Summary

Origin

I am a member of the public with no interest in the issue other than as a public health concern. I am an IT consultant and landowner.

I have recently been researching what the health implications may be for WLANs (Wireless Local Area Networks / wi-fi) in schools, and in so doing have been surprised by the scientific literature on the health implications for mobile phones and EMR (Electromagnetic Radiation) in general .

The Amendment Bill

My submission is related to the amendments to section 20, specifically the proposed addition of (2) and (4). I am in support of the necessity of these amendments, and would urge that the amendment should be extended to include a specific requirement to review and address, in a precautionary manner, the growing scientific evidence for the existence of non-thermal effects of EMR.

Rationale

The current international standards for RF (Radio Frequency) EMR exposure developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP)[1] in 1998 (which Australia's ARPANSA acknowledges as the basis for its 2002 standard[2]) were specifically and exclusively designed to address the possible health effects associated with thermal effects of RF-EMR. That is, the standards are concerned solely with the possibility of EMR physically heating the body or its constituent parts, and any effects thereof (a historical review on such standards notes that "the biological endpoint on which most contemporary standards are based is disruption of food-motivated learned behavior in subject animals" – which is less than reassuring with regard to the possibility of a host of long term cellular-level effects which may not manifest as changes in behavior[3]). Many scientists are claiming that of equal concern are the non-thermal (or "biological") effects which have been identified but not fully understood – the effects of EMR on the body which do not involve heat. While ICNIRP has acknowledged that non-thermal effects have found their way into the scientific research agenda, it states that because no plausible explanation has been made for *how* such effects would exist, they don't acknowledge biological effects as a risk.[4]

This is a demonstration of the "trouble" with scientific consensus in regard to public health concerns; it often takes a long time for consensus to be established since science is a philosophically positivistic endeavour, demanding a high degree of proof, while in today's world the potential risks are rolled out at large, while science slowly catches up and regulators and policy makers are several steps further behind again. Policy makers may be left to 'buck the trend' and act with a genuinely precautionary approach rather than waiting for science to know *how* something occurs.

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[1] http://www.icnirp.de/documents/emfgdl.pdf
[2] http://www.arpansa.gov.au/pubs/rps/rps3.pdf
[3] Osepchuk JM, Petersen, RC. 2003. Historical Review of RF Exposure Standards and the International Committee on Electromagnetic Safety (ICES), Bioelectromagnetics Supplement 6:S7-S16.
[4] http://www.icnirp.de/documents/StatementEMF.pdf

A timeline of some selected events and studies demonstrates this trend in respect to research around EMR.

Selected timeline

With regard to the studies cited here, this is obviously by no means an exhaustive list of studies – a search on the PubMed database alone, on just one phrase ("mobile phone radiation") returns around a thousand results of varying degrees of relevance.

- 1998: ICNIRP establishes RF exposure standards (which, though having been reviewed since, have not changed since 1998)
  http://www.icnirp.de/documents/emfgdl.pdf

- 1999: Dr Neil Cherry (later to be awarded ONZM[5]) of Lincoln University was invited by the Ministry of Health/Ministry for the Environment to carry out a peer-review of the proposal to adopt the ICNIRP guidelines for cell sites in New Zealand. According to the review, "this review shows that the assessment had ignored all published studies showing chromosome damage. It was highly selective, biased and very dismissive of the genotoxic evidence and the epidemiological evidence of cancer effects and reproductive effects. The assessment gives the strong impression of being predetermined in the belief that the only effects were from high exposures that cause electric shocks and acute exposures that cause tissue heating."
  http://hdl.handle.net/10182/3933

- In 2000, the Stewart Report (UK) announcement stated that "there is now some preliminary scientific evidence that exposures to radiofrequency (RF) radiation may cause subtle effects on biological functions, including those of the brain. This does not necessarily mean that health is affected but it is not possible to say that exposure to RF radiation, even at levels below national guidelines, is totally without potential adverse health effects", while at the same time concluding that "the balance of evidence to date does not suggest that emissions from mobile phones and base stations put the health of the UK population at risk".
  http://www.iegmp.org.uk/report/announcement.htm

- In June 2001, WHO's International Agency for Research on Cancer (IARC) classifies Extremely Low Frequency Magnetic Fields (ELF-MF) as a possible human carcinogen (while ELF-MF is a different beast to RF, they are each on the EMR spectrum, both are subject to emerging research, and the trend from "possible risk" toward approaching an established "consensus of risk" seems similar)
  https://apps.who.int/inf-fs/en/fact263.html

- As an example on ELF-MF, a study published in 2003 finds "Intermittent extremely low frequency electromagnetic fields cause DNA damage in a dose-dependent way", stating "Effects occurred at a magnetic flux density as low as 35 mu T, being well below proposed International Commission of Non-Ionising Radiation Protection (ICNIRP) guidelines. The induced DNA damage

