Vancouver CoastalHealth
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Statement of the Chief Medical Health Officer

June, 2011

Health Concerns About Cellular Phone Transmission Antennae and Base Stations

In 2005, in response to community concerns and after reviewing the evidence, the Vancouver Coastal Health Chief Medical Health Officer concluded that the installation of cellular antennae in the community did not create health risks for the public, and that Health Canada's Safety Code 6 provided an appropriate level of protection. At that time, the Chief Medical Health Officer also committed to undertake periodic reviews of the evidence and to provide public updates as necessary. The Chief Medical Health Officer provides the following updated evidence review and associated conclusions:

Background on Cellular Transmission Technology

The original cellular (analog) technology uses the radiofrequency part of the electromagnetic spectrum between 800-900 MHz (near the FM/TV, AM Radio bands and cordless telephone frequencies). The newer digital technology uses the frequency bands of 800-900 MHz and 1800-2200 MHz and relies on antennae of significantly less power than the analog system, emitting significantly lower radiofrequency (RF) radiation. Cellular communication operates through a network of base stations that transmits and receives signals. The area covered by a base station is called a cell – giving rise to the name cell phone. The number of base stations (cells) in an area varies, depending on the concentration of cell phone users. For example, compared to smaller communities, the number of base stations is greater in populated urban centres, with many cell phone users. Each base station consists of signal processing equipment, power supply, and one or more antennae. The antennae are the most visible parts of base stations. However, a network of many lower powered based stations may result in lower levels of RF radiation exposure to the public compared to a network that uses a few higher powered base stations covering the same area. This is because the power required to communicate between a cell phone and base station increases as the distance between the cell phone and the base station increases.

Conclusions At A Glance

1. The international scientific consensus remains unchanged: radiation from cellular base stations is far too low to cause adverse health effects in the community.

2. There is no public health benefit from prudent avoidance regarding base stations.

3. Telecommunication regulators and the industry need to be explicitly transparent in engaging communities and providing access to monitoring data to show compliance with expected standards.

To meet the demand for service, increasing numbers of cellular base stations have been installed across the country. However, it is not easy for the public to access information on the number, types, and locations of cellular base stations in their community. This difficulty has contributed to public concerns regarding potential harm from these installations.

Health Risks

The study of RF radiation and its possible effect on health is growing steadily. Since the last report in 2005, reviews from recognized scientific organizations include the International Commission on Non-Ionizing Radiation Protection (ICNIRP) 2009 Review, the European Commission Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) 2009 Review, the Swedish Radiation Safety Authority, SSM, Independent Expert Group on Electromagnetic Fields 2009 Report, and the Health Canada Safety Code 6 revised in 2009. The scientific consensus remains unchanged: radiation from cellular base stations is far too low to cause adverse health effects in the community. The current Canadian (Safety Code 6 revised 2009) and international standards such as ICNIRP provide significant safety margins for public exposure to RF.

In Safety Code 6 (2009), Health Canada states:

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

Critics of Safety Code 6 have challenged the adequacy of the Canadian standard to protect the public from effects other than those resulting from the thermal heating of cells in the body. However, when scientifically sound methods are used to assess the evidence, Health Canada's conclusions are consistent with the conclusions reached by other credible scientific bodies. In its review of evidence in 2009, the ICNIRP states:

> *"It is the opinion of ICNIRP that the scientific literature published since the 1998 guidelines has provided no evidence of any adverse effects below the basic restrictions and does not necessitate an immediate revision of its guidance on limiting exposure to high frequency electromagnetic fields. The biological basis of such guidance remains the avoidance of adverse effects such as "work stoppage" caused by mild wholebody heat stress and/or tissue damage caused by excessive localized heating (D'Andrea et al. 2007). With regard to non-thermal interactions, it is in principle impossible to disprove their possible existence but the plausibility of the various non-thermal mechanisms that have been proposed is very low. In addition, the recent in vitro and animal genotoxicity and carcinogenicity studies are rather consistent overall and indicate that such effects are unlikely at low levels of exposure. Therefore, ICNIRP reconfirms the 1998 basic restrictions in the frequency range 100 kHz–300 GHz until further notice."*

