
Electromagnetic fields: Questions and answers about wireless technologies

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What are the issues, the second-hand effects, and the standards for the wireless technologies?

Life on earth has evolved amidst a broad band of electromagnetic frequencies, which originate from throughout the universe. By 1980, environmental exposure to artificial, repetitive or random signals in the radiofrequency / microwave band has risen dramatically – by more than a trillion times, mostly for military technology.

Since 1980, mostly for newly-introduced commercial applications, the average “second-hand” exposure in Southern Canada has risen from about 0.005 microWatt/cm² to the current background environmental range of 0.4 to 100.0 μ Watt/cm². We note an 8 to 20,000-fold increase with peaks in downtown Toronto and some centres, including Brantford and Mississauga. About 100 square kilometres in Southern Ontario have environmental broadband radiofrequency and microwave power emission exposures during timeframes that can exceed the **Health Canada Safety Code 6** exposure limit of approximately 0.6 to 1 milliWatt/cm² (600 - 1,000 microWatt/cm²). Such illegal irradiation coverage can be expected to rise exponentially to several hundred square kilometres in both Ontario and Quebec by the end of this decade, on a more persistent basis, as more and more wireless technologies are approved by governments and marketed. Note that individuals within such exposed zones may experience a continual body temperature rise, with time, (but actually “feel” colder, and may seek greater warmth).

By “second-hand” exposure, we are referring to cases whereby an individual does not own nor use any radiofrequency/microwave device (wireless communication device, microwave oven, wireless computer tool, surgically implanted or portable RFID “spy chip”, etc) and is exposed simply by being in an irradiated zone, often outdoors. Additionally, there are places (public buildings, institutions, restaurants, etc.) where multi-frequency power absorption is unsolicited – actually, legally-speaking, in trespass of body functions. This level of average “second-hand” exposure is doubling annually in sparsely populated regions and tripling within more affluent urban zones. We can expect at 3 to 5 fold increase in second-hand exposure by 2010.

Background power emissions (0.5 MHz – 3GHz band) selected Canadian cities, 2007 microWatt/cm²

City	μ Watt/cm ²	City	μ Watt/cm ²
Windsor	0.2 - 15	Cornwall	0.3 - 5
London	0.2 - 5	Ottawa	0.1 - 25
Brantford	0.8 - 50	Montreal	0.1 - 10
Hamilton	2 - 10	St-Hyacinthe	0.1 - 4
Burlington	1 - 10	Mississauga	4.0 - 25
Oakville	1 - 15	Drummondville	0.1 - 4
Toronto	2.5 - 120	Laval	0.1 - 5
Ajax	1 - 10	St-Sauveur / Ste-Adèle	0.1 - 3
Oshawa	1 - 10	Mirabel	0.3 - 8
Trenton	0.2 - 20	Gatineau	0.1 - 5
Belleville	0.2 - 5	Renfrew	0.1 - 3
Kingston	0.3 - 5	Peterborough	0.3 - 3

What is behind the increases in second-hand and direct-use microwave exposure?

We can expect a further 3 to 5-fold Canadian general population increase in “environmental” exposure of microwave frequencies within a few years, with more wireless technologies, such as: smart water and electric power meters, intercarrier text messaging, mobile satellite radio, music downloaders, wireless e-mail, wireless video calling, social and corporate networking, mobile television, instant text, multimedia messaging, smartphones, 3G (as well as 4G available in Europe) products and services, GPS mapping. Still more leaps in exposure emerge as the plans of investors, the military and governments materialize: to have every dwelling, school, office and store in the world become a microwave transmitter/receiver for wireless computers and related linkages, and to have transceivers implanted and/or injected in our bodies, including for banking transactions. A significant factor driving cell phone sales worldwide is for telephone banking delivering monetary services to the “unbanked”. **Vodaphone** started in Kenya **Safaricom** “mobile money” banking in Swahili, attracting 175,000 subscribers signing up at a rate of 2,500 a day, even if they may need “fingertip” RFID chip authentication for their micro-lending. Although the intention was to enable loan payments, individuals have been using the phones for person-to-person transfers – in a “dial ‘M’ for money” type of culture.

