part 1. Radio Frequency Radiation, Part 2. Magnetic Fields (ELF), Part 3. Dirty Electricity. Public Seminar, Tobago, November 20, 2004. |

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| [10] | 83 | Havas, M. and D. Stetzer. 2004. Health Concerns Associated with Dirty Electricity and Power Frequency Fields. Public Seminar, Port-of-Spain, Trinidad, November 17, 2004 |
| | 82 | Health Concerns Associated with Radio Frequency Radiation. Public Seminar, Port-of-Spain, Trinidad, November 17, 2004 |
| | 81 | Dirty Electricity and Electrical Hypersensitivity (EHS): Five Case Studies, Bio-Ag Conference, Wellesley, Ontario, November 10, 2004. |
| | 80 | Dirty Electricity and Multiple Sclerosis, MS Society Pickering, Ontario, November 2, 2004. |
| | 79 | Dirty Electricity and Multiple Sclerosis, MS Society Oshawa, Ontario, November 2, 2004. |
| | 78 | Havas, M and J. Mackay. Street level magnetic fields within the City of Kingston, Ontario, Canada. Biological Effects of EMFs, 3rd International Workshop, Kos, Greece, 4-8 October, 2004. |
| | 77 | Havas, M., M. Illiatovitch, and C. Proctor. Teacher and student response to the removal of dirty electricity by the Graham/Stetzer filter at Willow Wood School in Toronto, Canada. Biological Effects of EMFs, 3rd International Workshop, Kos, Greece, 4-8 October, 2004. |
| | 76 | Havas, M. and D. Stetzer. 2004. Graham/Stetzer Filters Improve Power Quality in Homes and Schools, Reduce Blood Sugar Levels in Diabetics, Multiple Sclerosis Symptoms, and Headaches. Children with Leukemia International Conference in Westminster, London, UK September 6-10, 2004. |
| | 75 | Wireless Communication Antennas on Fire Halls: Dumb and Dangerous! International Association of Fire Fighters Conference, Boston, August 2004. |
| 2003 | 74 | Health Effects Associated with Power Lines. Expert Testimony. National Energy Board Hearing regarding Sumas Energy, Abbottsford, BC, Jul 2003. |
| 2002 | 73 | National Research Policy Conference, Ottawa, Ontario, Oct 22-25, 2002. |
| [15] | 72 | Cell Phone Towers and their Biological Effects. Behind the Scenes, Trent University, Peterborough, Ontario, October 19, 2002 |
| | 71 | Electromagnetic Fields in Schools: What can be done to reduce exposure. Health and Safety Conference, Toronto, Ontario, August 15, 2002. |
| | 70 | How to reduce your exposure to wired and wireless electromagnetic energy. Invited Speaker, Presented at People and the Planet Conference, Sierra Club of Canada, Queen's University, Kingston, Ontario, June 3-9, 2002 |
| | 69 | Health Concerns Associated with Wireless Telecommunication.. Invited Speaker, Public Lecture, Caledonia, PEI, May 29, 2002. |
| | 68 | Mapping Magnetic Fields in the School Environment. Guelph Ontario, May 24, 2002 |

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| | 67 | Electromagnetic fields (EMF) and Electromagnetic Radiation (EMR): An overview of Health Concerns and a Call for Action. Presented to the Standing Committee on Environment and Sustainability, Parliament Hill, Ottawa, Ontario, May 21, 2002 |
| | 66 | Biological Effects of Low Frequency Electromagnetic Fields, London, England, May 16-17, 2002 |
| | 65 | Lund-Lucas, E, R Silvestri, M Havas, DJ Cunningham, and L Thomas. 2002. Everything students should know about Thinking and Learning. Destination Success 2002: Building Accessible Learning Communities, Sponsored by Learning Opportunities Task Force, Ministry of Training, Colleges & Universities, Government of Ontario & Georgian College; Barrie, Ontario, May 6 & 7, 2002. |
| | 64 | Electromagnetic Fields in a School Environment, the Need for Mapping. Presented to School Health and Safety Officers, Mississauga, Ontario, May 3, 2002. |
| | 63 | Sources of electromagnetic fields in the home. Presented to Environmental Homes, Grand Valley, Ontario, April 27, 2002. |
| | 62 | Corporatization of the University, Smith Conference Room, Trent University, Peterborough, Ontario, April 6th. |
| | 61 | Electromagnetic fields in the home and childhood cancers: An overview from Wertheimer to Wartenberg. Presented at the International Centre for Electromagnetic Biocompatibility (ICEB) Conference, Montreal, Canada, March 6-8, 2002 |
| | 60 | Rapporteur, Simply Water? Workshop, Trent University, Peterborough, Ontario, February 18-20, 2002 |
| | 59 | Expert Testimony on the health effects of power line electromagnetic fields. Mendota Heights, Public Meeting, Planning Commission, Minnesota, January 2002. |
| 2001 | 58 | Electromagnetic fields and breast cancer. Eyes Wide Open, Conference on Breast Cancer, Peterborough, Ontario. October 2001. |
| 2000 | 57 | Toronto Round Table on Cell Phone Towers, RFR, Public Meeting with Panel Discussion, City of Toronto Department of Health, Toronto, Ontario, February 7, 2000 |
| [2] | 56 | Expert Testimony of the Biological Effects of Power Line electromagnetic fields, Mendota Heights, Minnesota, Public Meeting, January, 2000. |
| 1999 [1] | 55 | Power lines on London Street Peterborough and the Literature on Health Effects. Presented to the PUC, Peterborough, Ontario, June 22, 1999. |

Presentations prior to 1999 did not deal with electromagnetic pollution and have been omitted from this version of my CV.

## 6. YOUTUBE VIDEOS www.youtube.com/magdahavas -omitted

## 7 VIDEO LINKS to Talks and Interviews -omitted

## 8 Interviews: TV, Radio, Newspaper, Skype -omitted

# PART 3: TEACHING & STUDENT SUPERVISION

This section omitted from this document.

# PART 4: SERVICE WITHIN & BEYOND TRENT UNIVERSITY

## 12 COMMITTEES

### INTERNATIONAL

#### Electromagnetic Pollution

| | |
|---|---|
| 2015–pres | Member, Administrative Board, European Cancer and Environment Research Institute (ECERI), Brussels |
| 2015–pres | Founding Member of the International Scientist Appeal presented to the WHO and UN. |
| 2010–pres | Advisor: Electromagnetic Radiation Research Foundation of South Africa (EMRRFSA); www.emrrfsa.org/ |
| 2006–pres. | Advisor: Nationaal Platform Stralingscrisico's in the Netherlands |
| | Advisor: HESE, UK |
| | Advisor: EM Radiation Trust, UK |
| | Advisor: Council on Wireless Technology Impacts |
| | Member: International Commission on Electromagnetic Safety (ICEMS) |
| 2004–pres. | Advisor: EMR Policy Institute, Marshfield Vermont. |

2003-5 Advisor: International Association of Fire Fighters

### Chemical Pollution

1996-7 Advisor: Great Lakes Science Advisory Board Workgroup on Emerging Issues. International Joint Commission (IJC), Canada/US.

1993-96 Advisor: Environmental Science Program for Tribhuvan University, Nepal.

1988 Advisor: Public Focus; BARK (Backyard Acid Rain Kit) Program which is to be used in school across Canada and the United States.

1988 Advisor: Lakes 2000, on their Great Lakes Public Awareness Program.

1981 Member: Forest Sub-Committee, US/Canada Scientific Committee on Acid Rain, Huntington Forest, N.Y., September 1-3, 1981.

1980 Advisor: Acid Rain Coalition, Joint US/Canadian Committee on Acid Rain, Michigan 1980.

1978 Co-organizer (with T.C. Hutchinson): NATO Advanced Institute Workshop on Effects of Acidic Deposition on the Terrestrial Ecosystem, Toronto, May 21-25, 1978.

## NATIONAL

2010-pres. Co–founder: Electro Sensitive Society, www.electrosensitivitysociety.com

2010–pres Advisor: Citizens for Safe Technology Society, www.citizensforsafetechnology.org

2009 Advisor: RETA, Responsible Electricity Transmission for Albertans, Edmonton Alberta, November 2009

2005-pres. Advisor: WEEP Initiative, Canada. www.weepinitiative.org (originally named SWEEP (Safe Wireless Electrical and Electromagnetic Policy), July 2005

2002 PEI, Cell Phone Towers, May 2002

2002 Reviewer: National Policy Research Awards.

1993-98 Associate Director: KEY Foundation (Knowledge of the Environment for Youth).

1991-93 Editor: *KEYnotes*, Environmental Newsletter sent to 17,000 educators across Canada.

1988 Advisor: Trees for Today and Tomorrow on their Tree-Decline School Program

1988 Advisor: Boy Scouts of Canada on their Tree-Decline Program

1985-93 Director: KEY Foundation (Knowledge of the Environment for Youth).

1988-90 Member: Science and Technology Advisory Committee, CBC.

1987 Coordinator: Twenty-Second Canadian Symposium on Water Pollution Research, University of Toronto, February 19, 1987.

### PROVINCIAL

2015-17 Advisor: Private Member's Bill, Ground Current Pollution Act, Ontario.

2011-12 Member: Expert Working Group on Ground Current, Ontario Ministry of the Environmental

2006 Advisor: Private Member's Bill, Ground Current Pollution Act, Mpp2006.080.e5-CW in Ontario.

2005 Advisor: TRAHVOL, Tsawwassen Residents Against Higher Voltage Overhead Lines, Vancouver, BC. October 2005

2004 Adviser, STOP (Stop Power lines Over People), Markham, Ontario

1988-90 Member: Environmental Appeal Board, Ontario.

### LOCAL

1999-2004 Editor: View from Trent, in cooperation with the Peterborough Examiner, fortnightly column written by Trent Faculty. See end of this section for list of articles.

1998, 2000 Judge: Science Fair, Trent University, Peterborough, ON.

1996 Member: Co-coordinating Committee, Conference on Environmental Health and Alternative Medicine.

1992 Evaluator: Science Fair Competition, Peterborough.

1989-91 Member: Peterborough Committee on Sustainable Development, Mayor's Committee.

## 14 REVIEWER: GRANTS AND MANUSCRIPTS

I have been asked to review scientific papers for the following journals …

2018 Medical Hypotheses
2018 Medical Science Monitor
2017 Alternative Therapies in Health and Medicine
2017 Archives for Electrical Engineering
2017 Biomedical Research
2017 Bioscience Reports
2017 Environmental Science and Pollution Research

2017 Functional Foods in Health and Disease
2017 RAD 2017 Conference Proceedings
2016 Canadian Institute for Health Research (Grant Review)
2016 Current Chemical Biology
2016 Institute of Electronics and Telecommunication Engineers Journal of Research
2016 International Journal for Radiation Research
2015 Bioelectromagnetics
2015 Electromagnetic Biology & Medicine
2015 Environmental Pollution
2015 Environmental Research
2015 Frontiers in Public Health
2015 Journal of Veterinary Science and Medical Diagnosis
2015 Medical Research Archives
2015 Pathophysiology
2015 Review, Ph.D. Thesis, Occupational Health Division, DIPAS, DRDO, India
2015 Reviews on Environmental Health
2015 Toxicology & Environmental Chemistry
2010 British Medical Journal
2010 The American Journal of Medical Sciences
2008 Acta Pharmacologica Sinica,
2008 Parlar Scientific Publications, Fresenius Environmental Bulletin, Germany
2007 British Medical Journal, London
1995 Rutledge Press
1992 Environmental Reviews, NRC Journal
1986 International Association on Water Pollution Research and Control,
1985 Canadian Journal of Zoology
1985 Hydrobiologia
1985 Water, Air and Soil Pollution
1984 Canadian Journal of Fisheries and Aquatic Sciences,
1984 Environmental Science and Technology
1982 Science
1981 National Science Foundation (Grant Reviewer)

# CRTC Consultation 2019-57 5G Spectrum, Wavelength, Related Harm and Charter Breaches, Prepared in Support of the Intervention of EMF-OFF!

## AFFIDAVIT May 15, 2019

Dr. Magda Havas, B.Sc., Ph.D., Professor Emeritus
Trent School of the Environment, Trent University
1600 West Band Drive, Peterborough, ON, K9J 7B8, Canada
mhavas@trentu.ca

*This documents provides an overview of the effects on humans, plants and animals of non-ionizing electromagnetic pollution from extremely low frequency (ELF) electromagnetic fields (EMF) to radio frequency (RF) and microwave (MW) radiation flowing through the air, along the ground, along wires and other conducting objects. It provides a critique of Health Canada's Safety Code 6 and questions why the Government of Canada has failed to respond to HESA recommendations on radio frequency radiation issued by the Standing Committee on Health in 2015. Furthermore, concern is raised about the rapid deployment of 5$^{th}$ generation (5G) telecommunication technology, the use of mmwaves, increased exposure to frequencies commonly used in 3G and 4G technology and the potential long-term biological and health effects to humans and other organisms associated with 5G and the Internet of Things (IoT).*

## I. ACADEMIC CREDENTIALS

1. My name is Magda Havas, B.Sc., Ph.D. and I am a recently retired professor from Trent University (Trent School of the Environment), Peterborough, Ontario, Canada. My background is in environmental toxicology and for the past 44 years I taught and conducted research on the biological effects of chemical pollutants (1975–2000) and non-ionizing electromagnetic pollution (1995–present). I also do research on the beneficial effects of pulsed electromagnetic frequencies. My *Curriculum Vitae* is attached (Exhibit A).

2. Since 1995 I have become increasingly involved with assessing the potentially harmful effects of electromagnetic pollution (commonly referred to as electrosmog). I have conducted research and published in the area of extremely low frequency electromagnetic fields, poor power quality, radio frequency and microwave radiation, as well as ground current pollution.

3. I regularly give lectures and workshops at medical conferences where doctors receive medical accreditation. I am internationally recognized as an expert on the health effects of electromagnetic pollution. To date I have lectured in 30 countries and at 25 universities and have more than 190 publications. I co-authored the book, *Public Health SOS: The Shadow Side of the Wireless Revolution.* I provide advice about electrosmog to governing bodies and NGOs around the world (Canada, U.S., U.K., Spain, Italy, Netherlands, Brussels, South Africa, Australia). During the past few years I have provided expert

testimony related to electrohypersensitivity (EHS) and to the health effects of high voltage transmission lines, radio antennas, cell phone antennas, smart meters, and occupational & residential exposure to electromagnetic fields/radiation.

## II. TYPES AND SOURCES OF NON-IONIZING ELECTROMAGNETIC POLLUTION (ELECTROSMOG)

4. In this affidavit, I refer to non-ionizing radiation (NIR) and to both electromagnetic fields (EMF) and electromagnetic radiation (EMR). NOTE: Non-ionizing radiation (NIR) refers to the entire electromagnetic spectrum below ultraviolet (UV) radiation (Figure 1). NIR includes extremely low frequency electric and magnetic fields (less than 300 Hz); intermediate frequencies (kHz range); radio frequencies (3 kHz to 300 MHz); microwave radiation (300 MHz to 300 GHz); and mmwaves (30 to 300 GHz), which is part of the 5$^{th}$ generation (5G) telecommunication technology and the Internet of Things (IoT). Infrared radiation and visible light are also NIR, but are not included in this affidavit.