Similarly, SCENIHR of the European Commission in its 2009 review states:

> *"It is concluded from three independent lines of evidence (epidemiological, animal and in vitro studies) that exposure to RF fields is unlikely to lead to an increase in cancer in humans. However, as the widespread duration of exposure of humans to RF fields from mobile phones is shorter than the induction time of some cancers, further studies are required to identify whether considerably longer-term (well beyond ten years) human exposure to such phones might pose some cancer risk.*
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> *Regarding non-carcinogenic outcomes, several studies were performed on subjects reporting subjective symptoms. In the previous opinion, it was concluded that scientific studies had failed to provide support for a relationship between RF exposure and self reported symptoms. Although an association between RF exposure and single symptoms was indicated in some new studies, taken together, there is a lack of consistency in the findings. Therefore, the conclusion that scientific studies have failed to provide support for an effect of RF fields on self-reported symptoms still holds. Scientific studies have indicated that a nocebo effect (an adverse non-specific effect that is caused by expectation or belief that something is harmful) may play a role in symptom formation. As in the previous opinion, there is no evidence supporting that individuals, including those attributing symptoms to RF exposure, are able to detect RF fields. There is some evidence that RF fields can influence EEG patterns and sleep in humans. However, the health relevance is uncertain and mechanistic explanation is lacking. Further investigation of these effects is needed. Other studies on functions/aspects of the nervous system, such as cognitive functions, sensory functions, structural stability, and cellular responses show no or no consistent effects. Recent studies have not shown effects from RF fields on human or animal reproduction and development. No new data have appeared that indicate any other effects on human health."*

In its 2009 Report, the Independent Expert Group of the Swedish Radiation Safety Authority SSM concludes regarding cancer and transmitters:

> *"The majority of studies on cancer among people who are exposed to RF from radio- or TV-transmitters or from mobile phone base stations have relied on too crude proxies for exposure to provide meaningful results. Indeed, only two studies, both on childhood leukaemia, have used models to assess individual exposure and both of those provide evidence against an association. One cannot conclusively exclude the possibility of an increased cancer risk in people exposed to RF from transmitters based on these results. However, these results in combination with the negative animal data and very low exposure from transmitters make it highly unlikely that living in the vicinity of a transmitter implicates an increased risk of cancer."*
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> Regarding electromagnetic hypersensitivity, the SSM expert group writes:
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> *"While the symptoms experienced by patients with perceived electromagnetic hypersensitivity are very real and some subjects suffer severely, there is no evidence that RF exposure is a causal factor. In a number of experimental provocation studies, persons who consider themselves electrically hypersensitive and healthy volunteers have been exposed to either sham or real RF fields, but symptoms have not been more prevalent during RF exposure than during sham in any of the experimental groups. Several studies have indicated a nocebo effect, i.e. an adverse effect caused by an expectation that something is harmful. Associations have been found between self-reported exposure and the outcomes, whereas no associations were seen with measured RF exposure."*

Canadian Exposure Assessments

In 1997, Health Canada conducted a survey of radiofrequency radiation from cellular base stations in and around 5 schools in Vancouver, in response to the concerns raised by nearby residents earlier that year. The measurements revealed that:

- The highest level of electromagnetic radiation from a PCS antenna (across the street) was more than 6,000 times below the Safety Code 6 levels.
- In three of the schools the levels of radiation from all PCS digital antenna were actually lower than the normal AM and FM radio signals that have been in the area for decades.

In 2003, Health Canada released the results of comprehensive ground level RF measurements representative of human exposures near base stations within the Regional Municipality of Ottawa. The highest power density measured was 3000 times below Safety Code 6. Health Canada considers these measurements as likely representative of levels in other Canadian urban areas.