[5] New Zealand Order of Merit in 2002. http://www.dpmc.govt.nz/node/385

is not based on thermal effects and arouses concern about environmental threshold limit values for ELF exposure" (emphasis mine). http://www.ncbi.nlm.nih.gov/pubmed/12802592

- A 2003 study demonstrates neurone damage in rats exposed to mobile phone radiation. http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info%3Adoi%2F10.1289%2Fehp.6039

- A 2005 study finds "2.45 GHz radiofrequency fields alter gene expression in cultured human cells", stating "We used the pulsed RF fields at a frequency of 2.45 GHz that is commonly used in telecommunication to expose cultured human HL-60 cells… these results indicate that the RF fields at 2.45 GHz can alter gene expression in cultured human cells through non-thermal mechanism" (emphasis mine) This frequency is well above mobile phone frequency (it is standard wireless/wi-fi frequency), but within the range covered by the current RF standards which encompass mobile phones.
http://www.ncbi.nlm.nih.gov/pubmed/16107253

- A 2007 paper on work done at Lund University Faculty of Medicine, Sweden, states "Since 1988 our group has studied the effects upon the mammalian blood-brain barrier (BBB) by non-thermal radio frequency electromagnetic fields (RF-EMF). These have been revealed to cause significantly increased leakage of albumin through the BBB of exposed rats as compared to non-exposed animals—in a total series of about two thousand animals. One remarkable observation is the fact that the lowest energy levels give rise to the most pronounced albumin leakage." (emphases mine)
http://www.springerlink.com/content/81612n327545835v/

- A study in the same 2007 volume as the last point refers again to this group's work, and notes "our group has examined the effects of radiofrequency electromagnetic fields (RF-EMF), including pulse-modulated waves of the type emitted by mobile phones, upon the blood–brain barrier. In more than 2,000 rats, we have repeatedly demonstrated a passage of the rats' own albumin from the blood through the brain capillaries into the surrounding brain parenchyma at SAR values down to 0.1mW/kg" (emphasis mine). Note that the Australian regulatory limit is currently 80mW/kg for whole body exposure in that frequency range, and 2000mW/kg for peak in the head and torso – orders of magnitude above the levels cited as inducing the adverse effects studied.
http://www.springerlink.com/content/p704837103452638/

- The "BioInitiative Report", 2007, is published. A group of concerned professionals (employed in various fields – practical and academic – such as oncology, physiology, bioengineering, environmental health) self-publish a 600 page review of scientific literature demonstrating effects that are currently not acknowledged by ICNIRP standards, calling for an overhaul of a variety of standards.
http://www.bioinitiative.org/freeaccess/participants/index.htm

- 2008, Australian Centre for Radiofrequency Bioeffects Research (ACRBR) publishes its position statement on the BioInitiative Report. It notes that the authors do not represent an

authoritative international body, the report is of questionable scientific status since it was not peer reviewed (despite being a review of peer-reviewed literature), and concludes that it does not progress science.
http://www.acrbr.org.au/FAQ/ACRBR%20Bioinitiative%20Report%2018%20Dec%202008.pdf

- A 2008 study finds "Available epidemiological evidence suggests an association between occupational exposure to ELF-EMF and AD [Alzheimer Disease]" – again this refers to extremely low frequency EMF rather than mobile phone frequency radiation, but once again it represents a growing body of EMR risk evidence.
http://www.ncbi.nlm.nih.gov/pubmed/18245151

- Back to mobile phone frequency, a 2009 study finds "Continuous exposure to 900MHz GSM-modulated EMF alters morphological maturation of neural cells", stating that their experimental "system allows cells to be exposed at SAR value lower than that at which thermal effects may occur" (emphasis mine)
http://www.ncbi.nlm.nih.gov/pubmed/19429115

- Also in 2009, ICNIRP issues a statement that the scientific literature since the publication of their 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 whole-body 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."
http://www.icnirp.de/documents/StatementEMF.pdf

- 2010, Interphone Study published. Conclusion "Overall, no increase in risk of glioma or meningioma was observed with use of mobile phones. There were suggestions of an increased risk of glioma at the highest exposure levels, but biases and error prevent a causal interpretation." This muted conclusion is despite results such as "the OR [odds ratio] for ipsilateral use in the highest category was appreciably elevated (OR 1.96, 95% CI 1.22–3.16)" – appreciably increased risk of glioma on the same side as a mobile phone is held in heavy use – and "for cumulative number of calls, there was a consistent trend towards increasing ratios with increasing exposure."
http://ije.oxfordjournals.org/content/39/3/675.abstract?sid=0e944b8b-5561-49dc-8c95-38ade31c5bb5

- 2010, ICNIRP publishes a note on the Interphone study. It effectively discounts every finding (those that suggest a link between mobiles and cancer, and those that actually suggest a protective effect) on the basis of methodological flaws, but introduces the findings with "overall, the study did not find an increase in the risks of glioma or meningioma in relation to mobile phone use", and ends with "biases and errors in the study preclude a causal interpretation of the results."
http://www.icnirp.de/documents/ICNIRPnote.pdf