5. Electromagnetic pollution (commonly referred to as electrosmog) can flow through the air, along wires and other conducting materials, and along the ground (see Figure 2).

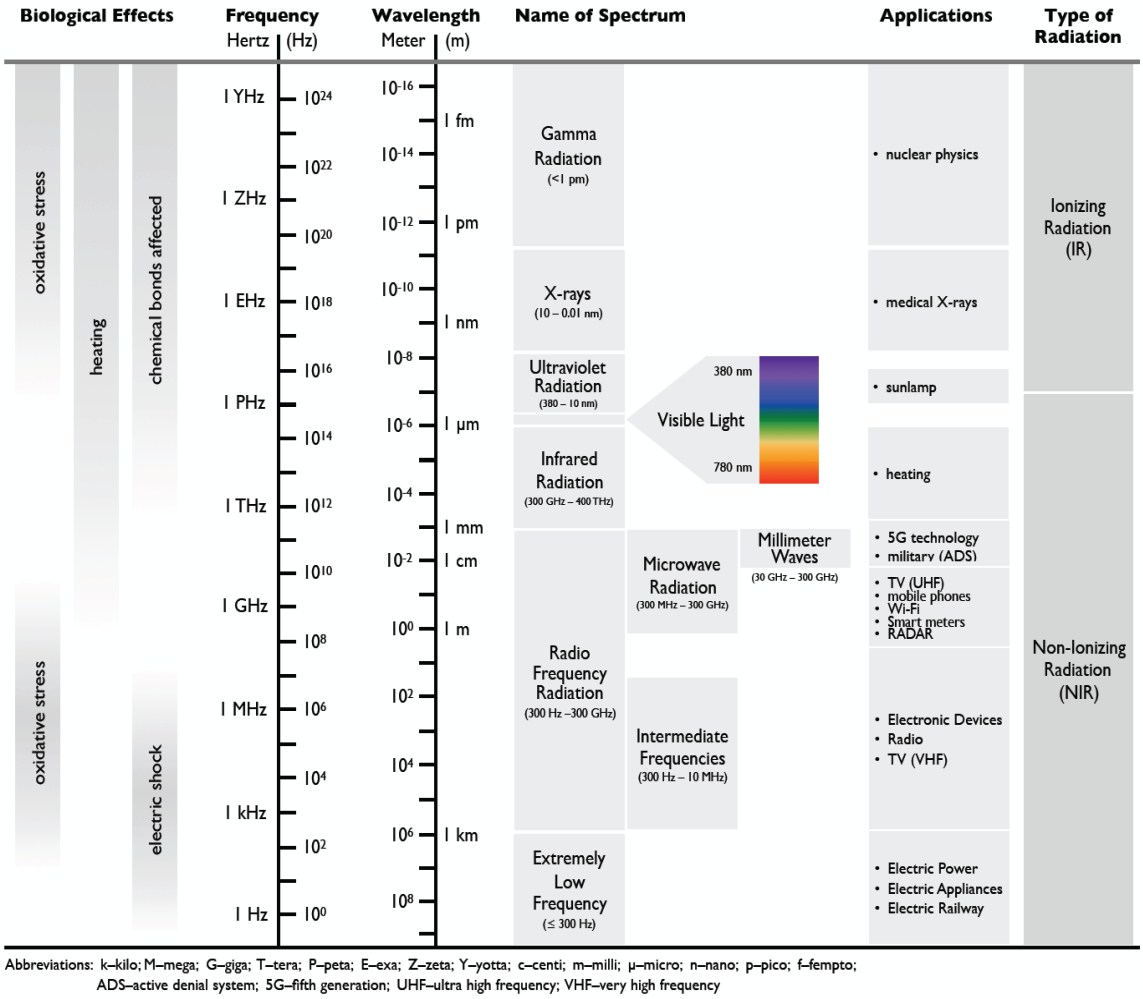



Figure 1. The electromagnetic spectrum showing frequency, wavelength, applications and biological effects.

6. Radio frequency and microwave radiation are generated by wireless devices (cell phones, Wi-Fi routers, smart meters, smart appliances; radar as well as by radio and televisions broadcast antennas). Extremely low frequency electromagnetic fields (ELF EMFs) are generated during the use, distribution and transmission of electricity. Poor power quality (or dirty electricity) refers to high frequency voltage transients (surges) on power lines, which are caused by arcing and energy efficient appliances as well as by electronic devices, wind

turbines, and solar power when converted from direct to alternating current (AC). 5G technology incorporates mmwaves (above 6 GHz and generally between 30 and 300 GHz) as well as lower frequencies in the 600 to 700 MHz range. The various frequencies that will be used for 5G has yet to be determined.

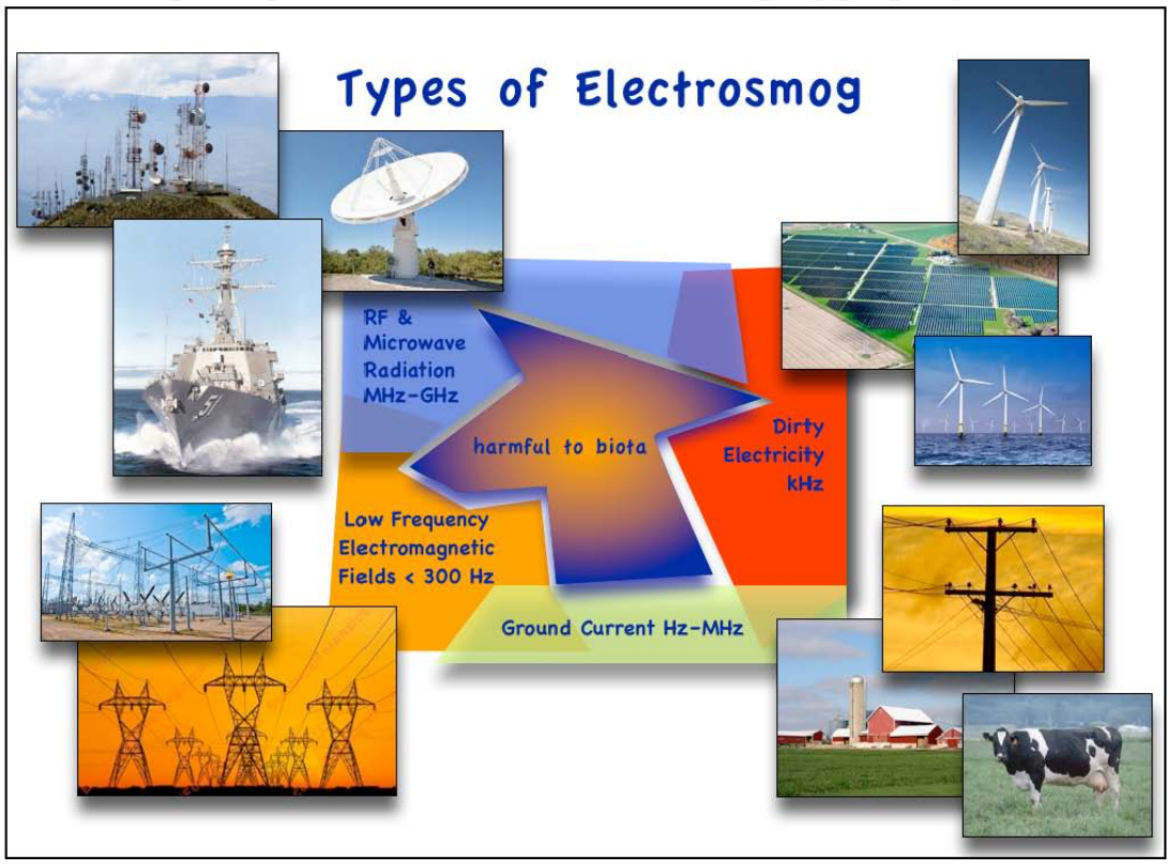



Figure 2. Different types of electrosmog generated by anthropogenic sources.

## III. EFFECTS OF ELECTROSMOG ON HUMANS

7. Human health effects of electrosmog fall into three categories: cancers, reproductive problems; and neurological/hormonal disorders that are collectively referred to as electrohypersensitivity (EHS).

**CANCERS**

8. RFR has been associated with cancers in people who use cell phones for more than 10 years. The tumors occur primarily on the same side of the head exposed to the cell phone (ipsilateral tumors) and they include gliomas, meningiomas, acoustic neuromas, and salivary gland tumors (Hardell et al. 2009; Cardis et al. 2011; Sadetski et al. 2008).

9. People who live near cell phone base stations, radio and TV broadcast antennas and radar installation have a greater risk of developing and dying from cancers than people who live further away (Hocking et al 1996; Michelozzi et al. 1998; Dode et al. 2011; Yakymenko et al. 2011). Many of these studies show an increase in leukemias especially among children.

10. Those who are occupationally exposed to RFR/MW radiation have a greater risk of developing different types of cancers (Wirth et al. 2013).

11. Residential exposure to ELF EMF has been associated with an increased risk of childhood leukemia at and above 2–3 mG. The higher the magnetic field strength the greater the risk of cancer (Figure 3).

12. With adults the values at which an increased risk of adverse health effects have been documented are generally higher than for children and range from 10–12 mG for brain cancer (Savitz and Loomis 1996; Savitz et al. 2000); 10 mG for adult leukemia (Bethwaite et al. 2001); 12 mG for breast cancer, and 20 mG for chromosomal aberrations (cited in Havas 2000). All of the studies except for

breast cancer are based on occupational exposure in epidemiological studies and demonstrate an association between exposure and outcome.

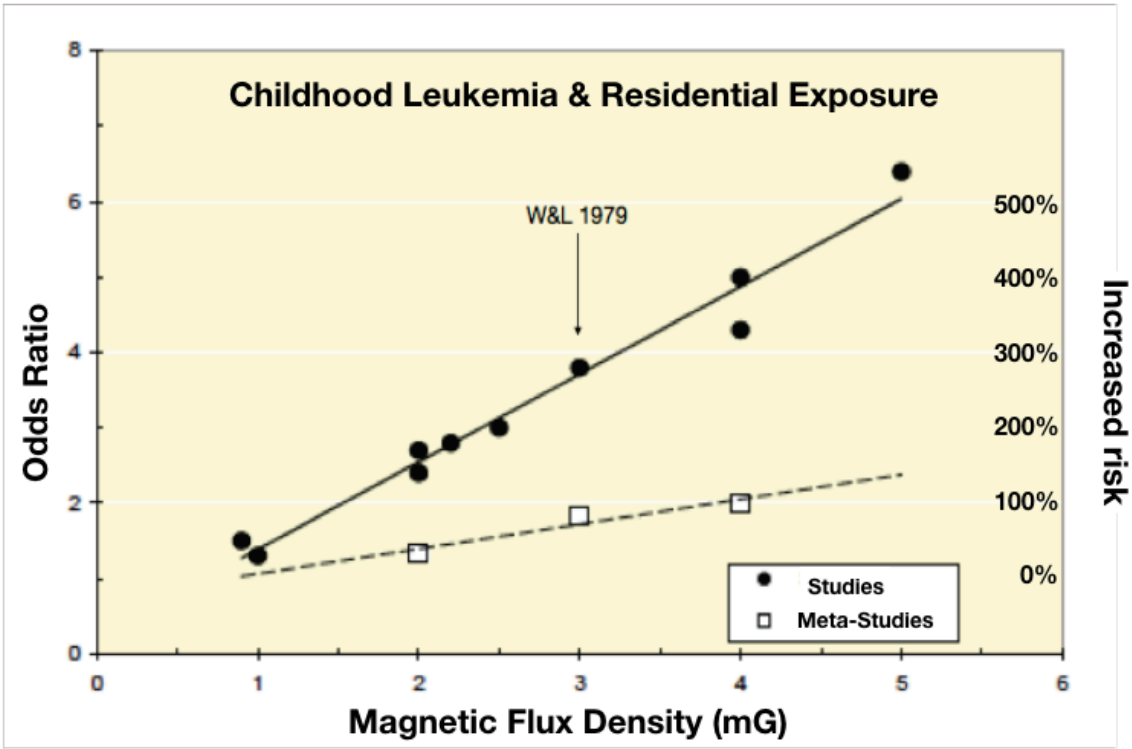



Figure 3. Epidemiological studies of childhood leukemia and residential magnetic field exposure indicate a dose-response relationship. Studies include: Wertheimer and Leeper, 1979; Savitz et al. 1988; Olsen 1992; Feychting and Albom 1993; Linet et al. 1997, Schulz et al. 2001; and for the meta-studies Albom et al. 2000; Greenland et al. 2000; and Wartenberg et al. 2001.

13. In one study (Milham and Morgan 2008), high frequency voltage transients (HFVT) or dirty electricity was associated with an increased risk of various cancers among school teachers in a California school. The risk or odds ratio (OR) for all cancers combined was 2.78 and was statistically significant. The risk for individual cancers was 9.19 for cancer of the uterus; 9.76 for malignant melanoma; and 13.3 for thyroid cancer (all highly significant).

14. These are all epidemiological studies and such studies show an *association* between exposure (or a surrogate of exposure like distance) and an increased risk of cancer that increases with cumulative exposure.

15. We also have at least three large, well-controlled, animal studies documenting that MW radiation causes cancer (Chou et al. 1992; NTP 2018; Falcioni et al. 2019) and several studies showing that MW radiation damages DNA in rodents (Phillips et al. 2009). More information is provided below when I discuss effects of RFR on laboratory animals.

16. Ionizing radiation (IR), in contrast to NIR, has enough energy to dislodge electrons from atoms, damage DNA and thus cause cancer. For decades, scientists believed that NIR, because it didn't have enough energy to break chemical bonds, could not cause cancer. However, we now know that NIR increases free radicals by interfering with the neutralization of reactive oxygen species (ROS) that are a natural byproduct of metabolism and respiration (Yakymenko et al. 2016).

17. ROS generate oxidative stress and are known to cause cancer and are implicated in various disease states including but not limited to arthritis, asthma, dermatitis, sexual dysfunction, liver damage, retinal damage, cataracts, stroke, atherosclerosis, and heart attack.

18. Since free radical damage is one of the key mechanisms in electrosmog health effects for both ELF and RF radiation and because a lay audience poorly

understands the concept of free radical damage, I provide a brief description here (see also Havas 2017).

19. A stable molecule has a pair of electrons in its outer orbital (Figure 4, blue face). Oxidizing agents (red face) like ionizing radiation and certain chemical pollutants can remove an electron and generate a free radical (green face). Free radicals are chemically reactive and cause oxidative damage (a type of rusting) to cells and organelles. Anti-oxidants (yellow face) are chemicals (like vitamin C, E, B12; minerals like zinc, selenium, manganese; melatonin, CoQ10 and various enzymes like superoxide dismutase) that are able to donate electrons to free radicals and thus begin to repair oxidative damage.

20. There are two ways to increase free radical damage in the body. One is to increase exposure to oxidizing agents and the other is to reduce exposure to anti-oxidants. IR creates free radicals while NIR interferes with anti-oxidant repair mechanisms. Both mechanisms can contribute to cancer (Havas 2017).

**REPRODUCTION**

21. Considerable evidence shows that NIR damages sperm. At least twenty studies show abnormalities in sperm, which have clear implications for male infertility. At least five studies show DNA damage, which could be teratogenic (affecting the development of the embryo or fetus) and multi-generational.

