ICNIRP
INTERNATIONAL COMMISSION ON NON-IONIZING RADIATION PROTECTION

Public Consultation Template - ICNIRP Draft RF Guidelines, Appendix A, Appendix B

Comments to be uploaded until 9.10.2018

Dear Contributor,

Thank you for participating in the public consultation of the ICNIRP draft guidelines.
Please note that it is important that ICNIRP understands exactly the points that you are making. To facilitate our task and avoid misunderstandings, please:

- be concise
- be precise
- provide supporting evidence (reference to publication, etc.) if available and helpful.

How to complete the comments table:

Please use 1 row per comment. If required, please add extra rows to the table.
This response document asks you to provide your 'comment', your 'proposed change', and the 'context' to this comment and proposed change. What is meant by these is the following:

Comment : A brief statement describing the issue that you have identified (and that you would like ICNIRP to take into account in the final version of the guidelines).

Proposed Change: A brief statement describing how you would like the document changed to account for this issue.

Context: A brief statement identifying relevant documents in support of your comment and proposed change.

Please, provide your details below as per the online form and the provision of the privacy policy

Last name, first name: WELLER, Steven	Email address:	Affiliation (if relevant): Oceania Radiofrequency Scientific Advisory Association
If you are providing these comments officially **on behalf** of an organization/company, please name this here: Oceania Radiofrequency Scientific Advisory Association		
☒ I hereby agree that, for the purpose of transparency, **my identity (last and first names, affiliation and organization where relevant) will be displayed** on the ICNIRP website after the consultation phase along with my comments. ☐ I want my comments to be displayed anonymously.		

	Document (Guidelines, App A, App B)	Line Number #	Type of comment (General/ Technical/ Editorial)	Comment. Proposed change. Context.
1	Guidelines	All	General	Overall, the draft RF Guidelines rely heavily on a limited field of physics and mostly ignore biology. ICNIRP is still maintaining (incorrectly) that only thermal effects are harmful. This approach supposes that the field of classical thermodynamics is the only field of science that is relevant to understanding the effects of microwave radiation on humans, animals and plants, and that no other area of science has a valuable persepctive or important evidence to contribute. This approach completely ignores the significant vast body of emperical evidence from well conducted *in vivo* and *in vitro* experiements that find significant biological effects with health implications, which occur in the absence of heating. Approximately 70% of the RF peer reviewed research evaluated and categorsied in the Oceania Radiofrequency Scientific Advisory Association's (ORSAA) database show statistically significant biological effects, with the clear majority of these bio-effects occuring at non thermal exposure levels (Leach and Weller, 2017; Leach, Weller, and Redmane, 2018). Many of the biological effects are most definitely linked to potential harm and include: • Oxidative stress • DNA damage • Altered voltage-gated ion channels • Cell damage/disrucption to basic functions (i.e. macromolecular damage, altered gene expression, altered protein confromation • Blood Brain Barrier (BBB) breaches • Circadian/ultraradian rhythm disruption • Increased inflammation • Neoplasia/cancer/tumours • Neurodegeneration These effects are detailed in the screenshot of the ORSAA database summary page, generated by using a filter applied to peer reviewed scientific papers specifically covering microwave frequencies, comprising approximately 2000 papers (see table on page 3 below). Oxidative stress is a significant outcome in close to 90% of papers which have investigated this endpoint (Bandara & Weller, 2017). It should also be noted that the assays used to verify oxidative stress/free radical production provide direct evidence of oxidative damge to cellular constitutents and include: • Lipid Peroxidation of fatty acid moieties of cell membranes and other biological tissue components • DNA Base Damage - oxidative DNA damage plays crucial roles in the pathogenesis of numerous diseases including cancer (Guo, Wang & Yu, et. al, 2016). • Protein Oxidation

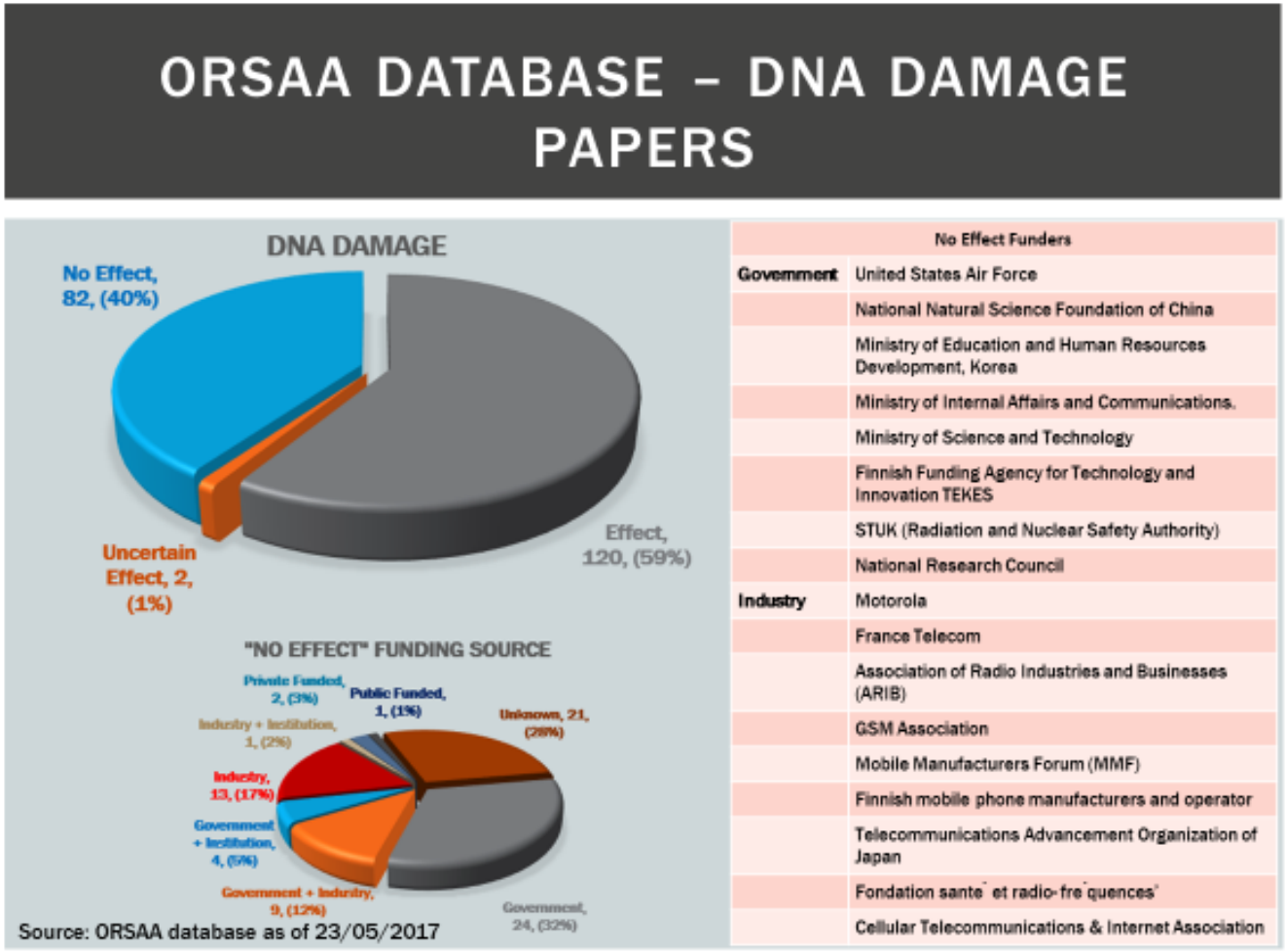
				Reactive Oxygen Species have the capacity to damage DNA directly and may explain why a significant number of studies looking at the genotioxic potential of RF exposure find direct evidence of increased DNA damage from RF exposure (Ruediger, 2009).