There are 19 million wireless customers in Canada (pop. 32,000,000). More than 5% of households now have only a cell phone. There is a convergence in usage rates with traditional phone services. At the end of 2006, Canada had 55.1 mobile subscribers and 55.3 traditional wire line access lines per 100 inhabitants (vs: 18.7 wireless subscribers and 64.4 traditional wire line accesses in 1999). 74% of those between the ages of 18 and 34 use a cellphone for an average of 400 minutes per month. 40% of Canadians between ages 12 and 24 consider cellphones to be their main means of communication. In the United Kingdom, 90% of the youth use cellphones, many sleeping with them “on”, under their pillows. 10% of the wireless transmissions are data, a segment that is rising 50% every 3 months.

Households with only a cell phone, December 2005	
	%
Canada	4.8
N.L.	2.3
P.E.I.	3.8
N.S.	4.1
N.B.	2.4
Que.	4.8
Ont.	4.1
Man.	4.5
Sask.	2.5
Alta.	5.8
B.C.	7.1

Source: Statistics Canada, Catalogue no. [56M0001XCB](#).

Direct-use microwave exposure characteristics and lack of quality control

Microwave devices are notorious for lack of quality control during manufacturing, especially with their emission leakage characteristics. For example, at least 33% of microwave products manufactured, whether microwave ovens or wireless communications devices do not meet the **Canada Safety 6 Code**, which sets the basic limits that are not be exceeded and are given in terms of body currents either by induction, or contact with energized metallic objects, or in terms of the rate at which radiofrequency/microwave energy is absorbed in a body, averaged over a period of time across the body. Some jurisdictions worldwide have more stringent regulations than Canada, as indicated below. We can infer the rules are not being met worldwide, for lack of competence, compliance and failure to measure emissions at manufacture. Microwave devices tend to easily deteriorate with wear and tear, lack of maintenance and proper cleaning.

INTERNATIONAL Radiofrequency / Microwave EXPOSURE STANDARDS

Country	Exposure level (<i>microW/cm²</i>)
New South Wales, Australia	0.001
Salzburg, Austria (pulsed transmissions)	0.1
Russia / Bulgaria / Hungary/ Switzerland	2 –10
Belgium	3
China	7 –10
Italy / Toronto, Canada	10
Auckland, New Zealand	50
Australia	200
New Zealand / Japan / Germany/ US /Canada	200 –1,000
United Kingdom	1,000 –10,000

Toward second-hand exposure statistics

On the basis of environmental irradiation surveys, it can be deduced that, in Toronto – population of over 2,500,000, at least 25,000 individuals are being exposed by unwanted trespass of “second-hand” environmental microwave emissions - for several hours daily – that are more elevated than those permitted by **Canada Safety Code 6**, simply by working or living in high-density urban “hot-spots” and that this number can increase during periods of wet ground as a result of precipitation. This means that these individuals risk irreversible damage to their body functions merely because of the popularity and the commercialisation of the wireless technologies. While government agencies assume that such environmental emissions are merely “a fog”, actual mapping point out to a dense and active network of multiple frequencies permeating the built-up environment, often without any centralized organisation. The densest groupings of hotspots tend to be in the traditional commercial cores, the transportation nodes (interchanges, bridges, over and underpasses) to and from the city, near high-voltage power transmission lines and near buildings that house significant mainframe computers and automated functions (such as postal sorting facilities, fabricators, etc.).



“Second-hand” microwave geography in Salt Lake City, Utah
Paul M. Torrens, Geography, Arizona State University

Autism connection

It is estimated that at least 300,000 Canadian children are being exposed to, and, are absorbing, illegal levels of microwave power associated with cellphone usage alone. This number is expected to double by 2010, even though the actual total base population of children is expected to decrease. These children face severe (or life-threatening) wireless-related physical conditions. Add to this group about 300,000 in Ontario alone who suffer from some form of autism, considering that 30 years ago, there were only a few hundred cases. More than 1 child in 100 is autistic, compared with 1 in 10,000 only 30 years ago, before the pervasive environmental exposure of wireless technologies.