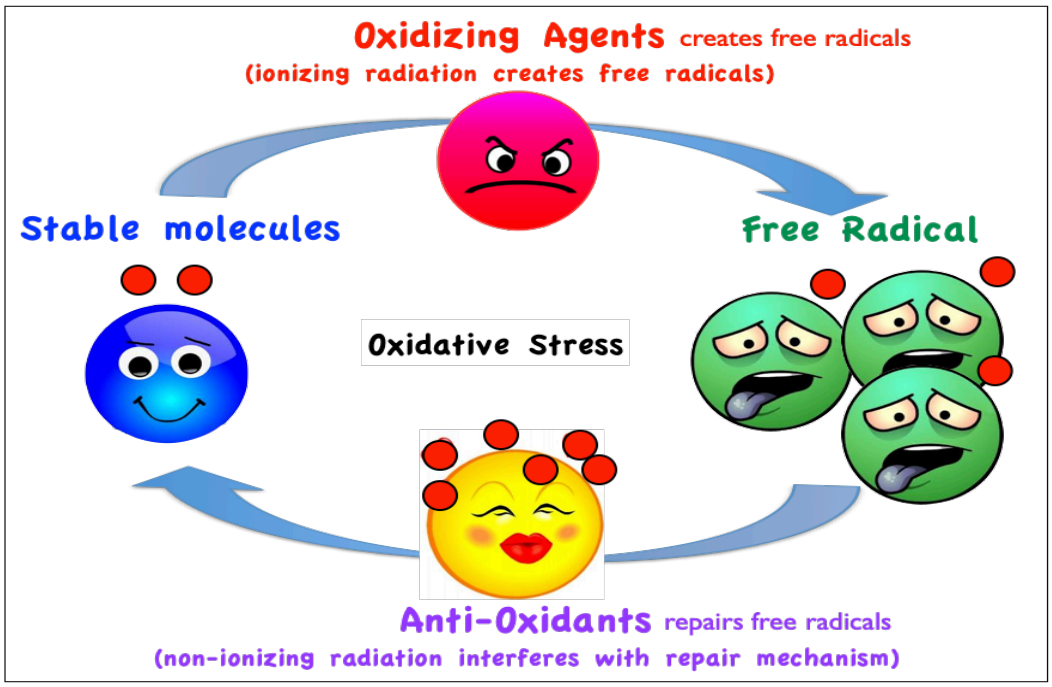



Figure 4. Oxidizing agents and anti-oxidants are responsible for generating and repairing free radical damage and oxidative stress. Source: Havas 2017.

22. Agarwal et al. (2008) documented reduced sperm count, reduced sperm motility, reduced sperm viability and increased abnormal sperm morphology among men who use cell phones. The longer they use cell phones each day the greater the damage to sperm (Figure 5). This study shows a dose-response relationship and such results suggest *causation*.

23. Adams et al. (2014) conducted a meta-analysis based on ten studies regarding the effects of mobile phones on sperm quality and presented the following conclusions in their abstract:

*We conclude that pooled results from in vitro and in vivo studies suggest that mobile phone exposure negatively affects sperm quality. Further study is*

*required to determine the full clinical implications for both sub-fertile men and the general population.*

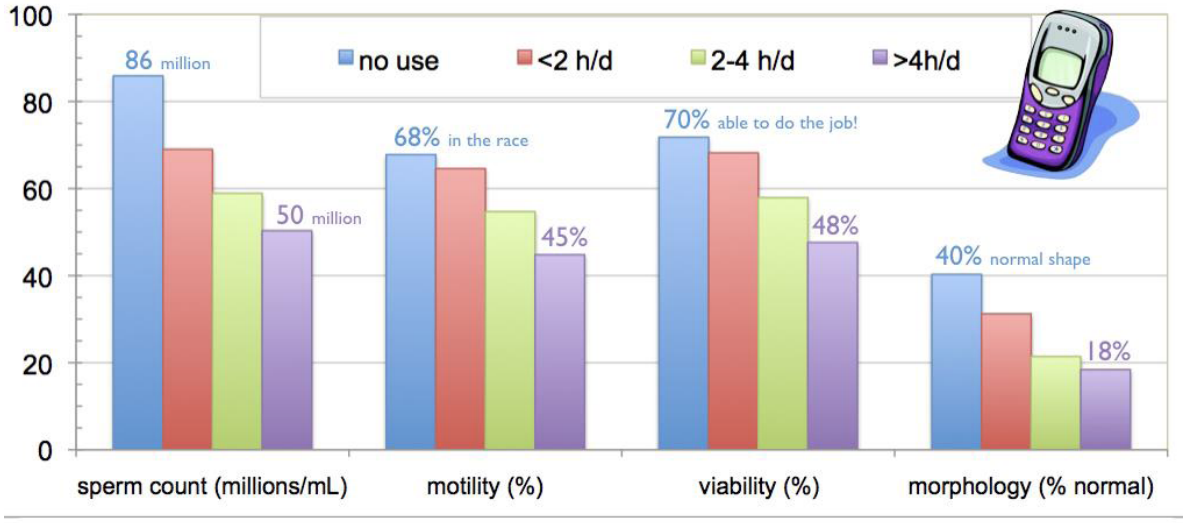



Figure 5. Cell phone use and sperm quality. The categories are based on the amount of cell phone use by men during a day that range from no use (blue); less than 2 hours daily (red); 2 to 4 hours daily (green) and more than 4 hours daily (purple). Data based on Agarwal et al. 2008.

24. In one laboratory study (Kesari et al. 2011) reactive oxygen species (ROS) were shown to reduce testosterone in rats exposed to mobile phone radiation. Lower levels of testosterone are often associated with altered sperm production. Note testosterone levels were also lower for people who live within 500 m of cell phone antennas (Eskander et al. 2012).

25. We have scientific evidence from both human and animal studies documenting damage to sperm, impaired reproduction and altered hormonal levels. There is nothing more powerful in science as when studies, conducted in different ways, in different countries, with various organisms including humans, by many researchers point in the same direction and support the concept that RF and

MW radiation harms sperm, reduces testosterone levels and adversely affects reproduction.

26. In addition to sperm damage, there is also evidence that women who are exposed to RF/MW radiation while pregnant have a greater risk of giving birth to offspring with attention deficit hyperactivity disorder (ADHD) (Divan et al. 2008). Authors concluded that, "Exposure to cell phones prenatally—and, to a lesser degree, postnatally—was associated with behavioral difficulties such as emotional and hyperactivity problems around the age of school entry. These associations may be noncausal and may be due to unmeasured confounding. If real, they would be of public health concern given the widespread use of this technology."

27. Exposure of pregnant women to elevated levels of ELF EMF (16 mG or higher) increases their risk of having a miscarriage (Li et al. 2002). Maternal exposure to low frequency magnetic fields above 2 mG is associated with a significant increased risk (252%) of asthma in offspring (Li et al. 2011).

**ELECTROHYPERSENSITIVITY (EHS)**

28. EHS also called *radio wave sickness* refers to a medical condition that includes poor sleep; chronic fatigue; cognitive dysfunction including brain fog, difficulty concentrating and poor short-term memory; mood disorders including depression and anxiety; chronic pain including headaches and/or migraines; dizziness; nausea; tinnitus; heart palpitations; abnormal blood sugar; skin problems; asthma; among others (Bevington 2018). This syndrome was

originally called *neurasthenia* or *asthenic syndrome* and later *microwave illness* or *radio wave sickness*. The scientific community has recognized these symptoms since the early to mid 1900s.

29. Dodge (1969) states that electromagnetic radiation affects the central nervous system, autonomic nervous system, neurohumoral systems, endocrine glands and function, eye and ocular functions, blood and hemapoietic system and miscellaneous organs in humans.

30. Santini et al. (2002) reported the health symptoms of people who live at different distances from cell phone antennas. People who lived closest to the antennas (within 10 m, red columns, Figure 6) had the highest incidence of symptoms and those furthest away (beyond 300 m, black columns) had the lowest incidence. Similar results have been reported in other countries.

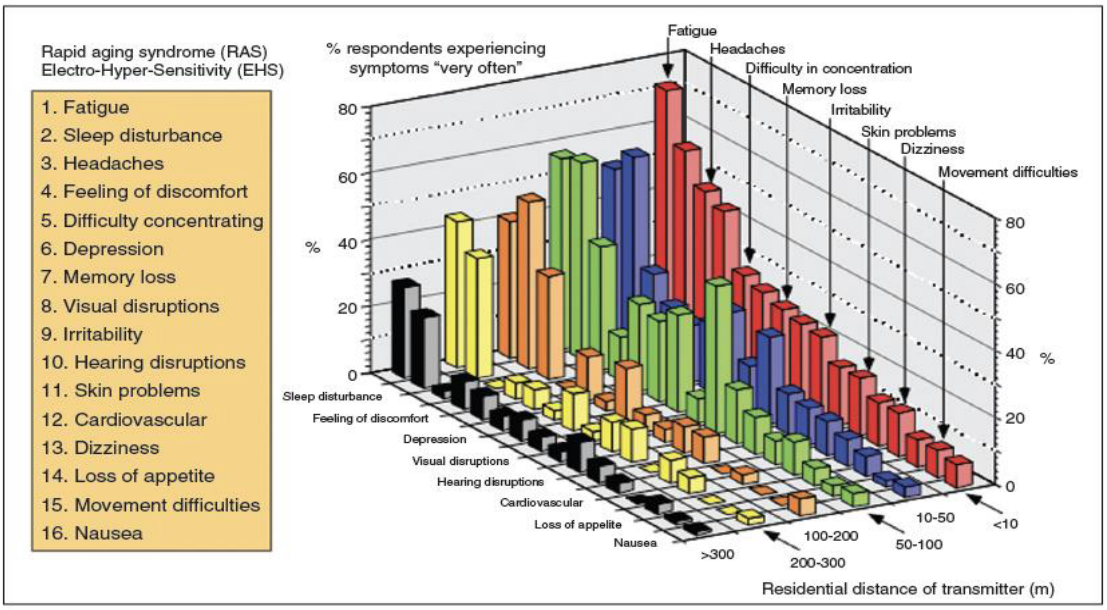



Figure 6. Symptoms experienced by people living near cellular phone base stations. Based on work by Santini et al. 2002. Reproduced from Havas 2013.

31. A number of people who have developed EHS complain of heart palpitations when they are exposed to microwave radiation. We did double-blind, placebo-controlled study with 25 human volunteers in Colorado to test the effects of radiation from a mobile phone base station on heart rate variability (HRV) (Havas et al. 2010). While many of the volunteers were not affected by the radiation, we found that those who were sensitive to this radiation developed either tachycardia (rapid heart rate) or arrhythmia (irregular heart rate) when exposed to 2.4 GHz frequencies generated by a cordless phone base station placed near their head. For some, the body went into a "fight, flight or faint" response as indicated by their autonomic nervous system (ANS) with an up regulation of their sympathetic tone and a down regulation of their parasympathetic tone. When this happens, a person feels as though he/she is having either an anxiety attack or a heart attack. The former is a more accurate description of what is happening. When the cordless phone base station was disconnected from the electrical outlet, the heart rate and the autonomic nervous system returned to normal. Some of the early research also indicates that MWs affect the autonomic nervous system and the heart and some scientists recommend that those who are going to work with MW radiation should be screen to ensure they can tolerate the exposure.

32. There is evidence that MWs affect the heart, the ANS, as well as the blood (Havas 2013). My own blood becomes more viscous when I am exposed to MW radiation for 10 minutes and this can be observed under a microscope

(Plate 1). Symptoms of this can involve cold, numbness or tingling in fingers and toes; dizziness and nausea; with more severe symptoms leading to blood clots, strokes, or heart attacks.

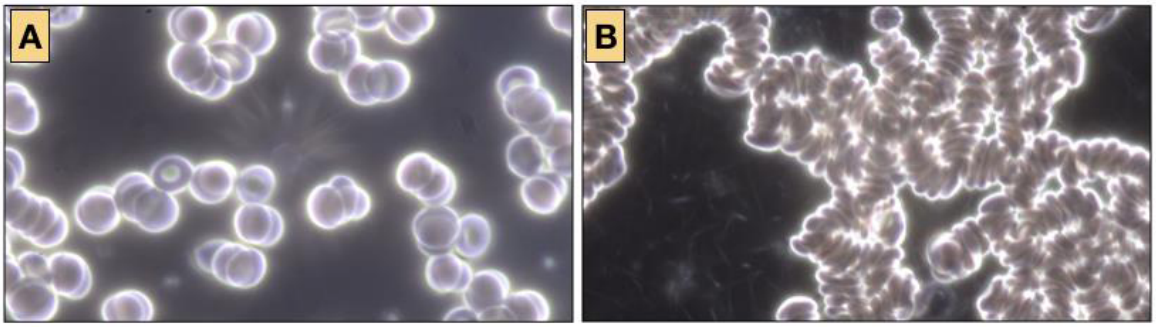



Plate 1. Live blood under dark field microscopy. (A) is in an electromagnetically clean environment and (B) is after a 10-minute exposure of the body to microwave radiation generated by a home Wi-Fi router. The red blood cells on the right (B) are sticking together in what is known as rouleau formation. This interferes with exchange of gases and nutrients and can lead to serious health problems and is one of the responses of people who are hypersensitive to electromagnetic radiation.

33. There are now tens of thousands of peer-reviewed documents on these effects, and what few people realize is that the effects mentioned above have been known for decades. Dr. Zory R. Glaser, former U.S. Navy Researcher and the Navy's key person responsible for microwave health, NIOSH Manger and Executive Secretary to the U.S. FDA, gave me his entire collection of declassified research articles, letters, and notes (more than 6000 documents) when he retired. Some of those articles are on my website: http://magdahavas.com/category/from-zorys-archive/ .

34. As early as 1971, Dr. Glaser published a paper that listed more than 2000 references documenting the adverse effects of microwave radiation. The Glaser document counters the statements that "credible" research showing non-thermal effects does not exist. The research that I summarized is newer research and is

just a small sample of what is available in the scientific literature. The statement that there are no adverse biological effects below the thermal guidelines is a false statement promoted by those who are either unaware of the scientific literature or unwilling to admit this radiation–at levels to which we are currently exposed–can be harmful. Good science that most people would consider "credible" does exist and has been around for decades, although many have largely ignored this science as it contradicts their worldview that this radiation is safe.

35. The above-mentioned effects (cancers, reproductive problems and neurological disorders) are documented at levels well below current U.S. and Canadian guidelines, which were designed only to prevent a heating effect in healthy adult males. These guidelines have not been updated despite the fact that our exposure to RF/MW radiation has increased considerably with the invention of wireless technology and that this exposure is no longer limited to the military or occupations but is found in homes, schools, hospitals, etc. and is difficult to avoid.

36. The intensity of RF radiation is measured as *power density* and the units are *Watts per meter squared* or *Watts per centimeter squared*. In the scientific literature values can range 12 or more orders of magnitude and so the units will vary from Watts (W) to milliW (1/1,000$^{th}$ of a W) to microW (1/1,000,000$^{th}$ of a W). In this document to minimize confusion I will convert all values to microW/cm$^2$.

37. The FCC guidelines have been significantly reduced in stages from 100,000 to 1,000 microW/cm$^2$ but are still 100 times higher than the current Russian guideline (which is 10 microW/cm$^2$).