Find Search Summary Totals

Peer Reviewed Studies Showing Biological Effects — Number of records used : 2013 of 3226

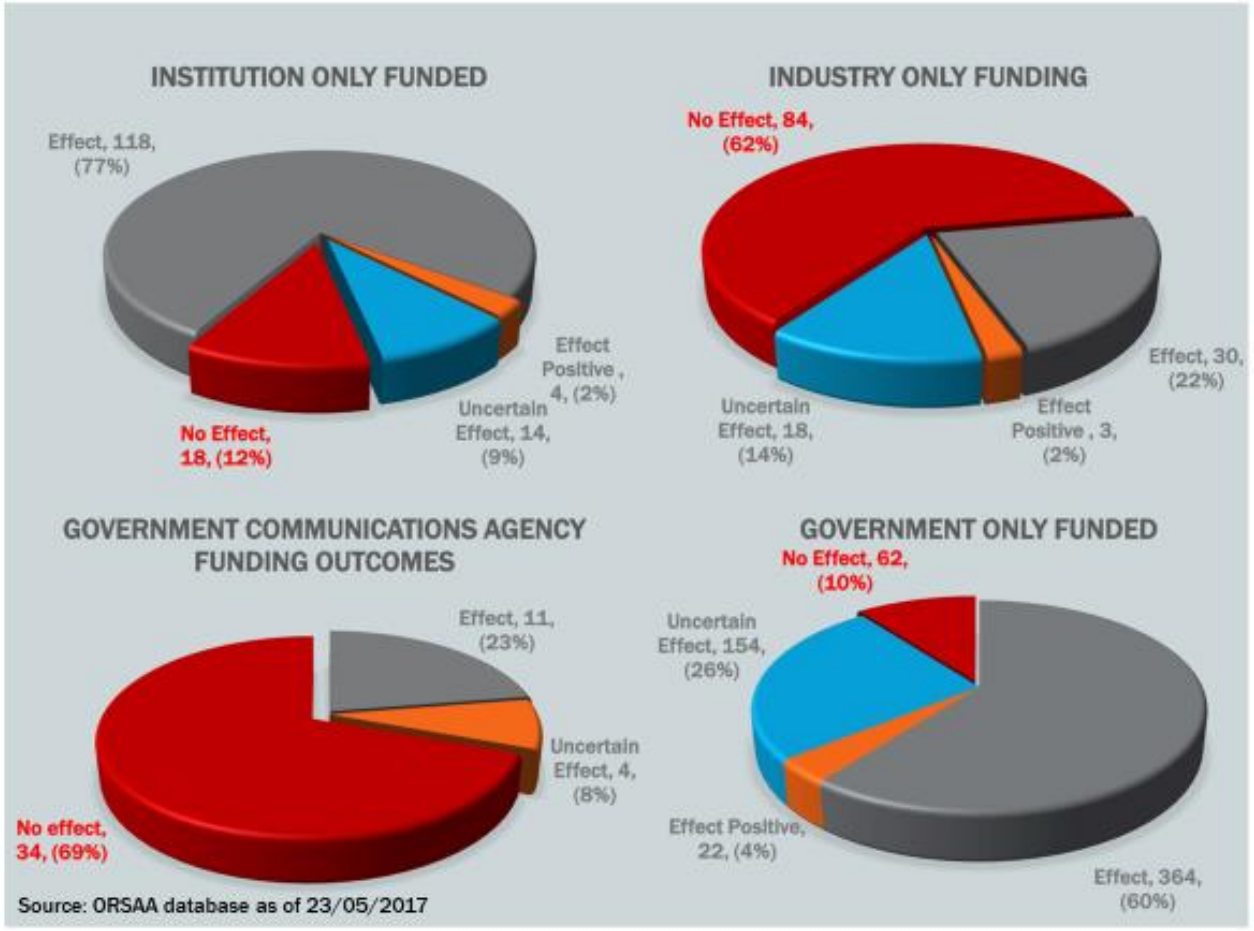
Auditory Dysfunction / Hearing loss / Tinnitus	36	Apoptosis (Programmed Cell Death)	93	Brain Tumours	47
Blood Brain Barrier Permeability Changes	15	Breast Cancer	6	Cellular Stress	58
Brain Development / Neuro Degeneration	48	Biochemical Changes	311	EEG changes / Brain Waves	102
Neuro Behavioural Effect / Cognitive Effects	175	Cell Irregularities/ Damage/ Morphological Changes	180	Effects on Mitochondria	36
Calcium Influx / Efflux	18	Fatigue	34	Altered Enzyme Activity / Protein Levels / Protein Damage	344
Circadian Rhythm Disruption	14	Altered Gene Expression	141	Headaches/Migraines	58
DNA Damage / Mutagenic / Genotoxic	144	Altered Glucose Level / Glucose Metabolism	20	Inflammation	23
Endocrine / Hormone Effects	62	Cardiovascular/Vascular Effects	57	Hepatic Effects (Liver)	20
Miscarriage / Spontaneous Abortion / Foetus Resorption	2	Immune System Effects	62	Impaired / Reduced Healing/ Bone Density Changes	5
Memory Impairment	53	Oxidative Stress / ROS/ Free Radicals	232	Speech Impairment	4
Sperm /Testicular Effects	87	Sleep Effects	54	Haematological Effects	47
Tumour Promotion	34	Neurotransmitter Effects	31	Synergistic/Combinative Effects	51
Thyroid Effects	14	Visual Disturbances/ Ocular Effects	39	Autism	8
Leukemia	5	Parotid Gland Malignancy	4	Neoplasis/ Hyperplasia (Abnormal Tissue Growth)	5
Depression	22	Induced Adaptive Response	48	Dizziness / Vertigo / Vestibular Effects	22