In 2010, the Public Health Department of the Health and Social Services Agency of Montreal was asked to assess two cell phone base station sites located near schools in Outremont, an urban residential neighbourhood. One location has 12 antennae (130 m to 145 m away respectively from two primary schools) and the other has three (50 m from a high school). The investigation team estimated that the level of exposure to students would be over 5000 times below Safety Code 6 inside the school and over 1000 times below Safety Code 6 on school playgrounds and adjacent streets. The team also reviewed the scientific literature on the subject and concluded that:

> *"The results of numerous scientific studies conducted to date do not argue in favour for a causal relation between RF exposure and health impact at exposure commonly encountered, whether cancer or more general symptoms. Moreover, no mechanism of action of RF on cells or human and animal tissues has been shown. However, due to uncertainties still present in this area of research, health agencies recommend further studies in some promising avenues (e.g. for cell phone users). As for cellular antennae, given the very low exposure levels and research results to date, most experts believe it is unlikely that this exposure, well below the limits allowed, can cause effects on the health of the population."*

In May 2011, the International Agency for Research on Cancer (IARC) placed radio frequency electromagnetic fields in its group 2B classification – possibly carcinogenic to humans. IARC defines group 2B as a category used

> *"for agents for which there is limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals. It may also be used when there is inadequate evidence of carcinogenicity in humans but there is sufficient evidence of carcinogenicity in experimental animals. In some instances, an agent for which there is inadequate evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals together with supporting evidence from mechanistic and other relevant data may be placed in this group. An agent may be classified in this category solely on the basis of strong evidence from mechanistic and other relevant data."*

Agents in Group 2B are not proven carcinogens. Details of the IARC review is expected to be published in July 2011. In the meantime, the IARC does make it clear that the primary reason for the Group 2B classification relates to uncertainty regarding long term heavy cell phone use and certain rare brain cancer. The type of radio frequency exposure of concern is associated with using the cell phone close to the ear. As stated above, the energy of radio frequency field from cell phone base stations experienced by the general public is thousands of times lower than from a cell phone near the head. The IARC conclusion therefore does not alter the assessment for radio frequency exposure due to cell phone base stations.

"Prudent Avoidance"

The practice of "prudent avoidance" has been advocated by some in their opposition to specific location of cellular base stations in the vicinity of schools, child care centres or residential buildings. "Prudent avoidance" in these situations does not result in any increased level of protection. It would be difficult, if not impossible, to "prudently avoid" some level of exposure to RF fields in an urban setting, whether it be from AM, FM, TV or cellular phones. The Medical Health Officer concludes that scientific evidence provides no basis for recommending prudent avoidance with respect to cellular base stations. There is no public health benefit. In fact, prudent avoidance ignores the reality that the area immediately below an antenna has the lowest RF levels.

Community Consultation and Public Access to Information

Despite reassuring evidence, some members of the public remain concerned about the presence of cell phone antennae and base stations. Telecommunications regulators and industry can do a better job in providing information (particularly about base station types and locations), as well as providing meaningful opportunities for public consultation when planning base stations. Industry Canada in 2009 established public and local government consultation guidelines for permit applications for mobile phone base stations. The requirement for consultation unfortunately applies only to antennae 15 metres or higher. There are a number of practices the telecommunications regulators and industry can implement to mitigate public concerns. These include:

- Meaningful discussion with communities.
- Clear and publicly accessible supporting documents when deploying base stations.
- Greater consideration for site sharing, where possible.
- Greater consideration for sensitive location and design.
- Improved public access to information on network compliance with Safety Code 6.
- Prompt response to community enquiries about base stations.
- Periodic but systematic and comprehensive measurements of population level exposure to RF to monitor trends.

Conclusion

As has Health Canada, the Chief Medical Health Officer concludes that, in light of the current scientific understanding of the risks of RF exposures to the public, the installation of base stations and cellular antennae in the community do not pose an adverse health risk and Safety Code 6 provides an appropriate level of protection. However, public engagement by telecommunication regulators and industry concerning the installation of base stations and antennae needs improvement.

The Chief Medical Health Officer will continue to monitor new scientific knowledge in this area and will provide updates when necessary.

Chief Medical Health Officer