38. Steneck et al. (1980) reviewed the origins of the U.S. safety standards for microwave radiation. The significance of this research is provided on my website [http://magdahavas.com/pick-of-the-week-2-origins-of-1966-u-s-safety-standards-for-microwave-radiation/ and is partly reproduced below. Based on published and unpublished literature as well as interviews and questionnaires, the authors of this report pieced together the process that led to the 1980 standard of 10 milliW/cm$^2$ (which is the same as 10,000 microW/cm$^2$) designed to protect military and occupationally exposed personnel from microwave radiation. The original recommended standard, established in 1953, was 100 milliW/cm$^2$ (100,000 microW/cm$^2$) and was based on a quick-and-dirty calculation that was grossly flawed and was almost immediately revised downward to 10 milliW/cm$^2$ (or 10,000 microW/cm$^2$). This calculation was based on the ability of a 70-kg man to dissipate heat. The 100 milliW/cm$^2$ (100,000 microW/cm$^2$) was obviously too high so a safety factor of 10 was introduced to reduce it to 10 milliW/cm$^2$ (10,000 microW/cm$^2$). In the 1990s, this value was deemed too high and was further reduced to 1 milliW/cm$^2$ (1,000 microW/cm$^2$), which is the current guideline internationally and in the U.S. Canada recently reduced their guideline by about 50% for microwave radiation but these levels are still too high to protect the public.

39. If a particular level of exposure is deemed harmful, then often a "safety factor"

is introduced to provide a margin of safety. Initially the disagreement about the appropriate safety factor ranged from a safety factor of 10 recommended by the US military to 100 suggested by General Electric to 1,000 suggested by Bell Telephone Laboratories. The military prevailed. Evidence for non-thermal effects was discounted. Had the Bell Laboratories' guideline prevailed current guideline would be 100 times lower and closer to those in Russia.

40. What few people realize is that emphasis at the time was to protect military operations and secondarily to protect military personnel. Protection of the general public was barely discussed, and no public standards were set because microwaves were viewed as radar and radar was limited to military and industrial exposure.

41. Both *microwaves* and *intermediate frequencies* (IF) are classified as radio frequencies although they are at different parts of the RF spectrum. MWs range from 300 MHz to 300 GHz and IFs are primarily in the kHz range. When RFR is used for telecommunication, it is modulated at frequencies ranging from extremely low to thousands of cycles per second (kHz). Indeed, it is these frequencies that provide the information. Consequently, exposure consists of the carrier wave and the modulated frequencies, both of which can elicit a biological response. So while we can discuss isolated regions of the electromagnetic spectrum and their effects, in real life situations, people are exposed to multiple frequencies that include combinations of ELF and RFR.

42. While MWs travel through the air and can penetrate buildings, IFs flow along electrical wires in the home and can radiate from these wires. Another term for

these IFs is "dirty electricity," which contributes to poor power quality. Dirty electricity consists of high frequency voltage transients (HFVT) that can be measured using an oscilloscope. HFVTs contribute to electromagnetic interferences (EMI) that can damage sensitive electronic equipment. Similarly, these frequencies can interfere with the electrical circuitry in the body. Ontario Hydro (1996) has a 130-page reference guide, entitled *Power Quality,* dealing with remediating poor power quality as it is the utility's responsibility to bring clean, safe power to its clients.

43. We have worked with pre-diabetics and diabetics (type 1 and type 2) and found that some of these individuals have great difficulty regulating their blood sugar in an environment where they are exposed to poor power quality or RF radiation (Havas 2008). When levels of dirty electricity are high their blood sugar increases rapidly (within a matter of 20 minutes) and when they move to an electromagnetically clean environment their blood sugar drops just as rapidly. Often these individuals require more medication in an environment with EMF pollution. Being unable to control blood sugar can be life threatening and can contribute to chronic illness including but not limited to organ damage, poor circulation, blindness, neuropathy and–in some cases–the eventual need for amputation of limbs. Diabetics who respond to electrosmog in this manner are deemed to be electrically hypersensitive.

44. According to the Center for Disease Control (CDC), 30 million people in the U.S. (9.4% of the American population) had diabetes in 2015. With so many diabetics and pre-diabetics in the U.S. it is unwise to increase their exposure to

electromagnetic radiation if this can be avoided. Exacerbating symptoms of diabetes, for those diabetics and pre-diabetics who are sensitive to this radiation, is likely to be quite costly from a human health perspective and will place greater pressure on the health care system in this country.

45. We have done studies with people who have Multiple Sclerosis (MS) and found that their symptoms improve when the dirty electricity in their home is reduced (Havas 2006). We have video evidence of tremors and ability to walk before and after remediation with no change in medication (see http://magdahavas.com/multiple-sclerosis-and-dirty-electricity/ ).

46. The symptoms of MS and EHS are similar and it is quite likely that some patients with EHS have been misdiagnosed as having multiple sclerosis.

47. We also have evidence that living in a home for seven years with reduced levels of dirty electricity repairs sclerosis in the brain as measured by MRI scans and hence this cannot be considered a placebo effect. In addition to improved physical symptoms like balance and tremors, we also noticed an improvement in cognitive activity when the dirty electricity in the environment was reduced.

48. When we reduced the levels of dirty electricity in schools, we found that teacher health and student behavior improved during remediation (Havas and Olstad 2008). The teacher symptoms that recovered are similar to those of radio wave sickness. The student behavior that improved resembles symptoms of attention deficit hyperactivity disorder (ADHD).

49. If *reducing* dirty electricity in a home or school improves the health and wellness of some individuals, one may expect that *increasing* the levels of dirty

electricity or modulated RFR may have the opposite effect. Many people have told me that their health problems began shortly after a smart meter was installed on the side of their home or a cell tower was erected nearby. Smart meters produce both MWs and dirty electricity.

50. Since 1997, EMF and RF experts have submitted more than 60 appeals stating that levels below existing guidelines are making people ill and that governments need to develop non-thermal guidelines that truly protect the health of the pubic and especially of children and pregnant women. http://magdahavas.com/international-experts-perspective-on-the-health-effects-of-electromagnetic-fields-emf-and-electromagnetic-radiation-emr/ and http://www.cellphonetaskforce.org/governments-and-organizations-that-ban-or-warn-against-wireless-technology/.

51. Of particular note is the International EMF Scientist Appeal, which was signed by more than 240 scientists and doctors who publish in this field from more than 40 countries (Blank et al. 2015). Collectively we requested that:

i. *children and pregnant women be protected;*
ii. *guidelines and regulatory standards be strengthened;*
iii. *manufacturers be encouraged to develop safer technology;*
iv. *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;*
v. *the public be fully informed about the potential health risks from electromagnetic energy and taught harm reduction strategies;*
vi. *medical professionals be educated about the biological effects of electromagnetic energy and be provided training on treatment of patients with electromagnetic sensitivity;*
vii. *governments fund training and research on electromagnetic fields and*

*health that is independent of industry and mandate industry cooperation with researchers;*

viii. *media disclose experts' financial relationships with industry when citing their opinions regarding health and safety aspects of EMF-emitting technologies; and*

ix. *white-zones (radiation-free areas) be established.*

*52.* A non-expert may conclude that the scientific community is conflicted when it comes to determining whether or not existing guidelines are safe. However, an examination of the source of funding and the results of studies indicates that research funded by industry has a preponderance of "no effects", while those independently funded are showing a preponderance of significant adverse effects (Figure 3) (Huss et al. 2007).

*53.* In Figure 3, only 8% of the studies funded by industry reported a statistically significant adverse effect of mobile phone use, whereas 45% to 64% of the studies with mixed funding or non-industry funding showed adverse effects of cell phone use. Conversely, 84% of the authors funded by industry reported "no effects" of cell phone use, whereas 23% to 46% in the studies otherwise funded reported "no effects". These results are statistically significant and suggest an inherent bias attributed to the industry-funded studies.

*54.* This potential bias in scientific publications is becoming so extreme that journals are requiring information on funding sources and disclaimers of conflict of interest.

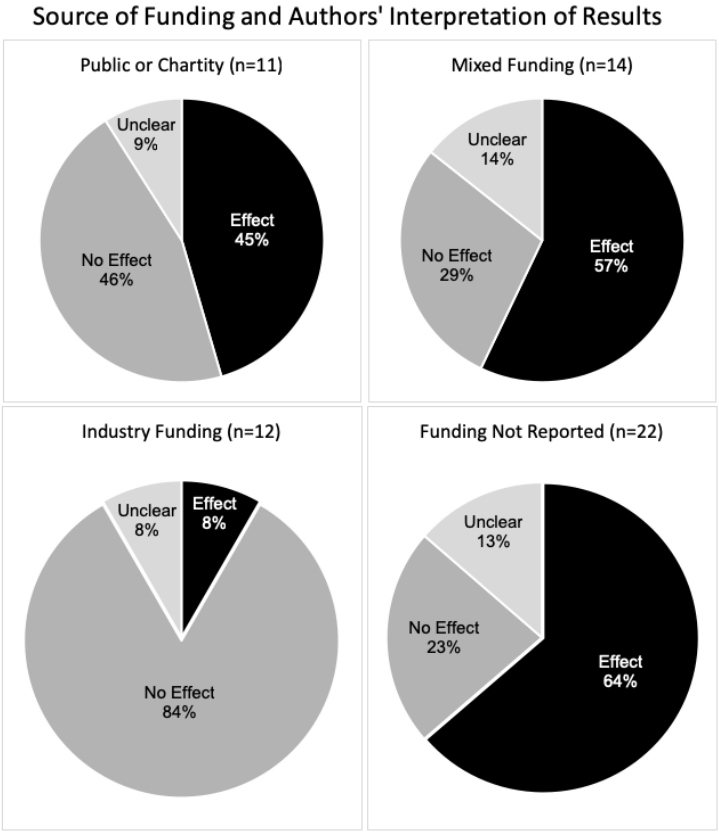



Figure 7. Relationship between funding source and outcome of research. Data from Huss et al. 2007 (Table 2).

55. Some people use the term "credible evidence" to mislead those who are not experts in this field. *Credible* according to what criteria and according to whom? The term "credible" is not a scientific term but one used by agencies and individuals attempting to downplay adverse effects. *Credible* is a value-laden term and one that most scientists would avoid using. Either the science is good or bad. If it is "bad" and does not follow the scientific method or has some inherent flaws it is not considered science.

56. The evidence that RF radiation is harmful to human health is overwhelming. In addition to cancer, RF radiation damages human sperm (at levels well below

FCC and HC guidelines) and reduces testosterone levels in laboratory rats. There is an association with people living near (within 500 m from) cellular antennas and a decrease in hormones (testosterone, plasma ACTH, serum cortisol, T3, T4 and progesterone), which gets worse with duration of exposure from 1 to 3 to 5 years (Eskander et al. 2012).

57. We have recent reviews with thousands of additional documents referenced for a variety of health effects (Carpenter and Sage 2007) available at www.bioinitiative.com. These documents cannot continue to be ignored. What must be kept in mind is that a study that reports "no effect" does not negate a study that finds an effect. If all of the studies reporting adverse effects were due entirely to chance, then we should have an equal number of studies showing beneficial effects of this radiation (also due to chance). Very few of these studies exist.

## V. EFFECTS OF ELECTROSMOG ON ANIMALS AND PLANTS

58. These studies include effects on biota living under natural conditions and recently exposed to NIR; as well as effects on various species exposed to NIR in controlled laboratory experiments. There are now hundreds of such studies available (Balmori 2006, 2010; Warnke 2009; Expert Group 2010; Hillman et al. 2013; Halgamuge 2015; Manville 2016). This affidavit is intended to provide an *overview* that highlights some key research in this area.

59. NIR in the form of power frequency (50/60 Hz) electric and magnetic fields; dirty electricity (kHz); radio frequency and microwave radiation (kHz to GHz)

has been associated with adverse health and reproductive effects in animals and with adverse effects on plants. The effects include the following:

A. Bee Populations: aggressive behavior, reduced productivity, swarming, abandonment of hive (colony collapse disorder)

B. Birds Populations:

   i. Wild and Domestic: impaired reproduction, aggressive behavior, bird deaths;

   ii. Migration: interference with migratory behavior;

C. Mammals:

   i. dairy cows: reduced milk yield, altered milk quality, reduced fertility and impaired reproduction, miscarriages and deformities in offspring, infections that won't heal with antibiotics, behavioral changes, sudden death;

   ii. rodents: impaired reproduction, cancers;

   iii. cats and dogs: impaired reproduction;

D. Amphibians: deformities, population decline;

E. Plants: reduced growth, stunted roots, reduced yield, increased infections.

### *A. Bee Populations*

60. Considerable concern has been raised worldwide regarding the sudden disappearance of bees from their hives, referred to as colony collapse disorder (CCD). Bees provide not only honey, wax, and pollen but are responsible also for the pollination of approximately 85% of all flowing plants that result in fruit and seed production. Without bees, production of fruits (cherry, apple, pear and plum); vegetables (tomato, cucumber, pumpkin) and agricultural crops (rap, sunflower, red clover, horse bean) would be severely reduced (Warnke 2009).

61. CCD has been reported in Canada, U.S., Germany Switzerland, Austria, Italy, Spain, Poland and New Zealand. Losses of bee colonies range from less than 10% to greater than 90% depending on location. Beekeepers agree that the bees are not developing properly, and while they may survive the winter, in spring they disappear leaving the colony empty. Only the brood remains in the hives and they are unable to survive without the care of the older bees (cited in Warnke 2009).

62. Several hypotheses have been put forward as to why bees are disappearing that include natural parasites and predators, extreme weather conditions and manmade stressors such as pesticides, genetically modified food crops, monocultures and electrosmog. While it is likely that all of these are adversely affecting bee colonies, this affidavit will focus on studies documenting the effects of only electrosmog.

63. Ferdinand Ruzicka, scientist and beekeeper reports (Ruzicka, 2003 as cited in Warnke 2009):

*"I observed a pronounced restlessness in my bee colonies (initially about 40) and a greatly increased urge to swarm. As a frame-hive beekeeper, I use a so-called high floor, the bees did not build their combs in this space in the manner prescribed by the frames, but in random fashion. In the summer, bee colonies collapsed without obvious cause. In the winter, I observed that the bees went foraging despite snow and temperatures below zero and died of cold next to the hive. Colonies that exhibited this behavior collapsed, even though they were strong, healthy colonies with active queens before winter. They were provided with adequate additional food and the available pollen was more than adequate in autumn. The problems only materialised from the time that several transmitters were erected in the immediate vicinity of my beehives."*

64. A survey through the magazine Der Bienenvater (2003/9) provided the following response from beekeepers (20 responses):

Table 1. Questions asked of Bee Keepers (n=20).

| # | Question asked of Bee Keepers | % answering "yes" |
|---|---|---|
| 1 | Is there a mobile radio antenna within 300 m of your beehives? | 100% |
| 2 | Are you observing increased aggressiveness of the bees compared to the time before the transmitters were in operation? | 37.5% |
| 3 | Is there a greater tendency to swarm? | 25% |
| 4 | Are colonies inexplicably collapsing? | 65% |

65. Several experiments have been performed to determine how microwave radiation affects bees in their hives.

66. In one study, Harst et al. (2006), placed a mobile phone near bee colonies and documented how quickly the bees returned to their hives. Twenty-five bees from control colonies (not exposed to mobile phone radiation) and 25 bees from exposed colonies were marked and taken 800 meters away from their hives. The return of the bees during a 45-minute period was assessed. Sixty-five percent of bees from the control colonies and less than 25% of the bees from the exposed colonies returned during the 45-minute period. At the end of the season, the exposed hives were 20% lighter with less honey and pollen than control hives. Apparently bees do not want to live in a hive exposed to electrosmog in the form of microwave radiation.