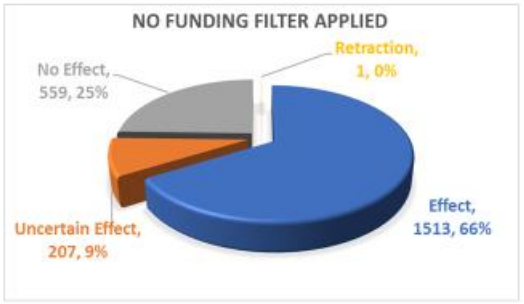
May have a role in disease pathway/ well-being — A known cause in disease — Continue

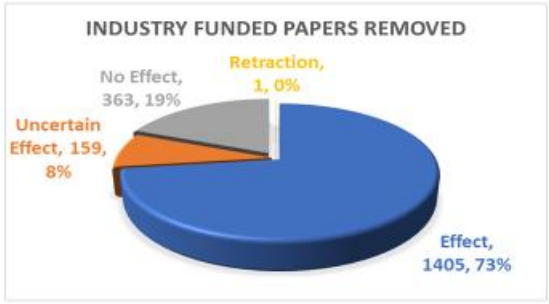


No Effect Funders	
Government	United States Air Force
	National Natural Science Foundation of China
	Ministry of Education and Human Resources Development, Korea
	Ministry of Internal Affairs and Communications.
	Ministry of Science and Technology
	Finnish Funding Agency for Technology and Innovation TEKES
	STUK (Radiation and Nuclear Safety Authority)
	National Research Council
Industry	Motorola
	France Telecom
	Association of Radio Industries and Businesses (ARIB)
	GSM Association
	Mobile Manufacturers Forum (MMF)
	Finnish mobile phone manufacturers and operator
	Telecommunications Advancement Organization of Japan
	Fondation sante et radio-frequences
	Cellular Telecommunications & Internet Association

It is very important when performing a systematic review that one takes into consideration the source of funding for both “effect“ and “no effect“ papers. ORSAA’s data analysis has revealed that for many bio-effect endpoints that “no effect“ outcomes are predominantly associated with funding from industry, government communication regulatory authorities and the military. In contrast, institutional funded research is predominantly finding statistically significant biological effects as shown below. Our findings further support previously published evidence of funding bias in RF health research (Huss et al 2007).

				 INSTITUTION ONLY FUNDED Effect, 118, (77%) Effect Positive , 4, (2%) Uncertain Effect, 14, (9%) No Effect, 18, (12%) INDUSTRY ONLY FUNDING No Effect, 84, (62%) Effect, 30, (22%) Uncertain Effect, 18, (14%) Effect Positive , 3, (2%) GOVERNMENT COMMUNICATIONS AGENCY FUNDING OUTCOMES Effect, 11, (23%) Uncertain Effect, 4, (8%) No effect, 34, (69%) GOVERNMENT ONLY FUNDED No Effect, 62, (10%) Uncertain Effect, 154, (26%) Effect Positive, 22, (4%) Effect, 364, (60%) Source: ORSAA database as of 23/05/2017





Altogether, the categorised research from the ORSAA database presented above speaks loudly and clearly. The thermal-effects only paradigm is outdated and unwarranted.

In order to pursue the evidence in a scientific manner, ORSAA recommends that ICNIRP conduct a thorough investigation of the scientific evidence, by engaging with truly independent scientists who are neither connected to, nor manitain close relations with, industry, military or government agencies. ICNIRP should also include scientists in its membership who have diverse expertise and view points rather that the current “echo chamber“ as discussed by Professor Dariusz Leszczynski in his presentation https://betweenrockandhardplace.files.wordpress.com/2017/02/leszczynski-reykjavik-lecture-feb-2017.pdf

It is also vitally important to include a large range of diverse expertise in the review process, most importantly and including but not limited to biomedical experts such as toxicologists, biochemists, physiologists, microbiologists,as well as medical experts such as neurologists, endocrinologists, immunologists, oncologists, and cardiologists, because RF has the capability to affect all tissue types and organs that make up an organism as well as cellular processes and metabolic pathways. It is only when we have all these specialist qualifications looking at the research collectively can we begin to improve our understanding.