A study by **Tamara Mariea** and **George Carlo** indicates how microwave wireless frequency emissions render cells incapable of releasing heavy metals (including mercury and aluminum), such as those used as stabilizers in the massive vaccination programmes. Heavy metals in the body interfere with the distribution of *dopamine*, a hormone and a neurotransmitter which controls motor skills. In autistic children, such functions are inhibited. When autistic children are detoxified from heavy metals, and when they are no longer exposed to wireless emissions, they can recover. This situation has the potential for trans-generation toxic accumulation.

Microwave device (dry weather conditions)	$\mu\text{Watt}/\text{cm}^2$
Common exposure	
Cellphone @ user	9 – 3,500
Cellphone, second hand exposure	1 - 200
Microwave oven @ user	10 – 2,000
Cordless phone base station @ 2 to 6m	7 - 17
Analog in urban environment (1-2 blocks away)	5 – 25
Digital in urban environment (within 100m)	0.2 - 5
Analog in rural environment 500m	0.25 - 30
Local amplification by metal window, door frames, studs, metal plumbing, grounding wire, unfiltered telephone and Cable TV wires	1 to 4.5 fold power increase

BIOLOGICAL EFFECTS OF MICROWAVES BELOW U.S. & CANADA'S REGULATORY LIMIT

(microW/cm ²)	Reported Biological Effects	References
0.00000000000001	Altered genetic structure in <i>E. Coli</i>	Belyaev 1996
0.0000000001	Threshold of human sensitivity	Kositsky 2001
0.000000001	Altered EEG in human subjects	Bise 1978
0.0000000027	Growth stimulation in <i>Vicius fabus</i>	Brauer 1950
0.00000001	Effects on immune system in mice	Bundyuk 1994
0.00000002	Stimulation of ovulation in chickens	Kondra 1970
0.000005	Effect on cell growth in yeast	Grundler 1992
0.00001	Conditioned "avoidance" reflex in rats	Kositsky 2001
0.000027	Premature aging of pine needles	Selga 1996
0.001	100 Yards / metres from Cell Phone	
0.002	Sleep disorders, abnormal blood pressure, nervousness, weakness, fatigue, limb and joint pain, digestive problems, fewer schoolchildren promoted	Altpeter 1995, 1997
0.0027	Growth inhibition in <i>Vicius fabus</i>	Brauer 1950
0.0027 to 0.065	Smaller tree growth rings	Balodis 1996
0.007	50 Feet from a Cordless Phone	
0.01	Human sensation	Kolbun 1987
0.016	1 Mile (1.6Km) from a Cellular Tower	
0.06	Altered EEG, disturbed carbohydrate metabolism, enlarged adrenals, altered adrenal hormone levels, structural changes in liver, spleen, testes, and brain in white rats and rabbits	Dumanskij 1974
0.06	Slowing of the heart, change in EEG in rabbits	Serkyuk, reported in McRee 1980
0.05	10 Feet /3 meters from a Wireless Computer	
0.1	Increase in melatonin in cows	Stark 1997
0.1 to 1.8	Decreased life span, impaired reproduction, structural and developmental abnormalities in duckweed plants	Magone 1996
0.13	Decreased cell growth (human epithelial amnion cells)	Kwee 1997
0.168	Irreversible sterility in mice	Magras 1997
0.2 to 8.0	Childhood leukemia near transmitters	Hocking 1996
0.3	Impaired motor function, reaction time, memory and attention of school children, and altered sex ratio of children (fewer boys)	Kolodynski 1996
0.6	Change in calcium ion efflux from brain tissue	Dutta 1986
0.6	Cardiac arrhythmias and sometimes cardiac arrest (frogs)	Frey 1968
0–4	Altered white blood cell activity in schoolchildren	Chiang 1989
1.0	Headache, dizziness, irritability, fatigue, weakness, insomnia, chest pain, difficulty breathing, indigestion (humans—occupational exposure)	Simonenko 1998
1.0	Stimulation of white cells in guinea pigs	Shandala 1978
2.5	Breakdown of blood-brain barrier (used a digital cell phone to radiate) Salford	1997
5.0	Leukemia, skin melanoma and bladder cancer near TV and FM transmitter	Dolk 1997
2.0	(lower "Microwave hearing" - clicking, buzzing, chirping, hissing, or high-pitched threshold notetones known)	Frey 1963, 1969, 1971, 1973, 1988, Justeson 1979, Olsen 1980, Wieske 1963, Lin 1978
5.0	Biochemical and histological changes in liver, heart, kidney, and brain tissue	Belokrinitskiy 1982
10.0	Damaged mitochondria, nucleus of cells in hippocampus of brain	Belokrinitskiy 1982a
10.0	Impaired memory and visual reaction time in people living near transmitters	Chiang 1989
10.0	Decreased size of litter, increased number of stillborns in mice	Il'Chevich (reported in McRee 1980)
10.0	Redistribution of metals in the lungs, brain, heart, liver, kidney, muscles, spleen, bones, skin, blood	Shutenko 1981
1,000.0	United States FCC Exposure Limit, Safety Code 6 Canada limit	