67. Favre (2011) exposed his hives to the handset of a mobile phone. The sound made by the bees was recorded and analyzed. The presence of actively communicating mobile phone handsets near honeybees within 25 to 40 minutes induced worker piping (a special sound which indicates distress and the signal to swarm and leave the hive). Repeated testing under different environmental conditions produced the same result. The experiment was terminated after 20 hours before any swarming could occur. Honeybees are reacting in a stressful way to pulsed electromagnetic fields generated by mobile telephones. While such phones are unlikely to be near beehives on a permanent basis, the radiation coming from nearby cellular phone base stations and future 5G transmitters are likely to elicit the same response.

68. In a similar study with a mobile phone placed near a beehive with much longer exposure (5 to 10 days), the colony collapsed. Worker bees left the hives with queen, eggs and immature bees, and failed to return home after foraging (Pattazhy 2009).

69. This study has been repeated with slightly different exposure conditions. Sahib (2011) exposed three colonies of honeybees to test conditions that consisted of a mobile phone in working conditions for10 minutes a day at 900 MHz frequency for ten days and had 3 control colonies, not exposed to this radiation. The results are shown in Table 2.

70. The results in Table 2 are dramatic and indicate that the worker bees left the colony after the 10-day experiment, which is what happens in CCD. Prior to

leaving, the activity of the workers decreased significantly as did the number of eggs laid by the queen. Under such conditions a colony is unable to survive.

**Table 2:** Change in colony status of honeybees exposed to mobile phones. The results are shown as the mean ± the standard deviation (% of control) (Sahib, 2011).

| Parameters | | Before Exposure | | During Exposure | | After Exposure | |
|---|---|---|---|---|---|---|---|
| Worker Bees | Control | 40.7 ± 15 | | 41.5 ±14 | | 42.4 ± 14 | |
| leaving the hive entrance/min | Treated | 38.2 ± 12 | 94% | 18.5 ± 13 | 45% | Nil | 0% |
| Returning | Control | 42.5 ±15 | | 43.6 ±14 | | 44.6 ± 13 | |
| Ability of Worker Bees | Treated | 39.5 ± 14 | 93% | 15.6 ± 13 | 36% | Nil | 0% |
| Honey | Control | 9 | | 9 | | 9 | |
| Productivity (# frames) | Treated | 9 | 100% | 5 | 56% | 1 | 11% |
| Egg Laying Rate | Control | 365 | | 362 | | 350 | |
| of Queen/day | Treated | 355 | 97% | 199 | 55% | 100 | 29% |

71. Kumar et al. (2011) exposed adult worker bees (*Apis mellifera*) to cell phone radiation. The bees displayed two types of behaviour. The initial response, during which time bees were much less active and had increase concentrations of biomolecules (proteins, carbohydrates and lipids), was followed by an en masse migration reminiscent of the *fight or flight* stress response.

72. Exposure of beehives to high voltage power lines also seems to be detrimental to the colony although perhaps for slightly different reasons. Greenberg et al. (1981) placed beehives at different distances from a 765 kV, 60 Hz transmission line. When the electric field was at 7 kV/m, there was increased activity with higher hive temperatures, abnormal propolization; reduced hive weight; loss of queen bee; decreased sealed brood; and poor winter survival. Foraging rates were significantly lower at 7 and 5.5 kV/m. Step-potential

induced currents up to 0.5 μA were measured in an electrically equivalent bee model placed on the honeycomb. A high electric field shock is likely to be involved as a stressor inducing elevated body current.

73. Collectively these studies indicate that bees are able to sense and react to both power frequency EMFs and microwave radiation generated by cell phones (and presumably cell phone base station antennas). The exposure elicits an aggressive bee reaction, and, if sufficiently prolonged (several days), workers bees leave the hive and the remaining brood and queen remain defenceless with no ability to survive. This could very well be contributing to colony collapse disorder globally since microwave exposure from wireless telecommunication antennas is now widespread. At this stage we have no idea how the bee populations are going to react to mmwaves that are part of the 5G rollout.

### *B. Bird Populations – i. Wild and Domesticated*

74. Research on the effects of electromagnetic fields on bird populations includes studies of behavioral changes and nesting success in the field and experimental exposure of eggs (mostly chicken eggs) under controlled laboratory conditions.

75. Balmori (2004) studied white stork populations nesting within 200 meters of phone masts compared to those nesting more than 300 meters away. He documented failures in breeding in nests near the antennas. Pairs of white storks near the masts were aggressive and had difficulty building their nests.

76. House sparrow populations have been decreasing during recent decades in the U.S., U.K. and several European countries (Balmori and Hallberg, 2007). Between October 2002 and May 2006, house sparrow populations were monitored and electric fields (1 MHz to 3 GHz) were measured along a transect in Valladolid, Spain. Significant declines (p=0.0037) were observed in bird density over time, and lowest bird densities were observed in areas with high electric fields. The authors concluded that electromagnetic pollution may be responsible, either by itself or in combination with other factors, for the recently observed decline of this species in European cities.

77. Everaert and Bauwens (2007) made similar observations in Belgium. Fewer house sparrow males were observed in areas with elevated electric fields from cell phone base stations supporting the concept that long-term exposure to higher levels of RFR reduces the abundance and alters the behavior of house sparrows in the wild.

78. Fernie et al. 2010 tested whether EMFs affect reproductive success of captive American kestrels. Birds were bred for 2 years under either controlled or EMF exposure that was equivalent to that experienced by wild kestrels. In both years fertility was higher, but hatching success was lower in EMF pairs than control pairs. EMF eggs were larger, with more yolk, albumen, and water, but had thinner eggshells than control eggs. EMF exposure affected reproductive success of kestrels, increasing fertility, egg size, embryonic development, and

fledging success but reducing hatching success. Reduced hatching success could put the population at risk.

79. In a follow-up study, EMF exposure altered melatonin, behavior, growth, and reproduction of captive American kestrels, particularly of males, and male kestrels exposed to EMFs experienced higher levels of oxidative stress (Fernie and Bird 2001).

80. Tanner and Romero-Sierra (1982) exposure chickens (white leghorns) to very low intensity continuous wave microwave radiation at 7.06 GHz for 248 days. Field intensity in each cage (without birds) ranged from 0.19 microW/cm$^2$ in the outer cages to 360 microW/cm$^2$. Egg production of the irradiated colony was greater (13.7%) than that of the control colony but was accompanied by twice the mortality rate. The irradiated birds that survived showed a profound deterioration in health when autopsied.

81. Grigoriev (2003) exposed chicken embryos to EMF from a cell phone for 21 days during embryonic development. He reported an increase in embryo mortality in exposed chicks (75%) compared with the controls (16%). Similar results were obtained for chick eggs exposed to 900 MHz frequencies (Ingol and Ghosh, 2006). Developmental abnormalities were observed in chick eggs exposed to 100 Hz, 2.1 μs pulse, 1 μT (10 mG) magnetic field (Ubeda et al. 1994).

82. Collectively these studies show that birds are sensitive to RFR and that this radiation affects behavior and reproductive success.

### *B Bird Populations: ii. Migratory Birds*

83. Birds that migrate great distances navigate with several redundant systems that include visible clues of landscape, location of the sun, and the earth's geomagnetic field for which they have magneto-receptors in their skull. Power lines, antennas for radar, broadcast, and cell phone communication can interfere with their magnetic compass and put them off course permanently or temporarily until other cues are able to correct their course. Factors that increase energy consumption of migratory birds, decrease their ability to survival. Another concern is collisions with towers or power lines or wind turbines.

84. According to a review of 14 studies, an estimated 12 to 64 million birds are killed annually in the U.S. by power lines; 8 to 57 million by collision, and 0.9 to 11.6 million by electrocution (Loss et al. 2014). Authors conclude that the amount of bird mortality at U.S. power lines is substantial and that conservation management and policy is necessary to reduce this mortality.

85. Birds are not the only flying species that are adversely affected by technology. Nicholls and Racey (2007) noted that many bats are killed by colliding with wind turbines.

86. Extremely low frequency (ELF) communications systems from 3 to 300 Hz were used by the U.S. Navy to communicate with submarines from the continental United States between 1950 and 1980. These large antenna arrays extended thousands of miles and provided one-way communication with

submarines submersed in several hundred feet of salt water anywhere in the world. Three separate programs were considered during this period: SEAFARER, SANGUINE, and SHELF. All three communication systems used the same ELF frequency band. The effects on human health and wildlife were of particular concern at the time.

87. An experimental array that could be turned on and off allowed for testing this system on bird migration. The ability of migrating birds to sense low intensity low frequency alternating current was documented more than 40 years ago (Southern 1975; Larkin and Sutherland 1977).

88. Gull chicks tested on clear days in the normal geomagnetic field clustered and headed in the direction of migration. When a large antenna (Sanguine) was energized, individual birds dispersed randomly leading the author to conclude that magnetic fields associated with such conductors interfere with bird navigation (Southern 1975).

89. Migrating birds within the field of the SEAFARER's antenna turned or changed altitude more frequency when the antenna was *on* compared to when it was turned *off*. Birds during nocturnal migratory flights rely largely on the earth's geomagnetic field and changes in that field can disrupt orientation (Larkin and Sutherland 1977).

90. Wiltschko et al. (2015) noted that radio frequency fields in the MHz range disrupted birds' orientation. In one experiment birds were unable to navigate as long as the RFR was present. Two different exposures were used: 7 MHz at 480

nT (4.8 milliG) and 1.315 MHz at 1 nT (0.01 milliG). Once the field was turned off, birds were able to orient to the local geomagnetic field.

91. Engels et al. (2015) demonstrated in a double blind experiment with European robins that migratory birds were unable to use their magnetic compass in the presence of urban electromagnetic pollution that ranged from 50 kHz to 5 MHz. Birds use a magnetic compass (magneto-receptors) in their skull or beak depending on species that provides information about their relative position to the earth's geomagnetic field. This field does not oscillate but does decrease in strength from the poles to the equator. Alternating current from power line frequencies to microwave radiation appears to interfere with their internal magnetic compass throwing them off course during migration. The more energy they extend to correct their course the less they have to complete their flight plan.

92. Bird feathers are piezoelectric and act like antennas receiving microwave radiation. Bigu-del-Blanco and Romero-Sierra (1975) showed that bird feathers "received" or absorbed microwave radiation in the 10 to 16 GHz region. So, in additional to magneto–reception, feathers may also play a role in birds being able to detect and react to microwave radiation. This "feather" reaction is likely to be more pronounced with 5G technology and mmwaves.

### *C. Mammals: i. Dairy Cows, Ground Current and Radio Frequency Radiation*

93. NOTE: "Ground current", also referred to as *tingle voltage*, *stray voltage* and *uncontrolled electricity*, refers to electrons flowing along the ground that can

come from off-farm sources being distributed by the power grid and influenced by technology that is connected to electricity (wind turbines, broadcast antennas, mobile phone base stations, nearby factories, etc.).

94. By far the most information on the effects of electrosmog on livestock comes from studies with dairy cows. Hillman et al. (2013) provide a concise literature review as well as a field study based on thirteen farms with serious ground current pollution in Wisconsin and Michigan. They show that dirty electricity flowing along the ground as ground current has serious effects on cow health and productivity. Levels at which this happens are well below existing guidelines.

95. Ground current may be due to a combination of both on-farm and off-farm sources. On-farm sources include lighting, variable speed frequency drives on motors, radio frequency identification system and off-farm sources are due to a poor primary neutral return on the utility side of the distribution system (Stetzer et al. 2016). Cows exposed to ground current above a 10 mV at kHz frequencies experience mastitis, foot sores that won't heal, swollen hocks. They have difficulty getting pregnant and produce less milk. Some become ill, refuse to eat, and once this happens there is little the farmer can do to prevent them from dying. In a dairy barn with a serious ground current problem, cows are seen lifting their feet off the ground as though they were "dancing". This lifting of the foot, temporary reduces the electrical current flowing through their body. Little is being done to help farmers or to protect livestock despite two

private member's bills being considered in the Ontario Legislative Assembly during the past 12 years.

96. To test the effects of power frequency EMFs on milk production and feed intake, lactating Holstein cows were experimentally exposed to 10 kV, 30 μT (300 mG), 60 Hz electric and magnetic fields under controlled conditions (Burchard et al. 2003). Exposure to EMFs resulted in an average decrease of 4.97% in milk yield and 16.39% in milk fat as well as an increase of 4.75% in dry matter intake. So the cows ate more but produced less milk of lower fat content resulting in a financial loss to the farmer.

97. In a related study (Rodriguez et al. 2003) EMF exposure altered the estrous cycle, which may help explain some of the reproductive problems cows experience when exposed to ELF EMFs.

98. In a follow-up study, (Burchard et al. 2006) conclude that in a "worst case" scenario exposure of dairy cattle to 10 kV/m, 30 μT (300 mG) EMF influences blood levels of thyroxine (T4) levels. Thyroxine is a hormone made in the thyroid gland for the regulation of metabolism, body heat production, blood pressure, and the normal development of the skeletal and nervous systems. While focus on dairy farms has been on cows, farmers have similar symptoms and suffer from the same exposure (reproductive impairment, chronic pain, swollen joints, etc.).

99. RFR also seems to adversely affect cows. On a dairy farm in Germany, after a mobile phone base station was erected nearby, calves born on this farm had a

higher incidence of cataracts compared with the Swiss average (Hassig et al. 2012). Neither chemical poisons nor infection could explain these findings. Microwave radiation is known to cause cataracts (Glaser 1971).

100. Loscher and Kas (1998) studied a herd of dairy cows on a farm near a TV and cell phone transmitting antenna over a two-year period and reported reduced milk yield, increasing health problems and behavioral abnormalities. Radiation from the antennas was monitored and ranged in frequency from 2.2 to 734 MHz. The highest power density reading in and around the stable was 45 microW/cm$^2$ at 512 MHz (well below international and Health Canada guidelines).

101. The following symptoms were observed:

    1. Most animals in the herd showed conjunctivitis with strong tear flow (constant wet cheeks) and eye itching (some animals were constantly scratching their eyes on reachable stable arrangements or neighboring animals).
    2. Many animals squeezed with their heads the breast area of their neighboring animal; thus, all animals ended up positioning their heads in the same direction.
    3. One animal showed remarkable head motions, periodically moving the head back and forth; periods of calmness were superseded by the above described behavior which could last for as long as 30 minutes.
    4. Calves and cows let out on the meadow grazed only for a few minutes, then they "took shelter" from the transmission tower behind the stable building.
    5. Cows, mostly after the third or fourth calving, fell into decay. When they were getting up after having lain down, their legs started trembling, and this condition became worse very quickly. The decay happened within a few weeks, and then the animals died.