It is concerning that ICNIRP‘s membership does not include any scientists from countries that have scientific, yet more biologically protective RF standards e.g., Russia and China. Some of ICNIRP‘s members have clear relationships with the power industry (EPRI), telecommunications companies (MMF, GSM Association UK, French Telecom, Nokia etc.) and military. Therfore, conflicts of interest cannot be ruled out. Confirmation bias is obvious, particularly in reference to sensitive individuals who are suggested to be suffering nocebo effects based on flawed and poorly conducted provocation studies (for further detail refer to response to Appendix B).

				Another cause for concern is that the draft guidelines appear to neglect the possible consequences to the wider environment, with no regard for effects on insects, birds or plants. Wildlife are not trained in radiation protection nor do they recongnize unsafe zones that may be fenced off to keep humans out because radiation levels may exceed limits e.g. areas directly in front of a cell tower transmitter. ORSAA submits that ICNIRP, in order to fulfill its international obligations to humanity and the greater environment, needs to address the limitations and concerns raised above. References Bandara P, & Weller S. (2017). Biological Effects of Low-intensity Radiofrequency Electromagnetic Radiation – Time for a Paradigm Shift in Regulation of Public Exposure. Guo, C., Li, X., Wang, R., Yu, J., Ye, M., Mao, L., ... & Zheng, S. (2016). Association between oxidative DNA damage and risk of colorectal cancer: sensitive determination of urinary 8-hydroxy-2'-deoxyguanosine by UPLC-MS/MS analysis. Scientific reports, *6*, 32581 https://www.nature.com/articles/srep32581 Leach, V. & Weller, S. (2017). Radio Frequency Exposure Risk Assessment and Communication: Critique of ARPANSA TR-164 Report. Do we have a problem? Leach, V. Weller, S. & Redmayne, M. (2018). A novel database of bio-effects from non-ionizing radiation Ruediger, H. W. (2009). Genotoxic effects of radiofrequency electromagnetic fields. *Pathophysiology*, *16*(2), 89-102.
2	Guidelines	18	General	Please clarify what ICNIRP defines as "best science currently available". Insert your proposed change. Without providing some context it can easily be seen as a subjective comment and so cannot exclude possible confirmation bias when it comes to creating guidelines from available research. That is, cherry picking papers to support an argument of safety is a concern that is being associated with scientific committees such as SCENIHR, AGNIR and even ICNIRP. The balance of evidence appears to have been skewed in favour of no effect when in many cases the collated evidence finds the results to be in favour of an effect (e.g., oxidative stress, DNA damage, endocrine effects, and neurotransmitter effects to name a few). Such a weight of evidence can be easily verified using the ORSAA database https://n432.fmphost.com/fmi/webd#Research_Review_V4. Furthermore, the cloud of uncertaintly, dressed up as scientific caution seems to have been mis-used as a mechanism to dismiss important findings made by well conducted research. Well-conducted studies showing potentially harmful biological effects must not be dismissed simply because other studies resulted in no effects for similar parameters. A null result in many instances can also be attrubributed to a deficiency in study design. For example, the use of simulated signals as opposed to real signlas gives very different outcomes, as shown in the table below:

<table>
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<table>
<tr><th>Research Categories</th><th colspan="3">Real Mobile Phone used in Experiments</th><th colspan="6">Simulated Mobile Phone Signals used in Experiments</th></tr>
<tr><th>Wave form</th><th colspan="3">Pulsed</th><th colspan="3">Pulsed</th><th colspan="3">Continuous</th></tr>
<tr><th>Outcome</th><th>#Effect</th><th>#No Effect</th><th>#Uncertain Effect</th><th>#Effect</th><th>#No Effect</th><th>#Uncertain Effect</th><th>#Effect</th><th>#No Effect</th><th>#Uncertain Effect</th></tr>
<tr><td>in-vivo</td><td>120</td><td>18</td><td>11</td><td>69</td><td>49</td><td>8</td><td>6</td><td>4</td><td>0</td></tr>
<tr><td>In-vitro</td><td>28</td><td>8</td><td>1</td><td>60</td><td>63</td><td>7</td><td>10</td><td>17</td><td>2</td></tr>
</table>
Source: ORSAA Database May 2018

