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Comment Submission
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Subject: NOI # 53, 66 - non-thermal biological effects of rf radiation exposure and recommendations for proper risk assessment.

Comment:

The regulatory approach to ionizing radiation relies on a precautionary approach, while that applied to non-ionizing radiation does not.

Introduction

Both authors work as head Radiation Protection Advisors for two of Australia's leading universities. This submission is a shared opinion of the authors and in no way represents the current opinion of the institutions we advise.

Our work extends from ensuring safe operations of cyclotrons and other ionising radiation devices to advising on the location of placement of non-ionizing radiation communication equipment and medical diagnostic radiation, as well as ensuring that laboratory uses of radioactive tracers comply with appropriate state, federal and international rules and regulations. We have been perplexed by the disunity in application of the precautionary principle and ALARA (As Low as Reasonably Achievable) which are the basis for standards when it comes to ionizing radiation, as illustrated below, and the failure to incorporate this basic public health concept into approaches taken to non-ionizing radiation.

We have, for the last year, put a concerted effort into the risk assessment of non-ionising radiation present within many areas of our universities. In conducting this work, we have first tried to determine what and where are the principle sources of non-ionizing radiation in our universities today. It appears that mobile towers and wireless network antenna access points, wireless routers, and devices marketed to boost wireless signal strength and improve call quality, are the major sources of non-ionizing radiation on the university today. Due to the ubiquitous nature of wireless communication devices, we are increasingly being surrounded by an ever rising background of imperceptible non-ionizing radiation energy. As the popularity of cell phones and tablets has been exponential in less than a decade, so has the growth in wireless access points and associated devices to keep those devices on line.

At present within the Radiation Protection community there is great debate as to whether the current standards as presented by the International Commission on Non-Ionising Radiation Protection (ICNIRP), adequately address the biological impacts of the growing abundance of non-ionizing radiation energy fields. The ICNIRP advice is based solely on controlling any possible change in temperature in tissue associated with non-ionizing radiations and does not see the need address

possible non-thermal effects that have been reported in the literature. This has lead to a disjoined response to regulators as shown in Table 1.

Based on our ongoing survey of current exposures throughout the university campuses for which we are responsible and the compilation of our own local findings and advice, we are implementing lower limits driven by the precautionary principle to ensure suitable prudent avoidance of potential staff risks due to these energy fields.

Table 1. Variation in Power Density RF exposure limits at 2110 MHz

Country or Organization	Advisory	Thermal	Non-Thermal	Regulatory	Power Density mW/m^2
ICNIRP Most countries Including US, Australia & NZ.	Yes	Yes			9,500
Italy			Yes	Yes	95
Russia China & Poland			Yes	Yes	100
Switzerland			Yes	Yes	95
Salzburg (non-pulsed signals)	Yes		Yes		100
Salzburg (pulsed signal)	Yes		Yes		1
Bio-Initiative Working Group	Yes		Yes		1

Ionizing radiation

Firstly, let's look at the way industry set limits when we are dealing with ionizing radiation. Industry have more than a century of experience with various forms of ionizing radiation starting foremost with medical and industrial uses of x-rays and radioactive Isotopes. We know the value of keeping exposures as low as is practicable.

.As a result, exposure limits can sometimes set on the basis of

- epidemiological evidence;
- experience with human exposures (intentional and accidental);
- laboratory animal experiments and
- mathematical modelling.

Since Second World War (WWII) we have changed annual dose limits and revised dose limits as new information has come to light. For example detriment adjusted probability coefficients for hereditary disease up to the second generation was 0.2 x 10^{-2} Sv^{-1} after the WWII and revised in 1962 from 1.3 x10^{-2} Sv^{-1}. This risk factor was relaxed by almost an order of magnitude following studies of the Japanese bomb survivors. So post WWII the limiting risk factor was the genetic risk factor and not the somatic risk. By the 1970s cancer incidence data began to show that somatic risk from ionizing radiation was far more prevalent than the germ line or inherited risk. As

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a result of these new data, the approach to setting standards was reversed, once the epidemiology had been done.

The scientific community of which the medical profession is part of took a much more conservative approach when using X-rays to diagnose problems when treating pregnant women post WWII. The caution displayed by the medical profession in using obstetrical X-rays was one of the driving forces behind the development of obstetrical ultrasound technology. This new ultrasound technology was quick to point out the lack of radiation risks when diagnosing a problem in early pregnancy. Regulatory limits and risk factors do and can drive changes in innovation.

In the case of radon daughter exposure we have the epidemiology (not perfect) from the lung cancer studies amongst uranium miners has provided some relative dose and response data. This lung modelling has been used to review limits for the radon daughter lung modelling which show a factor of 2 higher risk than the epidemiological studies. The international community is continually using various new tools like mathematical modelling to understand lung dose exposure and these findings inform regulators of the most conservative approach.

On the regulatory front since the era of WWII the authority that sets the radiation dose limits has been detached from the industry that promotes nuclear energy. In the 1960's the US started to move the regulation of the atomic energy industry away from the US Atomic Energy Commission and in 1974 split the authority into Energy Research and Development Administration (prompting agency) and the US Nuclear Regulatory Commission (regulatory agency). This was intended to remove any conflict in interest. Other world Governments followed the US lead. So for ionizing radiation we have always had a precautionary approach in setting limits and a regulatory advisory group set up that is quite distinct from the industry for which it makes recommendations. .