102. In this study, various tests were performed to determine what was affecting the cattle.

1. To rule out metabolic disturbances the feed was analyzed. Feed quality was high and the amounts given to the animals corresponded to their needs.
2. Autopsy of a four-year old cow indicated that death was caused by acute heart circulatory problems with internal bleedings in several organs. No signs of acute or chronic organ changes.
3. Analysis of miscarriage material provided no microscopic or serological evidence of germs that could have caused the miscarriages.
4. One animal with behavioral disturbances was relocated to a similar stable some 20 kilometers away from the transmission tower, together with another cow of the herd. After five days in the new stable the observed behavioral disturbances disappeared completely. The animals were brought home to the stable near the transmission station after two weeks. Already after a few days the symptoms could be observed in the animal again.
5. The symptoms experienced by these cows could not be explained by poor farm management and resemble effects documented for cows near high voltage power lines and cows exposed to ground current (Burchard et al. 1996; Hillman et al. 2013), two other forms of electrosmog.

103. Anything that interferes with reproduction is likely to have serious financial consequences for people who breed domesticated animals. Technology connected to the electricity grid can contribute to currently flowing along the earth and contributing to illness in animals that is often noticed on dairy farms but also in other operations that have a carefully controlled breeding program.

104. In a Michigan study, Marks et al. (1995) documented reproductive problems in terms of infertility, low or absent sperm count, impaired estrous cycling and high percentage of deaths of new born puppies and kittens, many of which were

deformed. These effects were associated with current flowing along the ground that was coming from off-farm sources.

105. Two dairy farmers in the same County reported similar health, reproductive and management concerns in their cows. Tests performed at these dairy farms revealed the presence of ground current or stray voltage. This current flows along metal structures and can adversely affect animals and humans. The level of voltage on the wellhead was 2.45 volts and consisted of high voltage transients or dirty electricity. Similar problems were evident in a kennel about 15 miles away. Experts from the power company, the Public Service Commission, and two independent consultants confirmed the presence of stray voltage (AC and DC) with periodic voltage spikes, as well as magnetic fields and electric fields.

**C. Mammals: ii. *Rodents & Cancer***

106. Mice and rats are used in controlled experiments as a surrogate for experiments with humans. Magras and Xenos, (1997) placed twelve pairs of mice, divided into two groups, in locations around an “antenna park" where the RF power densities ranged from 168 nW/cm$^2$ to 1053 nW/cm$^2$ (0.168 to 1.053 microW/cm$^2$).The pairs were mated five times. A progressive decrease in the number of newborns per dam was observed, which ended in irreversible infertility. The prenatal development of the newborns in smaller litter sizes was improved.

107. The U.S. National Toxicology Program (NTP 2018) conducted one of the largest and most expensive rodent studies to date and released their final report in 2018. Rats were exposed to RFR similar to modulations currently used in U.S. wireless cellular networks starting *in utero* and continuing throughout their lifetime. An increased incidence of malignant brain gliomas and heart schwannomas as well as potentially pre-cancerous lesions were observed in male rats exposed to RFR. The tumors observed were similar to tumors observed in some epidemiology studies of cell phone use. These findings support the International Agency for Research on Cancer (IARC) conclusions regarding the possible carcinogenic potential of RFR.

108. Another similar study conducted at the Ramazzini Institute (RI) in Italy, released a few months later (Falcioni et al. 2019) reported similar findings. This is the largest, long-term study that documents the effects of 1.8 GHz GSM antennas on Sprague-Dawley rats. The RI study also reported brain (gliomas) and heart tumors despite having lower exposures than the NTP study. These two laboratory studies in combination with RF epidemiological studies provide sufficient evidence for IARC to re-evaluate their classification of RFR from a "possible" to a "probable" human carcinogen.

109. An earlier study (Chou et al. 1992) that exposed rats for 25 months to 2.45 GHz frequencies (the same frequency used by Wi-Fi routers) reported a 100% increase in metastatic tumors and a 260% increase in primary tumors. There was also evidence that the immune system was impaired by the radiation.

110. Repacholi et al. (1997) exposed mice to 900 MHz microwave radiation pulsed at 217 Hz, specific absorption rate 0.007 to 4.3 W/kg for 30 minutes daily for up to 18 months. Exposed mice developed twice as many lymphomas as the unexposed mice.

**111.** These *in vivo* studies under controlled conditions demonstrate that RFR at both cell phone frequencies and Wi-Fi frequencies and at levels below current guidelines cause cancer in laboratory animals.

**D. Amphibians: deformities, population decline;**

112. Amphibians are considered bio–indicators of environmental quality. Changes in their populations bode poorly for other species. Balmori (2006) reviewed the literature on amphibian declines and found that 32% of the 5743 populations studied, were in threat of extinction. Amphibians with deformed, absent or extra limbs are also found in the environment. Both these deformities and declines are due to complex ecosystem interactions. One factor that is receiving increasing attention is the increase in microwave and radio frequency radiation in the environment from mobile phone antennas base stations.

113. The following effects are summarized in Balmori's review:

1. Radiation of frogs at 30–60 $\mu W/cm^2$ altered heart rhythm;
2. Radiation of toad hearts with 1425 MHz at 0.6 $\mu W/cm^2$ increased heart rate and produced arrhythmia;
3. Experimental frog tadpoles development was delayed compared to control tadpoles;
4. Electromagnetic fields (EMF) caused allergies and changes in blood counts;

5. Amphibians are particularly sensitive to weak electrical fields and respond to frequencies from 0.1 Hz to 2 kHz;
6. EMFs increase tadpole morality;
7. Electromagnetic radiation (EMR) alters the immune, nervous, and endocrine systems;
8. EMR produces stress on the immune system that interferes with DNA;
9. Heat shock proteins may play a role in protecting animals exposed to EMR;
10. Susceptibility to EMR varies among species and among populations.

**E.** ***Plants***

114. Plants are also sensitive to electrosmog in various forms, but especially radio frequency and microwave radiation. Halgamuge (2016) reviewed 45 scientific publications describing 169 experimental observations to detect changes in plants exposed to weak radio frequency radiation. Almost 90% of the studies documented physiological and/or morphological effects. Maize, roselle, pea, fenugreek, duckweeds, tomato, onions and mungbeans were particularly sensitive to RF-EMFs. Frequencies with the greatest effect were from 0.8 to 1.5 GHz; 1.5 to 2.4 GHz; and 3.5 to 8 GHz. Biological effects relied on field strength and amplitude modulation of the applied field. The effects were more pronounced in short-term (up to 13 weeks) rather than long-term (3 months to 6 years) exposure studies implying there may be some adaption to this exposure.

115. In 1990, permanent plots were established near the Skrunda Radio Station in Latvia, which had been operating for the previous 20 years, and a nearby control area to test the growth of pine trees using tree ring data and examining annual growth rate (Balodis et al. 1996). The annual growth rate can be

determined by tree ring radius. There was a significant negative relationship ($p<0.01$) between the annual increment in tree growth and the intensity of the electric field that was traced back to 1970 when the station began operation. No other environmental factor could account for this response except the radiation from the radio station.

116. In 2015, the intensity of RFR was mapped in two Germany cities (Bamberg and Hallstadt). A total of 120 trees were selected for detailed analysis of damage. Sixty of these were damaged trees, 30 were from low RF environments and 30 were selected at random (Waldmann-Selsam et al. 2016). Significant differences were observed between the damaged side facing a phone mast and the opposite side of trees. Damage was associated with power flux density and damage afflicted on trees by mobile phone towers usually started on one side and extended to the whole tree over time. The trees selected from low radiation areas (no phone mast visible and <50 $\mu W/m^2$) (0.005 $\mu W/cm^2$) showed no damage. This study demonstrates that electromagnetic radiation from mobile phone masts is harmful for trees.

117. Tree decline is one indicator of environmental stress as the declines are often associated with infestations (insects, fungi, etc.), air pollution or altered climatic conditions. Since 2004, rapid declines in aspen clones ere documented in Colorado, and the hypothesis that this decline was associated with RFR from nearby broadcast and cellular antennas was investigated (Haggerty 2010).

118. Seedlings were grown in shielded (aluminum screen) faraday cages and with mock-shielding (fiberglass screen). A portable radio was used to test the effectiveness of the shielding and indicated that there was no reception within the aluminum cages as compared with the mock shielding and unshielded controls. Conditions in the shielded and mock-shielded enclosures were similar except for the difference in RF background intensities.

119. Plants in the shielded and mock-shielded enclosures looked different at the end of the study. The RF background appeared to be adversely affecting leaf and shoot growth and inhibiting fall colors associated with leaf senescence in trembling aspen seedlings. The mock-shielded plants had many more necrotic spots on the leaves than the shielded plants (see Plate 2). According to the author, these effects suggest that exposure to the RF background may be an underlying factor in the recent rapid decline of aspen populations in Colorado.

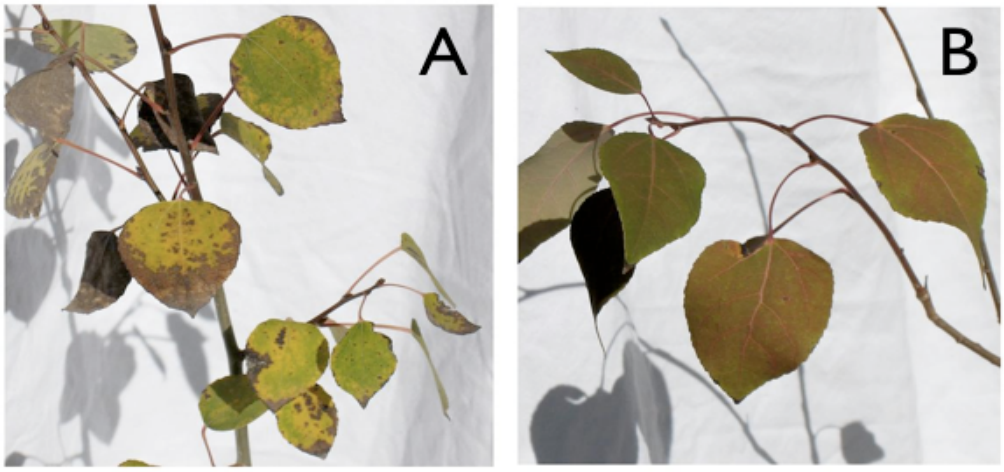



Plate 2. More necrosis visible on mock-shielded (A) than shielded (B) aspen seedlings. Also leaf veins of mock-shielded plants are yellow or green and petioles are light red to pink and less healthy than leaf veins and petioles of shielded plants (Oct 6, 2007). [Source: Haggerty 2010]

120. Another experiment was conducted under controlled conditions testing the effect of radiation from a Wi-Fi router on the germination and growth of edible and fast germinating seedlings (garden cress, broccoli, red clover and pea) (Havas and Symington 2016). Radiation levels were 0.00001 $\mu W/cm^2$ for the controls. The mean and maximum exposure levels for the RF-exposed seedlings were 2–4 microW/$cm^2$ and 9.6 microW/$cm^2$ respectively. These levels are well below international and Health Canada's guidelines for RF exposure.

121. There were no effects on germination of the seedlings. However, dry weight of the broccoli and peas (Plate 3) exposed to Wi-Fi radiation was much lower than controls at the end of the experiment ($p<0.01$). Wi-Fi exposure inhibited root growth of several species. It also caused root tips to turn brown and reduced root hairs of cress compared with the reference treatment. Broccoli seedlings closest to the Wi-Fi router grew away from the router; cress seedlings had larger leaves and were chlorotic compared with controls; and several of the Wi-Fi replicates had obvious growth of mould in Petri plates with unhealthy seedlings. Radiation generated by Wi-Fi routers can adversely affect plant growth and may interfere with a plant's ability to protect itself from opportunistic mould.

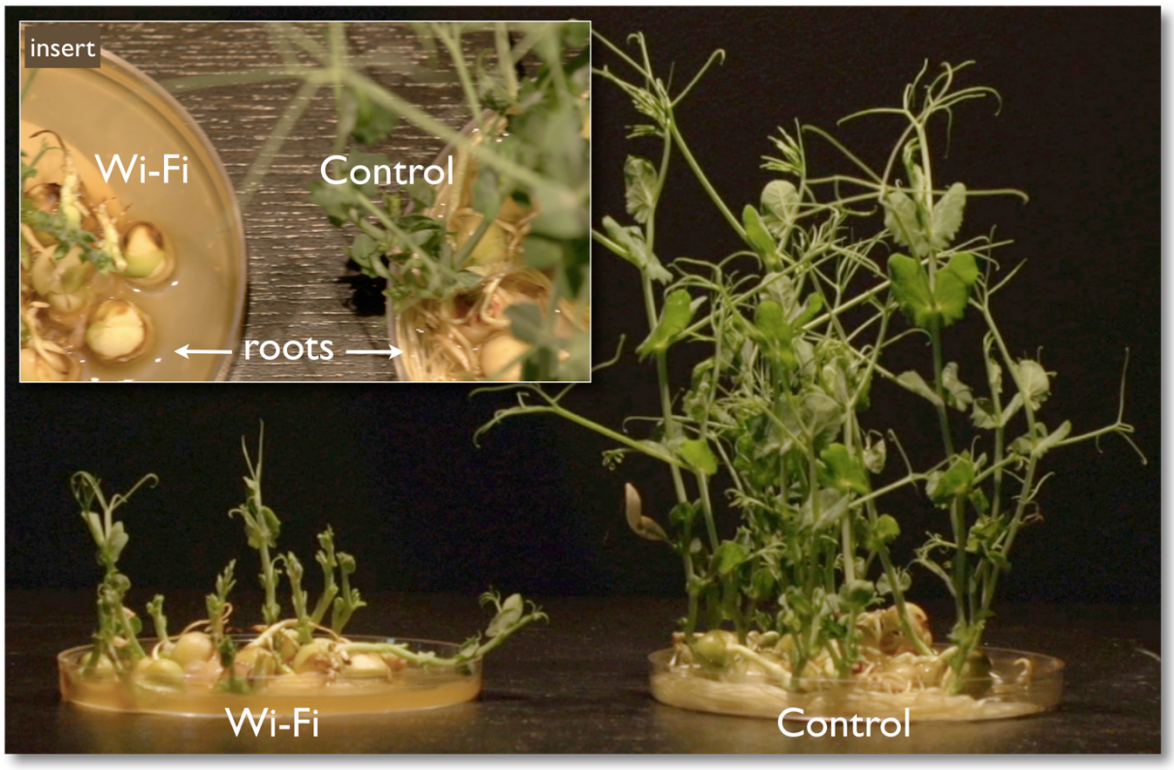



Plate 3. Growth of pea seedlings exposed to Wi-Fi radiation for one month compared with controls that were not exposed to RFR. Wi-Fi radiation reduced root growth (insert) and reduced above ground biomass. [Source: Havas and Symington (2016)]

## V COMMENTS ABOUT SCIENCE, THE SCIENTIFIC METHOD, SCIENTIFIC CONCEPTS AND SCIENTIFIC TERMINOLOGY

122. Popular words sometimes have different meanings when used in science and this can lead to confusion in legal cases due to miscommunication. In this report I would like to focus on just a few terms and concepts that may facilitate communication.