Important findings have been excluded from the summary sections of papers.
When constructing and seeding the ORSAA database, ORSAA has discovered a number of instances where statistically significant outcomes have been buried in the full paper and not included in the publication‘s abstract.
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<td>3</td>
<td>Guidelines</td>
<td>24</td>
<td>General</td>
<td>
ICNIRP claims the draft guidelines aim to provide protection for all people. If this is the case, we need to make clear what consideration ICNIRP has given to the elderly, pregnant women, children and the infirm, and to those who may be deemed to be more sensitive than the average population. Such sub-groups do exist, as is evidenced when looking at pain sensitivity, pollution sensitivity, chemical sensitivity and even photo (light) sensitivity.
ICNIRP needs to be clear on how it is protecting vulnerable people as well as more sensitive sub-groups.
Disappointingly it appears that ICNIRP is of the belief that its draft guidelines will protect all people. This is a position that appears to have changed from its previous stance outlined in the ICNIRP 2002 philosophy statement where it adivsed under
“People being protected” (p 545)
“Different groups in a population may have differences in their ability to tolerate a particular NIR exposure. For example, children, the elderly, and some chronically ill people might have a lower tolerance for one or more forms of NIR exposure than the rest of the population. Under such circumstances, it may be useful or necessary to develop separate guideline levels for different groups within the general population…”
“Some guidelines may still not provide adequate protection for certain sensitive individuals nor for normal individuals exposed concomitantly to other agents, which may exacerbate the effect of the NIR exposure, an example being individuals with photosensitivity. Where such situations have been identified, appropriate specific advice should be developed….”
“ICNIRP distinguishes occupational and public exposures in general terms. When applying the guidelines to specific situations, it is ICNIRP’s opinion that the relevant authorities in each country should decide on whether occupational or general public guideline levels are to be applied….”
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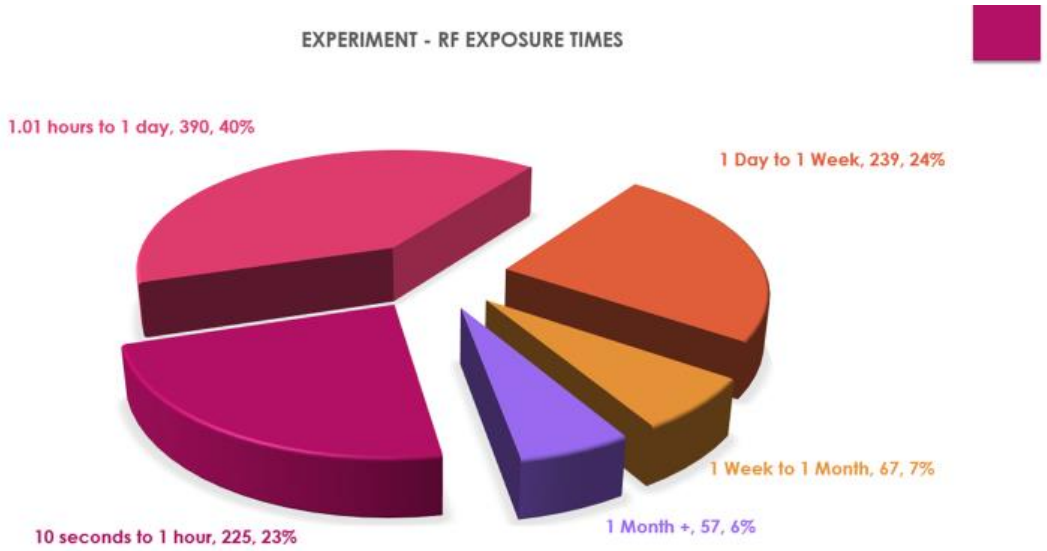
				"Environmental conditions may also influence the effect of whole-body exposure to optical or RF radiation. Seriously ill patients might be considered as more vulnerable when exposed to NIR, but ICNIRP guidelines do not consider these potential vulnerabilities…." The World Health Organisation also has the following statement on RF Guidelines. ***"What guidelines cannot account for..."*** *"…Guidelines are set for the average population and cannot directly address the requirements of a minority of potentially more sensitive people…"* Source: http://www.who.int/peh-emf/about/WhatisEMF/en/index4.html
4	Guidelines	45-48	General	ICNIRP claims to have identified published research papers, evaluated them, presumably identified biological effects that result from RF exposure and then established whether these effects are harmful. A number of questions arise from these claims: 1. Where is the list of papers that were evaluated? 2. What were the biological effects that were identified and which biological effects were noted but deemed to be harmless? 3. Who performed the evaluation to determine whether an effect is harmful and what are their qualifications? 4. On what basis was an effect deemed to be harmful or not? 5. What is ICNIRPs definition of "sufficient scientific quality"? 6. What proportion of the studies evaluated could be considered chronic long-term exposures and how many were short-term or single acute exposures? Insert your proposed change. Today, the majority of RF research is not useful for determining long term health implications because: 1) studies have not been specifically designed to look for health outcomes; and 2) while we have an excellent body of experimental studies (in vivo/in vitro), there is a clear lack of controlled clinical studies investigating the role of RF-EMR exposure in human diseases. There should be more *in vivo* studies invovling more long-term exposures as we currently have most studies conducted with short-term exposure, which are not representative of typical exposures experienced in a person's lifetime. The graph below depicts a breakdown of exposure durations for a set of RF papers contained within the ORSAA database. The sample size was 978 papers (in vivo and in vitro only). Within the sample, 87% of the papers could be classified as short-term exposures and so are unliklely to provide any detailed insight into "substantiated" health effects. However, biological effects are noted, and their implications for health can be predicted if they are sustained based on their "known" role in disease pathways. Toxocologists and medical specialists could facilitate this understanding.

				
5	Guidelines	54	Technical	"adverse health effect threshold" - Specific details are missing regarding the bioeffects and the specific levels determining effects. Appendix B is quite weak and underwhelming as it appears to disregard a large number of bio-effects that would most likely have health implications, and which occur at exposures well below the levels permitted by ICNIRP draft Guidelines. From a historical perspective, in the 1970's the US Naval Medical Research Institute (1971) and the US Defence Intelligence Agency, (DIA, 1976) performed literature reviews and identified the following bio-effects, many of which have serious implications for long term health and wellbeing: ▪ Changes in physiologic function including but not limited to changes in the oxidative processes in tissues and organs, alterations in sensitivity to light, sound, and olfactory stimuli, electrocardiographic (EKG) changes ▪ Central Nervous System effects including headache, insomnia, restlessness etc. ▪ Autonomic Nervous System effects including neuro-vegetative disorders (altered heart rhythm), fatigue, stimulation of parasympathetic nervous system (Bradycardia) ▪ Psychological Disorders including depression, anxiety, sleepiness, insomnia, mood changes, increased fatiguability, chest pain etc. ▪ Blood Disorders including hemolysis, increased blood glucose and could have a role in raising the risk of diabetes, increased cholesterol increasing risks of cardiovascular disease, increased blood histamine content increasing the risk of allergies ▪ Vascular Disorders ▪ Metabolic Disorders – including glycosuria (glucose in urine), ▪ Gastrointestinal disorders ▪ Genetic and chromosomal changes that lead to chromosomal aberrations, mutations, somatic alterations and neoplastic diseases (tumors)