- 2010, the "Seletun Scientific Panel" – following on from the work of the BioInitiative Report – issues a "consensus statement" in 2009 with similar aims, content from which is published in the journal *Reviews on Environmental Health*.
  www.ncbi.nlm.nih.gov/pubmed/21268443

- In 2011, WHO's IARC classes radio frequency (i.e. including mobile phones) electromagnetic fields as a possible human carcinogen.
  www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

- In response to WHO's classification of RF-EMF as a possible human carcinogen (a 2B classification which includes substances ranging from DDT and petrol engine exhaust to coffee and pickled vegetables), ICNIRP issues a 2011 statement with a somewhat 'challenging' tone: "ICNIRP awaits with interest the full Monograph that explains the justification and arguments put forward by IARC in arriving at this conclusion"
  http://www.icnirp.de/documents/ICNIRP_IARCclassificationRF.pdf

- As at the time of writing this submission, the Monograph in question is still listed on the IARC website as "in prep".
  http://monographs.iarc.fr/ENG/Classification/ClassificationsGroupOrder.pdf

- 2011, the WHO fact sheet on mobile phones states that "tissue heating is the principal mechanism of interaction between radiofrequency energy and the human body."
  http://www.who.int/mediacentre/factsheets/fs193/en/index.html

- February 2012, Israeli Parliament passes the first of three readings of a new bill which would require all mobile phones sold in Israel to carry a health hazard label, and to pose restrictions on advertising to minors.
  http://www.knesset.gov.il/spokesman/heb/Result.asp?HodID=9871 (in Hebrew, translation below)

  Translation of the above page:
  http://translate.google.com/translate?hl=en&sl=iw&tl=en&u=http%3A%2F%2Fwww.knesset.gov.il%2Fspokesman%2Fheb%2FPrintResult.asp%3FHodId%3D9871

  News report:
  http://www.haaretz.com/business/knesset-backs-bill-requiring-cell-phones-to-bear-health-hazard-warning-1.415677

Discussion

The ICNIRP note on the Interphone study is interesting, and perhaps representative, in its approach. The study suggested a protective effect against brain tumours with regular use, but an increased risk with high cumulative use. Both these findings were dismissed as unlikely, and probably due to methodological errors. While science is a rational undertaking upon which our critical faculties must be brought to bear where such irregularities are seen, it must be noted that groups such as the BioInitiatve working group appear to be more open to a genuinely scientific admission of "we just don't know".

ICNIRP seems inclined to dismiss elements of the study that don't fit with a preconceived model of how data "should" behave (both ICNIRP and the study's authors declare that since a protective effect is unlikely, some other explanation should be sought for the data that showed it was, and ICNIRP is not comfortable that the high use risks shown appear to be an isolated result – the next nearest classification of use showed no such trend – so considers that an aberration). If, as studies appear to be increasingly demonstrating, the non-thermal effects of EMR are abundant and little understood, demanding simple dose-response relationships and specific aetiology before science considers something 'likely', could be a gross error.

Similarly, ACRBR's (and others') assessment of the BioInitiative report tackles its credentials as a scientific study, focusing on what it is not rather than what it is. Dismissing it as not progressing science is arguably valid, since it is apparently intended to be a position statement from a group of concerned professionals (albeit mostly scientists and researchers) - a public health document focusing on the risks of the technologies communities are being swamped with, rather than a document that weighs up every study for and against. But the fact of its existence should give pause; that fourteen individuals from various backgrounds would make the effort to produce a 600-page document, potentially compromising their presumably gainful employment[6], risking the character assassinations that could well ensure, to make their concerns public, is more than a little food for thought. The "International EMF Alliance", custodians of the report, now publically lists the support of some 40 odd international life science/health experts.[7]

The idea that EMR could cause unpredictable results on the human body, a system which is regulated by a very complex and incompletely stood system of controls, many of which are chemical and induce their own electrical currents, should not be surprising. Taken with findings that demonstrate links between EMR (including, specifically, mobile phone frequency radiation) and adverse affects on different biochemical systems in the body, this notion is not implausible. Add to that studies which show effects well below the intensities where thermal effects occur, and indeed some suggestions of an *inversely proportional* relationship between the intensity of radiation and its effects, and we should be open to the possibility that there are things happening that we as yet simply don't understand.

This is not a tenable position upon which scientists can claim a scientific consensus, especially in medically-related fields, which seek to isolate specific causes and effects before something is scientifically "known". From a public health perspective, however, this position warrants an approach that does more than give in-principle lip service to precautionary principles, and that *actively* limits the possibility of inflicting such effects on the public.

[6] See http://www.bioinitiative.org/freeaccess/participants/index.htm for a list of participants
[7] http://international-emf-alliance.org/index.php/the-alliance/supporting-life-scientists