123. *Guidelines vs. Standards*: Health Canada provides exposure *guidelines* in their Safety Code 6 document that is updated every 5 to 10 years. *Standards* are mandatory controls while *guidelines* are non-mandatory controls. Health Canada's guidelines are limited to individuals working at, or visiting, federally

regulated sites. It is my understanding that there is no program to monitor the environment for radio frequency radiation and a guideline that is not monitored cannot be enforced.

124. Since a person's home is not a federally regulated site, Canadians are not protected by these guidelines. Radiation at 2.45 GHz (microwave oven, Wi-Fi router, cordless phone, baby monitor, home security system, smart light bulbs, etc.) does not require a license and as such is not regulated. The more of these devices people have at home, school or work the higher their exposure is likely to be. People who live in multiunit dwellings are also exposed to microwave radiation generated by their neighbours.

125. *Significance*: The term *significance* is used to imply *statistical significance*, which is set by convention (unless otherwise noted) to a probability of 5% or less. This means that the probability of obtaining a result due to chance or error is less than 5%.

126. *Weak association*: A *weak association* generally used in epidemiological studies indicates that the odds ratio (OR, ratio of observed to expected outcome) is low (less than 2). A weak association can be significant. For example, the OR for tobacco and lung cancer is considered high (OR above 5) whereas the association between low frequency magnetic fields and childhood leukemia was originally believed to be low ($\leq 2$). Both were significant. We have since learned that this association with childhood leukemia in dose-

dependent and can be much higher than 2 depending on the magnetic field exposure (Figure 3).

127. *Acute vs. chronic exposure*: Generally *acute* refers to high-level short-term exposure, while *chronic* refers to low-level long-term exposure. For example, a person working very close (within 10 meters) to a live antenna for a few hours would have acute exposure and a person living near (within 400 m) of an antenna for months or years would experience chronic exposure. The effects of both chronic and acute exposure seem to be similar, with a few exceptions.

128. *Cumulative exposure*: This is a form of chronic exposure and is quantified using *time-weighted average*, which is the exposure intensity multiplied by the duration of exposure. For example, a microwave oven can cook a potato at 100% power within 5 minutes; at 50% power it requires 10 minutes and at 20% power it requires 25 minutes.

129. *Weight-of-evidence*: There are several issues with the concept of *weight-of-evidence.* Health authorities (including Health Canada) use this concept when they describe how they evaluate the science on the biological and health effects of electromagnetic pollution.

130. First, this concept is a management tool and is not part of the scientific method. *Weight-of-evidence* has far too many subjective elements that are seldom explicitly stated when doing this type of assessment. Management decisions are based on a combination of science, societal values, public opinion, and both technological and economic factors.

131. Second, weight-of-evidence is applied incorrectly by Health Canada and a few other health agencies. These organizations compare studies that show a significant effect to studies that do not show an effect, as though non-effect studies cancel statistically significant studies. This is nonsense. What they should be doing is similar to what is done with drug research where the beneficial effects of the drug are compared with the harmful side-effects of a drug. The corollary is comparing the biologically harmful effects of cell phones to the biologically beneficial effects of cell phones. When this is done the harmful effects become increasingly obvious. The rational behind this relates to the 5% probability mentioned above. The statistical outcome in any study may be due to chance (5% of the time) and finding something harmful vs. something beneficial by chance (by error) should be the same. Comparing studies with positive vs. negative outcomes should eliminate this type of "error".

132. *Scientific Method*: The scientific method, according to Popper involves falsification. Procedurally a hypothesis is formulated that can be tested and falsified. The example most often cited involves swans. One cannot prove that all swans are white by seeing and counting white swans. However, the statement that "*all swans are white"* can be falsified by finding one black swan. Similarly scientific studies that document adverse health effects below existing guidelines and that are repeatable indicate that guidelines are non-protective.

133. *Epidemiological vs. in vivo vs. in vitro Studies*: Scientists use multiple techniques to test a scientific hypothesis. These tests fall into three categories

within environmental health research. They include epidemiological studies, *in vivo* studies, and *in vitro* studies. Often a combination of these tests is required to address key environmental health concerns as they each provide different information.

134. *Epidemiological studies* test the **association** between an agent (cell phones) and an outcome (brain cancer) in human populations living under realistic conditions. So statements that a particular epidemiological study does not prove that cell phones cause cancer is not necessary because these studies are not designed to show cause-effect relationship and when this is provided in a scientific article it is misinterpreted by the public. The strength of a well-conducted epidemiological study is that it is under realistic conditions. This can also be one of the weaknesses as there may be confounding factors that can influence the results. Well-conducted studies attempt to correct for confounders.

135. *In vivo* studies test the effect of an agent on living organisms under controlled conditions. These studies indicate a **cause-effect** relationship between the agent and the outcome. The test organism may be a human being or–when testing a human subject is unethical–rats, mice, rabbits and other species are used. The strength of *in vivo* studies is that everything is controlled and can be repeated by other labs. The weakness is that it can be difficult translating the data to human if test animals are used as different species and even different strains of the same species have different sensitivities.

136. *In vitro* studies use biological tissue under controlled conditions to determine **mechanisms** of action an agent may have on living cultures. Once again, the strength of such research is that it can be repeated and the weakness is that what happens in a test tube may not always happen in a living organisms as homeostatic mechanism come into play.

137. When all three types of research point in the same direction, we can be certain that the evidence is real and not an artefact. This is the case for microwave radiation (cell phone use and living near cell towers) and cancer.

1. epidemiological studies showing an association between an agent and an outcome (i.e. cell phone base stations and cancer, Brazil, Israel, Germany);
2. *in vivo* studies showing a cause-effect relationship in laboratory rats (cancer in rats exposed to cell phone radiation, NTP 2018, Falcioni et al. 2019 study); and
3. *in vitro* studies that provide the mechanism of action (oxidative stress and production of free radicals that are carcinogenic).

## VI HEALTH CANADA'S SAFETY CODE 6 – CRITICAL ASSESSMENT

138. Health Canada (HC) is responsible for establishing guidelines and standards to protect the Canadian public against electromagnetic pollution. When it comes to NIR, HC is failing to fulfill its mandate. Very briefly I have some concerns about Health Canada's Safety Code 6 (SC6), the document that provides guidelines for electromagnetic pollution. Those concerns are as follows:

1. HC does not have guidelines for electromagnetic frequencies below 3 kHz. Consequently, we have no guidelines for ELF electric or ELF

magnetic fields associated with our use of electricity despite the fact that studies are documenting, a) an increase in various types of cancers with occupational exposure to ELF EMFs; b) an increase in childhood leukemia for residential exposure to ELF EMFs; and c) reduced oncostatic effect of melatonin and tamoxifen on breast cancer in the presence of a magnetic field of 12 mG (Havas 2000). Consequently people who live near high voltage power lines or are exposed occupationally to ELF EMFs are not protected due to absence of guidelines. This is unacceptable. Canada needs guidelines for ELF EMFs and those guidelines should differ for children and adults as we know that children exposed to magnetic fields at or above 3 mG have a greater risk of developing leukemia whereas adults appear to develop cancers at higher magnetic field exposures in the range of 10 to 12 mG. Indeed IARC recognized this in 2002 when they classified ELF EMFs as possibly carcinogenic to humans.

2. HC's guidelines for frequencies between 3 kHz and 300 GHz are out of date and are based on the false assumption that only shock (at lower frequencies) and thermal effects (at higher frequencies) are important from a biological/health perspectives. In other words, if you don't get a shock and if your body temperature does not increase you are safe. Once again, thousands of studies at levels well below thermal effects document adverse health effects that are being ignored by HC.

3. Guidelines are for a small subset of the population and not for all Canadians. In HC's "Understanding Safety Code 6" https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/understanding-safety-code-6.html they state: "The safety limits in this code apply to all individuals working at, or visiting, federally regulated sites." There are no guidelines for schools, hospitals, or occupational settings. This is unacceptable.

4. To establish if guidelines are exceeded, HC relies on the average readings based on a 6-minute period of monitoring. There are two concerns related to this. Averages are used by engineers but living organisms respond to extremes and not averages. Consequently someone can scald their hand within a matter of seconds with boiling water even if they then place their hand in a cool water bath giving a lower average temperature. The second concern is effects of short-term exposure differ considerably from long-term exposure and we have no guidelines for long-term, continuous exposure irrespective of what Health Canada states.

5. In an earlier version of SC6 (1999) the following statement appeared on page 11, "Certain members of the general public may be more susceptible to harm from RF and microwave exposure." This statement was removed from more recent versions with no explanation provided for that removal.

6. It is unclear which scientific documents HC relied on for their guidelines and which ones they ignored as no monograph has been produced and no references are provided. This is in sharp contrast to the two excellent monographs produced by IARC for ELF (2002) and RF (2012) exposure. What is missing is transparency.

139. Perhaps what I find most disturbing is HC's Fact Sheet entitled, "Busting Myths on Safety Code 6." These are "myths" and "facts" according to HC.

140. Health Canada provides the following myths/facts that I challenge below: https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/fact-sheet-what-safety-code-6.html

**141. Myth #1:** Safety Code 6 limits only provide protection based on limited exposure for healthy adults. The guideline does not account for vulnerable populations such as children or people with electro hypersensitivity disorder.

*142.* **HC Fact**: 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.

*143.* **My Comments:** Where is the scientific evidence supporting this statement? I know of no study that deliberately exposed a small child to continuous RF radiation and documented the health effects. Indeed this type of research would be ethically unacceptable. What does seem to be happening is that students in schools with Wi-Fi are complaining of ill health (see 16 by 9 the bigger picture

Wi-Fi in Schools dangerous, http://www.emf-safety.com/169-wifi-in-schools-dangerous.html).

144. **HC goes on to state**: While the symptoms attributed to electrohypersensitivity conditions are real, scientific evidence has failed to demonstrate that they are caused by exposure to electromagnetic fields.

*145.* **My Comments:** A double blind, placebo controlled study showed that exposure to 2.4 GHz microwave radiation at levels below 5 microW/cm$^2$ (i.e. less than 1% of SC6 guidelines) affects the heart and the autonomic nervous system of those who are electrically sensitive (Havas et al. 2010).

146. Dr. William Rea and colleagues (1991) tested the response of 100 patients to different electromagnetic frequencies from 0.1 Hz to 5 MHz and found that 16 regularly responded only to EM exposure and not to blank exposures. Most of the reactions were neurological (such as tingling, sleepiness, headache, dizziness, and in severe cases unconsciousness) although a variety of other symptoms were also observed including pain of various sorts, muscle tightness particularly in the chest, spasm, palpitation, flushing, tachycardia, edema, nausea, belching, pressure in ears, burning and itching of eyes and skin.

147. In addition to the clinical symptoms, instrument recordings of pupil dilation, respiration, and heart activity were also included in the study using a double-blind approach. Results indicate a 20% decrease in pulmonary function and a 40% increase in heart rate. Patients sometimes had delayed or prolonged responses. These objective instrumental recordings, in combination with the

clinical symptoms, demonstrate that EMF sensitive individuals respond physiologically to certain EMF frequencies.

**148.** **Myth #2**: Frequent users of cell phones, such as children and teenagers, are at an increased risk of adverse health effects caused by exposure to RF energy.

**149.** **HC Fact**: There is no evidence that children and teenagers are at increased risk when Safety Code 6 exposure limits are respected.

*150.* **My Comments:** Hardell et al (2009) showed that young people who used a cell phone before the age of 20 had a greater risk of developing a brain tumor than did adults. Gandhi et al (1996) showed that radiation from a cell phone penetrates much more deeply into the brain of a children than that of an adult (Figure 8).

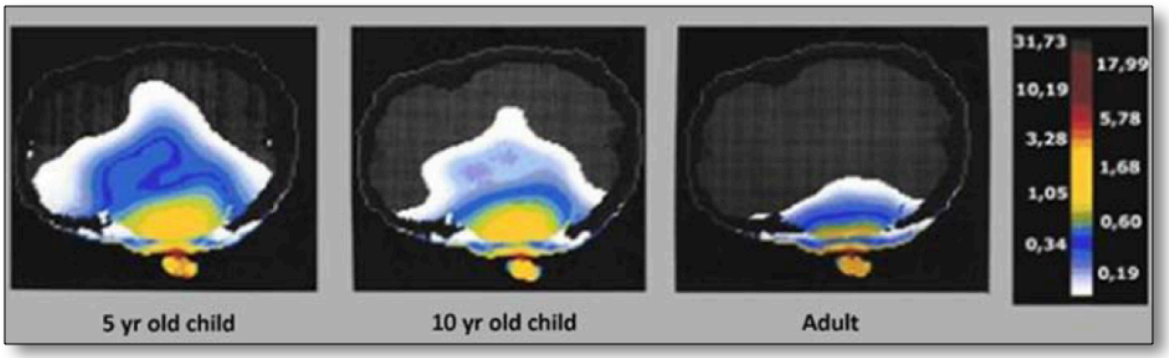



Figure 8. Depth of absorption of cell phone radiation in a 5-year old child, a 10-year old child, and in an adult from GSM cell phone radiation at 900 MHz. Color scale on right shows the SAR in Watts per kilogram. Source: Gandhi et al., 1996.

*151.* To their credit, HC provides information on how to reduce your risk in their fact sheet on *Cell Phones and Cell Phone Towers*

https://www.canada.ca/en/health-canada/services/consumer-radiation/safety-cell-phones-cell-phone-towers.html. They state the following:

Health Canada 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
- replacing cell phone calls with text messages
- Health Canada also encourages parents to take these measures to reduce their children's RF exposure from cell phones since children are typically more sensitive to a variety of environmental agents.

152. **My comments:** So HC does recognize that children are more sensitive than adults to a variety of environmental agents, but they don't apply this concept to their RF guidelines.

**153. Myth #3:** Many countries have limits 100 times lower than Safety Code 6. This must mean Safety Code 6 doesn't protect my health.

*154.* **HC Fact**: 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.

*155.* **My Comments:** Countries that rely on the science-based evidence recognize non-thermal effects and hence have much lower guidelines than does Canada. Guidelines globally fall into one of three categories: thermal, non-thermal and precautionary principle. Canada's guidelines are thermal and are the least protective.

**156.** **Myth #4**: Health Canada ignores certain studies, especially those that show adverse health effects resulting from exposure to RF energy.

*157.* **HC Fact**: 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.

158. **HC goes on to state:** 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.

*159.* **My Comments:** First it is not possible to consider "all" peer-reviewed scientific studies as there are hundreds of thousands of them. Second, HC does not provide any of the studies upon which they relied so it is not possible to determine which studies were omitted or ignored. And finally, HC conducts weight-of-evidence improperly and comes to the wrong conclusion from a scientific basis. As they state above, they consider whether a study documents adverse or no effects. What about studies that document a beneficial effect? How does HC deal with those studies? When conducting weight-of-evidence analysis studies showing adverse effects are compared to studies showing beneficial effects. Studies showing no effect are ignored. The appropriate way to conduct research and to establish guidelines is demonstrated by IARC in their two monographs on ELF (2002) and RFR (2012) both of which are longer than 400 pages. These monographs provide the studies considered and the rationale for the conclusions drawn. This is the appropriate way to conduct and

communicate research in a transparent manner that allows for further dialogue among experts.

**160.** **Myth #5**: Safety Code 6 is based only on preventing thermal (heating) effects and doesn't consider other harmful non-thermal/biological effects.