Meg Sears, *Medical Perspective on Environmental Sensitivities*, Canadian Human Rights Commission, 2007.

Significant Secondary infrastructure effects

There has been a significant increase in corrosion problems in the last few decades, parallel to the spread and implementation of wireless technologies. Whereas in the 1970s, only a small number of engineers consulted on corrosion problems, now a full quarter of all engineers in North America are experts in corrosion trying to resolve problems associated with building structures, water and oil and gas pipelines, fluid containers. How radiofrequencies affect corrosion can be verified by anyone who replaces a fluorescent compact bulb into a metallic fixture that once had an incandescent bulb. It takes only a few weeks to have the onset of paint coating corroding in lamp holders, followed by the steady eating away of metallic sheeting. Likewise, one can see which urban areas are exposed to elevated levels of microwave emissions: where sewer and telephone service covers rust – actually powder away rather than just coat themselves with oxidation, where fire hydrants crumble – even if installed within the previous 6 months - that is likely to be a zone subject to denser environmental microwave emissions. Normally, such fittings last problem-free for decades. This is an effect of enormous burden to tax and rate-payers.

The **Federation of Canadian Municipalities** has made an emergency plea to the federal government for \$123 Billion within 5 years to avoid building collapses in Canadian cities due to corrosion, which only emphasizes how outrageously expensive for our civilization is this problem of accelerated corrosion from radiofrequencies and microwaves is. What is little known is that most corrosion is induced by weak voltages and amperages from net currents in our electric power delivery systems, which are imbalanced. What is even less known is that as the electric power system becomes more affected by the use of computers and wireless systems, radiofrequencies and microwaves penetrate the electric power system's ground, via neutral wires. The ground in many populated areas now carries charges that are highly electronic with radiofrequency and microwave characteristics. This new phenomenon accelerates corrosion of materials – whether pipelines, rebars in buildings and transportation infrastructure or even nuclear power plant reactor rods - by quantum leaps. Galvanic coupling between alloys and hydrogen and e particles is accelerated, leading to hydrogen-induced cracking in steels. Electromagnetically-induced Hydrogen diffusion has become so commonplace under such environmental conditions that a Russian scientist, **P. S. Orlov** proposed this year a method of locating underground corroded (hydrogen saturated/embrittled) steel gas-supply pipes simply by measuring hydrogen leakages. This conduction of charges has been observed with electrochemical impedance spectroscopy (EIS) and reported this year by scientists from **Atomic Energy of Canada** and the **National Research Council of Canada**. There is also greater spattering of deposits, crevice enhancements and oxidation reactions.

What we can expect as health effects due to these new exposures?