				▪ Changes in circadian rhythms – we have knowledge from investigations into the health of shift workers that circadian rhythm disruption has long term health implications. Over time, working night shifts increases your risk of heart disease, diabetes and cancer. While a number of these effects listed above may not be considered immediately harmful per se, they can definitely be considered as nuisance effects and if sustained can have far reaching health and wellbeing implications. Given the wide-ranging scope of wireless infrastructure deployment into our environment, the quality of life and productivity of large numbers of people worldwide are threatened. DIA specifically found: ▪ *"Animal experiments reported in open literature have demonstrated the use of low level microwave signals to produce death by heart seizure or by neurological pathologies resulting from breaching of the blood-brain barrier."* (page viii) ▪ "*Personnel exposed to microwave radiation below thermal levels experience more neurological, cardiovascular, and haemodynamic disturbances than do their unexposed counterparts*." (page 6) ▪ *"Subjects (military personnel) exposed to microwave exhibited a variety of neurasthenic disorders against a background of angiodystonia (abnormal changes in the tonicity of the blood vessels). The most common subjective complaints were headache, fatigue, perspiring, dizziness, menstrual disorders, irritability, agitation, tension, drowsiness, sleeplessness, depression, anxiety, forgetfulness and lack of concentration." (page 8)* Many of these listed effects will impact a person's quality of life and so it is important that serious efforts are taken to reduce or avoid their development. ▪ *"Another possibility is alteration of the permeability of the blood-brain barrier. This could allow neurotoxins in the blood to cross. As a result, an individual could develop severe neuropathological symptoms, either die, or become seriously impaired neurologically." (page 26)* When we look at more recent accumulated evidence in the ORSAA database (see Field Search Summary Table in #1 above) we see the same or similar biological effects appearing. The question to ICNIRP is 'why are these findings being collectively ignored?' Could ICNRRP's approach be best explained by US DIA's statements of why adopting stricter safety guidelines were a problem in the 1970's: ▪ "***If the more advanced nations of the West are strict in the enforcement of stringent exposure standards, there could be unfavourable effects on industrial output and military functions***." (page vii) ▪ ***"Recognition of the .01mW/cm2 standard (stringent safety regulations) could also limit the application of new electronic technology by making the commercial exploitation of some products unattractive because of increased costs imposed by the need for additional safeguards."*** (page 24) Insert your proposed change. Explain the context of your comment.
6	Guidelines	63	Technical	Reduction Factors applied by ICNIRP are not scientifically based and appear to be only relevant to heating effects because they do not provide biological protection to a range of bio-effects clearly demonstrated in the scientific literature (e.g. oxidative stress causing different forms of cellular damage including DNA, and membrane damage leading to functional impairment such as neurological and metabolic effects) that are associated with disease outcomes and are occuring at athermal/non-thermal exposure

				levels. Oxidative stress plays a major part in the development of chronic and degenerative disease such as cancer, arthritis, autoimmune disorders, cardiovascular and neurodegenerative diseases as well as aging (Halliwell and Gutteridge, 2015); Pham-Huy, He, & Pham-Huy 2008). The aforementioned diseases are a significant problem today in developed nations, is ever increasing and parallels the deployment of wireless technology in our society. Given that oxidative stress features in the clear majority of papers that investigate this endpoint, it would seem ICNIRP is negligent in its lack of acknowledgement of this bio-effect and its implications to health and well being. References Halliwell, B., & Gutteridge, J. M. (2015). *Free radicals in biology and medicine*. Oxford University Press, USA. Pham-Huy, L. A., He, H., & Pham-Huy, C. (2008). Free radicals, antioxidants in disease and health. *International journal of biomedical science: IJBS*, *4*(2), 89. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3614697/ ORSAA requests that ICNIRP address the issue of oxidative stress induced by low-intesity RF-EMR and explain why it has been omitted as a health concern. Explain the context of your comment.
7	Guidelines	84	Technical	The Draft Guidlines indicate that "Occupationally-exposed individuals are defined as healthy adults...." There appears to be no consideration for those individuals whose health maybe compromised by varying degrees – a person's health status can easily change as a result of infection, stress or many other temporary ailments. Of course there is another concern. It is assumed that the information provided to occupationally exposed individuals about the possible risks are accurate. One can assume that these individuals would be relying on the advice provided by ICNIRP and the RF Guidelines, which are clearly questionable based on the improved awarenss of the science and subsequent concern that have been raised in this document. As such, the risks could be underestimated and precautionary/protective measures taken by occupationally exposed individuals could be severely inadequate for their protection. Unfortunately, looking for established evidence of harm is not a recognized risk management best practice. Risk Management is not about requiring established evidence of harm. Risk Management is about recognising the potential for harm and if there is evidence for potential harm , taking precautionary measures. What is quite obvious today is the distinct lack of public awareness of the real risks associated with radiofrequency exposure – wireless devices operating within RF Guidelines are assumed to be completely safe irrespective of how frequent or how long they are used for. It is also critically important to understand that the research being evaluated by ICNIRP and other scientific committees, are in most cases, not designed to answer the question of whether there are possibly multiple downstream health effects arising out of the observed biological effects, including those in the second and subsequent exposed generations. This is because experiments are typically performed with controlled exposures that are: 1. Not representative of typical real-life exposures situations 2. Often performed with simulated signals that lack the signal variation that occurs with real wireless devices 3. Typically short-term acute exposures

				4. Rarely investigating synergistic effects with other environmental/manmade toxins 5. In nearly all cases not looking at the possibility of both additive effects (exposure to multiple different frequencies simultaneously) or accumulative effects (damage to cells and organs over a long period of time) It is also problematic that bio-effects routinely found in well-conducted studies are not being addressed by health bodies for their potential to cause harm. Recommendation: All ICNIRP members read "Late lessons from early warnings report" https://www.eea.europa.eu/publications/environmental_issue_report_2001_22 https://www.eea.europa.eu/publications/late-lessons-2 ***The scientific elites have also been slowly losing public support. This is in part because of the growing number of instances of misplaced certainty about the absence of harm, which has delayed preventive actions to reduce risks to human health, despite evidence to the contrary.*** **(Late lessons learned from early warnings, European Environmental Agency, 2013)** ORSAA recommends ICNIRP adjust its methodology for evaluating the science to include recognition of potential risks associated with non-thermal bioeffects. Looking for established "evidence of harm" while ignoring clear evidence of nonthermal biological effects is counter to best practice, especially considering the number of people being exposed to potential harm 24x7 without informed consent. ICNIRP should follow the recommended precautionary approach adopted by the ICRP which incorporates as low as reasonably achievable (ALARA). ICNIRP needs to ensure that an ethical foundation is applied to non-ionising radiation protection that includes the following tenants: ▪ Reasonableness and tolerability ▪ Transparency and accountability ▪ Impartiallity and independence ▪ Commitment to public and environmental safety The mantra – "no established evidence of harm" has been widely used to give the public a false sense of security and is not acceptable, given that the weight of scientific evidence at present clearly indicates health risks. The uniformed public bears the consequences of these undisclosed risks.