It should not be said that the precautionary approach is not only about lowering exposure but it's also about setting limits. When we apply the precautionary approach to ionizing radiation it is both the lowering of exposure and regulatory limits. Setting lower annual ionizing radiation dose limits are used to change behaviour.

Non-ionizing radiations

So how then do we go about limiting exposure with non-Ionising radiation? Should we forget the lessons of the past and continue with a lip service only precautionary principle?

The aim of our government should be to foster a healthier community, ensuring longevity of the work force and a reduction in the burden of the healthcare system.

The exposure can be addressed with a threefold approach

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- Educating the end user
- Enforcing more stringent and restrictive transmission limits
- Promoting technological innovation in software and hardware that will reduce absorbed radiation by end-users

Now let's look at the way we set radiation safety limits as it applies to RF radiation and in particular mobile phone frequencies. We acknowledge that measuring microwave radiation accurately is not easy as introducing the instrument into the field

perturbs the fields you are trying to measure. However, we can focus on the range of measurements and use the maximum readings as our guide to setting reference limits.

When we started to review the literature on the setting of EMF reference limits, we constructed Table 1 on the current regulatory limits of different countries.

The RF safety standards for members of the public vary by four orders of magnitude (9,500 to 1) in different countries as shown in Table 1 for the 3G radiofrequency of 2110 MHz. The difference in standards in various countries is a result of applying a precautionary approach in setting these standards, which takes into account the effects that are mainly non- thermal biological effects. The variation in member of the public standards shown in Table 1 is essentially disagreement over the validity and importance of non-thermal biological effects. The EMF Project of the WHO & ICNIRP contend that their current RF exposure limits do in fact take into account non-thermal effects. But close examination of their arguments shows that the ICNIRP approach is in fact biased against considering the need to avoid non-thermal biological effects.

On closer examination it's our belief the organizations like the EMF Project of the WHO and ICNIRP are heavy influenced by the telecommunications industry. There is limited evidence that, these advisory groups and are not acting to lower radiation exposure consistent with the precautionary approach and they are not taking steps to promote changes in behaviour that would result in risk reduction through exposure reduction. Hence, as shown in Table 1 different governments are going it alone and ignoring the advice of international organisations such as the WHO and ICNIRP.

In order to improve the social capacity to reduce risks, it is important to separate the function of technology promoter (Telecommunication Industry) from that of technology regulator.

Wireless technology is here to stay; it pervades our life but it should not be marketed as risk-free. Mobile phones are not toys to be marketed to children. On the Australian home page of our promoter/regulator of these technologies the ACMA (http://www.acma.gov.au/) displays the following pictures of children with phones close to the body and a farmer with the phone glued to his ear. This clearly shows the industry has scant regard for the hazards. The telecommunication industry now plans to extend its mobile phone reach into the community offering what are billed as "kid friendly" mobile plans—intended to expand the regular use of phones by young children.

We need to change behaviour to promote practices that result in reduced exposures to microwave radiation from cell phones and other wireless devices, in light of growing scientific concerns about the impact such radiation may have on the developing brain and body. One way to promote such behavioural change is to change both hardware and software in the technology.

One such solution could be; the phone with antennas can be made separate to the device you talk into like current low power blue tooth technology. Technology that allows the user to leave the mobile phone in a bag or case, increasing the users distance from the mobile antenna, and the device closest to the user communicating with the phone is a very low power device. Remember, in all matters radiation to lower exposure time and distance are your friend in lowering overall radiation dose. With lower limits and stricter standards manufacturers will change their design and

like ultra sound technology in the ionizing radiations might see that lowering external radiation exposure to these RF emitting devices as a marketing strategy.

About the Authors

Mr Victor Leach

I have worked as a Radiation Health Physicist in Australia since 1972. I worked in a regulatory role and also in a research role in the Australian Radiation Laboratory (now ARPANSA) and later in the uranium mining industry so my focus has been with radiation safety associated with ionizing radiation. For the last 6 years I took up new role as University Radiation Safety Officer. In this role I was asked to review the installation of mobile phone towers on the top of university buildings. In my review of the regulations associated with the installation of these mobile phone towers I started to feel uneasy about the way the RF reference levels had been set and the overwhelming involvement of the Telecommunications industry in setting these limits. I was reviewing the setting of these RF radiation reference levels from the perspective of the setting of ionizing radiation limits and alarm-bells started to ring out given the gross inconsistencies in approaches taken to these two different forms of radiation..

Mr Simon Turner

I have been advising in radiation protection since 2002 at ANSTO (Australian Nuclear Science and Technology Organisation). I was involved in the commissioning of cyclotrons, a reactor and the decommissioning of two others. Performing as team leader for operational Health Physics officers providing radiological advice to medical isotope production facilities and research groups. Previously, a member of the IAEA Response and Assistance Network(RANET) and have been involved with many projects rehabilitating contaminated land areas. I have been training staff and industry clients in ionising radiation protection since 2005. In 2012 I moved from ANSTO to my current role, University radiation safety officer, continuing as a health physicist. In this role I was asked to complete a review on the Electro Magnetic Fields that staff and students are subjected due to current, and proposed, wireless and telecommunication infrastructure. The primitive and slanted nature of setting non-ionising standards by deterministic effects, without a precautionary principle or understanding of potential stochastic effects, seems contrary to well-established safety principles and is a cause for concern.