Experimental observations with low-level microwave exposure

Observation	Effects of microwave emissions	Exposure level
Effects on DNA	Single and double-strand breaks, electron flows within staked base pairs of double helix of DNA molecules, direct gene transcription, 40-90% increase in <i>Fos mRNA</i> from cellphone signals,	2h, 0.6W/kg, 0.001W/kg
Blood-brain barrier	Toxins may reach brain tissues: serotonin, glucose, selective permeability, allows glucose to pass	After 2 minutes, as low as 0.0004W/kg
Psychoactive Drugs	Neurotransmitter functions modified: Pentobarbital (alters narcosis), entylenetetrazol (more convulsions), Curare (less anaesthesia), Valium, Librium (potentiated). Endogenous <i>opioids</i> activated: increase in alcohol use, less of withdrawal symptoms in morphine-dependents	
Eye damage	Worsen effects.	
Behavioural changes	Major errors in judgment, vision altered; disruptive attitude (hyperactivity); memory problems, [non-lethal weapons for combat advantage]; <i>synthase</i> inhibition caused by increase in body nitric oxide production by digital (pulsed) signals	
Cognitive functions	Faster reaction time, auditory memory retrieval [mind control], difficulty in concentration, "fuzzy thinking", dizziness (indication of <i>serotonin</i> activity increase)	0.16 μ Watt/cm ²
Sleep	May promote sleep, sleepiness, reduction of REM sleep (important to memory, learning)	
Melatonin	Melatonin secretion decreases	
Fundamental life processi	ELF-encodes in wireless transmissions may imitate heartbeat, cellular communications, brainwaves, cell growth, human metabolism; sperm count lowered, irreversible infertility in mice after 5 generations from "an antenna park", chicken embryo mortality increases by half	As low as 0.005 W/kg
Dosedependency	Observed in Korean War, US embassy personnel in Moscow, cumulative effects	
Microwave syndrome	Fatigue, irritability, nausea, anorexia, depression Cardiovascular disorders, hypo /hypertension Change in skin, skin allergies, eczema, psoriasis Increase in <i>lymphocytes</i> , effects in EEGs, reduced insulin production, multiple allergies, <i>Tinnitus</i> , itches in the ear, ears feel heated	As low as 0.02 to 8.0 μ Watt/cm ²

Some, natural, highly-coherent oscillations in living beings have same or similar characteristics as those produced by wireless technologies. For example, the 2Hz-encoded signal from cellphones reporting to base stations resembles the heartbeat (and can entrain heartbeat). Other extremely-low-frequency-encoded signals resemble, and interact with, brain waves, cell growth, cell communication, calcium ion balance and other fundamental life processes, even at levels as low as 0.005W/kg.

What can be done?

In many built environments, microwave power levels are too elevated for even minimum health risk conditions.

Many health practitioners are unaware either of the general exposure conditions, not those of their patients, thus not taking under consideration their bearing of the diagnosis, nor therapy at hand. Similarly, employers may not realize that the microwave environment faced by their employees might adversely affect their job performance, occupational health and safety and productivity.

Fortunately, appropriate design and careful oversight in installation can provide citizens with acceptable, safe and generally no-risk levels of electromagnetic fields. But the implementation of these measures, even if they entail relatively no cost to the public or private purses, requires a public demand for common sense safety.

Municipal governments who participate in the siting process by issuing permits are in the frontline for complaints and legal filings because they are, legally, accomplices. The **City of Toronto** has an active guideline that provides for a Canadian platform for precedence from a health and safety legal perspective, that other communities can emulate, and eventually help industry and federal regulatory agencies, including the **Canadian Radio-Television and Telecommunications Commission** (CRTC), review their current policies and practices.

An **European Parliament** expert analysis in 2000, which was comprised of **World Health Organization**, **European Community** and scientific peers recommended that the average annual exposure near microwave emitters should not exceed $0.10 \mu\text{Watt}/\text{cm}^2$ (following the lead of the **Italian Government** notion of quality target) and that anyone exposed to higher fields should receive regular medical attention, including blood analysis, EEG and ECG tests. All zones with higher exposure rates should be posted with markings on pavement and with road signs.

In Canada, you can view your wireless transmission environment on <http://spectrum.ic.gc.ca/tafl/tafindxf.html>.

A socio-political question

Is it worthwhile to promote an industry that emerges while it hurts civilization and induces costs greater and more expensive than the “benefits” that it offers? Is the wireless industry prepared to pay for these costs?