8	Guidelines	98 -105	General	A conservative approach is claimed to have been taken yet ICNIRP draft Guidelines are several orders of magnitude higher (more permissive) than scientifically based standards adopted by other countries in order to prevent at least some non-thermal effects (Russia, China, Poland etc.). Precautionary aspects that have been included such as reduction factors do not protect against a range of biological effects that are potentially harmful. Insert your proposed change.

				Unfortunately, ICNIRP does not see the need for further precautionary measures yet various tumours (schwannoma, glioma and other neoplasms) have been associated with RF exposure levels that are signfincantly lower than what is permitted by ICNIRP guidelines in both epidemiological and animal studies (Hardell, CERENAT, NTP, Ramazzini, 2018). ICNIRP must seriously take on board the opinions of independent scientists. https://ntp.niehs.nih.gov/ntp/about_ntp/trpanel/2018/march/actions20180328_508.pdf https://www.icnirp.org/cms/upload/publications/ICNIRPnote2018.pdf
9	Guidelines	161-164	General	ICNIRP claims it has primarily used major international reviews of the literature on radiofrequency EMF and health, but has only mentioned two in this paragraph – WHO 2014 and SCENIHR 2015. This presents a number of significant problems: The WHO EHC technical document did not move past the the draft phase, and the researchers who performed the RF-EMF literature review as part of Environmental Health Criteria (EHC) were predominantly ICNIRP members. This appears to be a blatant conflict of interest because those who are responsible for setting the RF Guidelines are the same ones trying to assess if those guidelines are adequately protective. ORSAA notes with interest that the Ethics Board of the Karolinska Insittue, Sweden had in 2008 determined that ICNIRP may have a conflict of interest. When ICNIRP members consult health authorities (such as WHO), regarding health risks of EMR, that Conflict of Interest should be declared (Karolinska Institute diary number: 3753-2008-609, 2008). However, no statement of such conflict of interest appears to have been made by ICNIRP members when working with the WHO. ORSAA performed a 'two degrees of separation' to review the relationships between the original EHC scientists performing the review, their qualifications, who funded their research and the how their research findings stack up with the ratio of "effect" vs "no effects" seen in the ORSAA database. The results showed that: • There was no representation from countries that have RF Standards significantly lower than what ICNIRP has adopted for its basic restrictions. This suggests that WHO and/or ICNIRP had employed biased selection criteria when establishing the EHC group. • EHC expert panel composition appeared to be over represented by "No Effect" scientists particularly in the core group. A small number of token "Effect" researchers were included in the mix. This stacking of "no effect" scientists in the EHC is not representative of what the balance of evidence is showing. • There was a clear lack of representation from countries that are finding significant amount of effects versus no effects, which is very concerning particularly when the majority have adopted RF standards that are significantly more restrictive (90 – 100 times or lower) than those advised by ICNIRP; e.g., China, Russia, Turkey and Iran • A number of experts, including the EHC core group, appear to have conflicts of interest and are members of ICNIRP. ICNIRP is an NGO with no public accountability and promotes the least protective exposure guidelines, globally. • Most members of the group have performed research (predominantly "no effect" studies) sponsored directly by the industries and/or military that generate anthropometric EMF e.g., Electrical Power consortiums (such as EPRI) and Telecommunications companies such as Motorola, Nokia, French Telecom, Telecom Italia Mobile etc. as well as industry groups or associations (GSM Association, Mobile Manufacturers Forum, Cellular Telecommunications & Internet Association) and the US Airforce.

				• It was abundantly clear that there were gaps in EHC specialist expertise and research experience and so it is questionable whether the reviewers could accurately interpret all potential health effects associated with bio-effects being found in the RF literature. • Some of the researchers in the EHC group are known to cherry pick their data to support their "no evidence" or "no association" conclusions - particularly in relation to mobile phone usage and brain tumour studies. • A number of the same "no effect" scientists appear to have been involved in multiple review panels and expert advisory committees over the last 10 years (ICNIRP, AGNIR, SCENIHR, SSI). • The composition of the EHC tasked with reviewing the literature on RF bio-effects is not representative of the diverse opinions held in the wider scientific community. The SCENIHR working group has also been criticised for: • using the wrong methodology for evaluating potential harm, • having scientists as part of the reveiw panel that appear to have conflicts of interest, • being biased, • a lack independence and impartiality. See https://www.stralskyddsstiftelsen.se/wp-content/uploads/2015/09/Annex_1_SCENIHR_Experts_2015.pdf and https://www.researchgate.net/publication/287791372_Comments_on_SCENIHR_Opinion_on_potential_health_effects_of_exposure_to_electromagnetic_fields_Bioelectromagnetics_36480-484_2015] In summary, various working groups such as AGNIR, SCENIHR and ICNIRP appear to be relying on each other's inaccurate assessments, ignoring evidence contrary to their position, thereby perpetuating confirmation bias and groupthink. Moreover, such repetition gives a false impression of cosensus amongst a large group of international scientists, when in fact, the number of members in these groups is a fraction of the total numer of scientists involved in RF-EMR research. Insert your proposed change. Explain the context of your comment.
10	Guidelines	168-169	Technical	ICNIRP's claim that "EMF can affect the body via three primary biological effects" is overly simplistic and incomplete. To make such a statement sugests a possible lack of expertise within the ICNIRP team. EMF can impact any organ systems due to interference with basic biological functions at the cellular level such as interference with voltage gated ion channels and signal transduction pathways which in turn can lead to systemic disregulation: 1. Immune system: EMF can cause immune system dysfunction; i.e, overactive, underactive and auto immune conditions. EMFs can cause calcium flux changes which in turn can result in mast cell degranulation releasing histamine, implicated in allergic reactions. There has been clear evidence of exacerbation of allergic reactions in sensitised people as demonstrated in double-blind provocation studies (Kimata 2002, 2005; see https://www.ncbi.nlm.nih.gov/pubmed/15876318, https://www.ncbi.nlm.nih.gov/pubmed/12795649)