*161.* **HC Fact**: Health Canada scientists consider all peer-reviewed scientific studies and consider many different potential health effects including thermal, non-thermal and biological effects.

162. **HC goes on to state:** The exposure limits in Safety Code 6 for frequencies above 10 MHz are therefore set below the level at which heating (thermal effects) could occur. Harmful non-thermal/biological effects at levels below the limits in Safety Code 6 have not been scientifically established.

163. **My comments**: If HC believes that non-thermal effects have not been scientifically established then they must have ignored all the scientific literature documenting non-thermal effects. Many of these studies are available in the BioInitiative Report (Carpenter and Sage 2007).

**164.** **Myth #6**: I live and work in a major city, so I am constantly exposed to RF energy, all the time. Safety Code 6 does not account for the cumulative effects of this exposure to RF energy.

*165.* **HC Fact**: Canadians are protected from the cumulative effects of RF energy when Safety Code 6 is respected.

*166.* **My Comments:** Where is the evidence supporting the statement above? Instead of providing evidence, HC simply repeats their mantra that "no adverse health effects will occur from exposure to RF energy at the levels permitted by Safety Code 6." What scientists are finding is that the long-term chronic and cumulative exposures are contributing to adverse health conditions including but not limited to cancers.

**167.** **Myth #7**: Safety Code 6 does not protect my health, as it's based on an exposure time of only six minutes. Given our constant exposure to RF energy, especially in urban environments, this is not enough.

*168.* **HC Fact**: Canadians are protected from continuous exposure to multiple sources of RF energy when Safety Code 6 is respected.

169. **HC goes on to state**: This reference period is not a maximum exposure time. It means that the levels of RF energy from *all sources combined* shall not exceed the exposure limits in Safety Code 6 in *any* six-minute time period throughout the day.

*170.* **My Comments:** Where is the evidence and who is measuring exposure of Canadians to ensure that SC6 is not exceeded? To my knowledge neither HC nor Innovation, Science & Economic Development Canada do routine monitoring of RF exposure. If you don't monitor it you can't enforce it!

**171.** **Myth #8**: The International Agency for Research on Cancer (IARC) classified radiofrequency energy as potentially carcinogenic. This means that I will get cancer due to my exposure to RF energy.

*172.* **HC Fact**: The IARC did not find a direct link between RF energy exposure and cancer.

173. **HC goes on to state:** IARC … classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer, associated with wireless phone use. However, the vast majority of research to date does not support a link between RF energy exposure and cancers in humans.

174. **My Comments:** How many studies are needed to justify that there is a direct link between cancers (for example) and RF exposure? To date we have dozens of studies showing an association between cell phone use and gliomas, that occur on the same side of the head where the cell phone is placed; that rats exposed to RFR have a greater risk of developing various tumors including gliomas; that the age-standardized incidence rate for stage 4 gliomas in the frontal and temporal lobes are increasing in both the England and California according to cancer registries. Surely these studies provide enough scientific evidence to recognize a direct link between RF exposure and the formation of gliomas and other tumors.

**175.** **Myth #9**: Because Health Canada regularly reviews Safety Code 6, it must mean the current Code doesn't offer me enough protection.

*176.* **HC Fact**: The exposure limits recommended in Safety Code 6 protect the health of Canadians.

177. **HC goes on to state**: The Department continues to monitor and analyze ongoing scientific research on this issue and should new scientific evidence arise demonstrating that exposure to RF fields poses a health risk to Canadians, Health Canada will take the appropriate action to safeguard the health of Canadians.

178. **My comments:** While HC states that they continue to analyze ongoing scientific research there is no evidence that they recognize any of the research dealing with non-thermal effects. The health risk to Canadians from RF is clear yet HC fails to act and to protect the public. Indeed, no testing is done to find out what people are actually exposed to and whether the limits are exceeded. Health Canada and Innovation, Science & Economic Development Canada (ISEDC) (formerly Industry Canada) rely on the telecom industry to provide them with information on exposures. And since these companies report only on what they are emitting who is measuring the combined exposure from multiple antennas on towers where co-occupancy is required? Who is detecting "hot spots" when RFR is re-radiated by metallic objects?

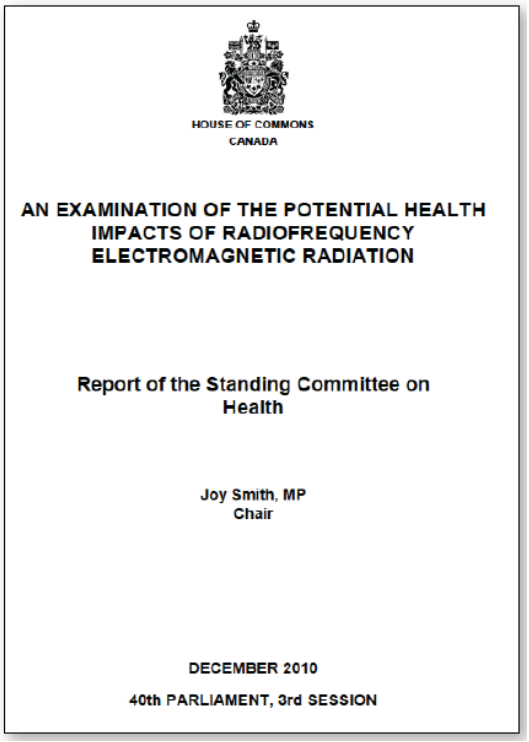
## VII HESA RECOMMENDATIONS ON RADIO FREQUENCY RADIATION

179. In 2010 and again in 2015, The Standing Committee on Health (HESA) held hearings on Radio Frequency Radiation and made a number of

recommendations to the Government of Canada. Those recommendations are summarized in Tables 3 and 4.

180. To my knowledge, the Government of Canada and its various Departments and Agencies have largely ignored these recommendations.

Table 3. HESA Standing Committee Recommendations to the Government of Canada, 2010.



HOUSE OF COMMONS
CANADA

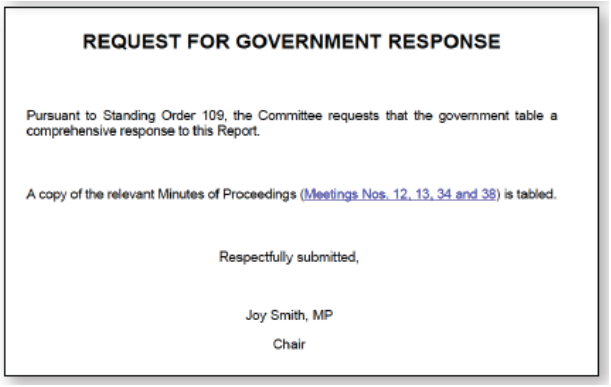
**AN EXAMINATION OF THE POTENTIAL HEALTH IMPACTS OF RADIOFREQUENCY ELECTROMAGNETIC RADIATION**

**Report of the Standing Committee on Health**

**Joy Smith, MP**
**Chair**

**DECEMBER 2010**

**40th PARLIAMENT, 3rd SESSION**



**REQUEST FOR GOVERNMENT RESPONSE**

Pursuant to Standing Order 109, the Committee requests that the government table a comprehensive response to this Report.

A copy of the relevant Minutes of Proceedings (Meetings Nos. 12, 13, 34 and 38) is tabled.

Respectfully submitted,

Joy Smith, MP
Chair

RECOMMENDATION 1

The Government of Canada consider providing funding to the Canadian Institutes of Health Research in support of longterm studies examining the potential health impacts of exposure to radiofrequency electromagnetic radiation.

RECOMMENDATION 2

Health Canada request that the Council of Canadian Academies or another appropriate independent institution conduct an assessment of the Canadian and international scientific literature regarding the potential health impacts of short and long-term exposure to radiofrequency electromagnetic radiation, which would include an examination of electromagnetic sensitivity and a comparison of public policies in other countries governing exposure to radiofrequency electromagnetic radiation; and report on its findings.

RECOMMENDATION 3

Health Canada and Industry Canada develop a comprehensive risk awareness program for exposure to radiofrequency electromagnetic radiation, which would include Health Canada making public in an accessible and transparent way all the studies and analyses undertaken by the Department on the impact of radiofrequency electromagnetic radiation on human health, as well as the provision of information promoting the safe use of wireless technologies.

Table 3 continued …

RECOMMENDATION 4
Health Canada and Industry Canada offer to provide information, including awareness sessions on exposure to radiofrequency electromagnetic radiation.

RECOMMENDATION 5
Health Canada ensure that it has a process in place to receive and respond to reports of adverse reactions to electromagnetic radiation emitting devices.

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181. Recommendation 3 above requests that Health Canada and Industry Canada make public *in an accessible and transparent way* all the studies and analyses undertaken by the Department on the impact of radio frequency electromagnetic radiation on human health. Nine years have passed and Health Canada has failed to provide the studies it relied on to formulate Safety Code 6.

Table 4. HESA Standing Committee Recommendations to the Government of Canada, 2015.

| Radiofrequency Electromagnetic Radiation and the Health of Canadians, Report of the Standing Committee on Health; Ben Lobb, Chair; 41st Parliament, Second Session, June, 2015. |
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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.

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182. HESA clearly recognizes the importance of electromagnetic hypersensitivity as it is mentioned in several of the recommendations above. It is unclear which of these recommendations have been implemented.

## VIII 5G AND THE INTERNET OF THINGS (IOT)

183. Various countries around the globe are racing ahead to install and have 5G operational by 2020. 5G represents the 5th generation of telecommunication technology with 1G being voice (1982), 2G being voice and text (1992), 3G being voice, text, internet (2001) and 4G being voice, text, internet and video (2012). 5G promises much faster speeds of down loading information from the Internet. These faster speeds allow for autonomous cars and a whole host of new devices that rely on real-time computing.

184. In order to have these faster speeds, high frequencies are going to be used for 5G along with some lower frequencies in the 600 and 700 MHz range. The high frequencies are called millimetre waves (mmwaves) and these are currently being used at airport scanners where the airport staff are complaining of health effects.

185. The U.S. military also uses mmwaves as part of their active denial system (ADS) for non-lethal crowd control. Large parabolic antennas on trucks or tanks are aimed at a person or several people in a crowd and when the operator engages the joy stick, a highly intense beam of radiation causes extreme heat/pain for those in its path. The radiation penetrates clothing and causes the surface of the skin, and especially the sweat glands to heat up resulting in excruciating pain. According to the military these short-burst of mmwaves have no long-term health effects. What they fail to mention is that eyes are extremely sensitive to this type of radiation.

186. In Canada, the Ontario-Quebec corridor is going to be among the first to get 5G technology as soon as Ottawa begins to auction this part of electromagnetic spectrum.

187. The primary concern shared by many scientists is that there has been no testing of the long-term effects of exposure to 5G radiation and mmwaves.

188. The eyes and the testicles (both of which are highly sensitive to microwave radiation and a heating effect) are likely to be adversely affected following prolonged exposure to mmwaves.

189. Scientists are also warning that insects are likely to be adversely affected as their body is similar in size to the waves and this causes resonance and a greater absorption of energy.

190. Since moisture in the air and trees readily absorb these higher frequencies and smaller wavelengths, the transmitters will need to be within line-of-sight of each other in order to function properly. This will result in millions of small cell antennas placed on light, hydro and telephone poles at an interval of ever few hundred meters. Consequently small cells that transmit and receive mmwaves will be placed in front of every 3$^{rd}$ to 5$^{th}$ home depending on the density of the homes in any one neighbourhood. This rollout will cost hundreds of millions of dollars and will be paid for by the consumers of the technology.

191. The infrastructure for 5G will consist of satellites, large cells, small cells and fibre optics using a combination of mmwaves and lower frequency microwaves.

192. Clearly with 5G there will be winners and losers. The Industry is predicting 5 billion people will be connected, resulting in $4 trillion dollars in revenue

opportunities as 25 plus millions of apps are developed and embedded into of intelligent systems. All of this will enable 50 trillion GBs of data to be generated. All of this "data" means more RF exposure since most of the transfers will be through the air rather than through wires or fibre optics.

193. Since we have no research on the long-term effects it is difficult to predict the biological and health responses to 5G technology.

194. Russell (2018), reviewed what limited research is available and came up with the following conclusion.

1. sweat glands will be the target as they act like miniature antennas to mmwaves.

2. systemic signaling in the skin can result in physiological effects on the nervous system, heart, and immune system mediated through neuroendocrine mechanisms;

3. some frequencies had no effect (61 and 75 GHz) while other frequencies (55 and 73 GHz) caused pronounced arrhythmia. For this very reason, testing is essential to identify the frequencies that are least likely to be harmful should we move ahead with 5G technology.

4. there is likely to be an epidemic of ocular pathology with long-term exposure and an increase in cataracts in both young and old;

5. evidence that the immune system is impaired after a single dose resulting in 50% suppression of phagocyctic activity in healthy mice;

6. teratogenic effects (birth defects) were detected in drosophila (fruit flies that are used in the lab for studies involving several generations).

7. evidence that bacterial growth may increase or decrease depending on the species tested and on frequency and intensity of the mmwaves; and

8. evidence of antibiotic resistance caused by mmwaves.

195. Clearly, we need to be very carefully to avoid harmful biological and health effects to humans and other species if we are to expose virtually the entire population of Canada (and the world) to mmwaves.

196. Professor Martin Pall (2018) predicts four types of blindness associated with 5G technology: cataracts, detached retinas, glaucoma and macular degeneration. He goes on to state, "Putting in tens of millions of 5G antennae without a single biological test of safety has got to be about the stupidest idea anyone has had in the history of the world."

197. Many scientists agree that 5G needs to be placed on hold until proper scientific testing of the biological effects is complete. Scientists and doctors have signed a 5G appeal http://www.5gappeal.eu/scientists-and-doctors-warn-of-potential-serious-health-effects-of-5g/ and warn of potential serious health effects of 5G. They recommend a moratorium on the roll-out of 5G for telecommunication until potential hazards for human health and the environment have been fully investigated by scientists independent from industry. 5G will substantially increase exposure to radio frequency electromagnetic fields (RF-EMF) on top of the 2G, 3G, 4G, Wi-Fi, etc. RF-EMF has been proven to be harmful for humans and the environment at current levels. Increasing exposure is likely to make things that much worse.

198. This 5G Appeal, has been signed by more than 231 scientists in 40 nations as of April 30, 2019.

## IX FINAL COMMENTS

199. Overall, the studies examining the effects of various types of electromagnetic pollution from power frequency electric and magnetic fields to microwave radiation are documenting adverse effects on reproduction, health and longevity of humans and wildlife as well as reduced productivity in agriculturally and commercially important animals, insects and plants. Increased cancers in rats exposed to microwave radiation at cell phone and Wi-Fi frequencies under controlled conditions have also been documented in at least three large, well funded studies. These effects and these studies cannot continue to be ignored. As levels of electromagnetic pollution continue to increase and as the areas of exposure continue to expand a growing number of people and species are being placed at risk. Some of these species have critical functions in ecosystems and their disappearance can have widespread adverse effects on societies around the world.

200. This concludes my testimony.

201. I, Magda Havas, residing at 304 Woodward Avenue, Peterborough, Ontario, Canada solemnly affirm that the information presented above is, to the best of my knowledge, true.

202. I hereby agree to waive confidentially with the present Report.

_____ May 15, 2019

Magda Havas, B.Sc., Ph.D. date

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