				2. Endocrine system: EMF can cause endocrine dysregulation via above mentioned biological effects leading to circadian rhythm disruption etc. Research shows that biochemical actions induced by EMR exposures lead to adverse changes in hormones essential in male and female reproduction: a. Testosterone level decreases (e.g., Qin, Zhang and Cao et al. 2014) b. Luteinising hormone (LSH) levels increased (e.g., Ozguner, Koyu and Cesur, et al, 2005) c. Follicle-stimulating hormone (FSH) level increased (e.g., Sepehrimanesh, Saeb, and Nazifi et al., 2014) d. Estrogen level changes (e.g., Yüksel, Nazıroğlu and Özkaya, 2016) e. Progesterone level changes (e.g., Nakamura, Matsuzaki and Hatta et. al, 2003) f. Prolactin levels decreased (e.g., Eskander, Estefan and Abd-Rabou, 2012) g. Corticosterone level increases (Corticosterone is a main glucocorticoid, involved in regulation of energy, immune reactions, and stress responses) (e.g., Ragy, 2015) h. Adrenaline and Noradrenaline levels (catecholamine) change and is more dramatic with length of exposure (e.g., Megha, Deshmukh and Ravi et. al, 2015) i. Thyroid hormone levels change (TSH, T3, T4) (e.g., Bergamaschi, Magrini and Ales et. al, 2004) j. Adrenocorticotropic hormone (ACTH) levels decreased (e.g., Eskander, Estefan and Abd-Rabou, 2012) k. Melatonin level decreases (e.g., Burch, Reif, and Noonan et. al, 2002). 3. Cardiovascular system: EMF causes changes to HRV as well as vascular disturbances (Bandara, & Weller, 2017). 4. Central nervous system: EEG changes provide direct evidence that EMF affects brain waves. The mechanism is yet to be fully explored and the implications not fully known. Long-term exposure to microwaves leads to impairment of cognitive function due to neurotransmitter disruption (Zhao, 2012). RF-EMF influences monoamine neurotransmitter levels and their key regulating enzymes (Megha, 2015). Many studies looking at learning and spatial memory deficiencies also find neurotransmitter profiles changed (Shtemberg, 2000; Zhao, 2012, Maaroufi, 2014; Qin 2014; Wang 2015 etc.). Neurotransmitters GABA, dopamine, serotonin, norepinephrine (noradrenaline), epinephrine (adrenaline), glutamate, acetylcholine levels are all impacted by RF exposures. 5. Peripheral nervous system: Dysaesthesia associated with C nerve fibre changes (Hocking 2002), whereby neurotransmitter effects also feature. 6. Hepatic system: oxidative stress, lipid peroxidation, structural/morphological changes, AST and ALT Activity changes. 7. Renal system: glomerular damage, dilatation of Bowman's capsule, large spaces between tubules, tubular damage, and oxidative stress. 8. Haematological system: increased haemolysis, micronuclei induction, oxidative protein damage, lipid profile and cholesterol level changes, haemoglobin structural changes, decreasing values of RBCs, WBCs, platelets, and haemoglobin. There are a vast array of biological effects that if widespread can also impact the body (see field search summary table in comment #1 above). **References** Bergamaschi, A., Magrini, A., Ales, G., Coppeta, L., & Somma, G. (2004). Are thyroid dysfunctions related to stress or microwave exposure (900 MHz)?. *International journal of immunopathology and pharmacology*, *17*(2_suppl), 31-36.

				Burch, J. B., Reif, J. S., Noonan, C. W., Ichinose, T., Bachand, A. M., Koleber, T. L., & Yost, M. G. (2002). Melatonin metabolite excretion among cellular telephone users. *International Journal of Radiation Biology*, *78*(11), 1029-1036. Eskander, E. F., Estefan, S. F., & Abd-Rabou, A. A. (2012). How does long term exposure to base stations and mobile phones affect human hormone profiles?. *Clinical biochemistry*, *45*(1-2), 157-161. Megha, K., Deshmukh, P. S., Ravi, A. K., Tripathi, A. K., Abegaonkar, M. P., & Banerjee, B. D. (2015). Effect of low-intensity microwave radiation on monoamine neurotransmitters and their key regulating enzymes in rat brain. *Cell biochemistry and biophysics*, *73*(1), 93-100 Nakamura, H., Matsuzaki, I., Hatta, K., Nobukuni, Y., Kambayashi, Y., & Ogino, K. (2003). Nonthermal effects of mobile-phone frequency microwaves on uteroplacental functions in pregnant rats. *Reproductive Toxicology*, *17*(3), 321-326. Ozguner, M., Koyu, A., Cesur, G., Ural, M., Ozguner, F., Gokcimen, A., & Delibas, N. (2005). Biological and morphological effects on the reproductive organ of rats after exposure to electromagnetic field. *Saudi medical journal*, *26*(3), 405-410. Qin, F., Zhang, J., Cao, H., Guo, W., Chen, L., Shen, O., ... & Tong, J. (2014). Circadian alterations of reproductive functional markers in male rats exposed to 1800 MHz radiofrequency field. *Chronobiology international*, *31*(1), 123-133. Ragy, M. M. (2015). Effect of exposure and withdrawal of 900-MHz-electromagnetic waves on brain, kidney and liver oxidative stress and some biochemical parameters in male rats. *Electromagnetic biology and medicine*, *34*(4), 279-284. Sepehrimanesh, M., Saeb, M., Nazifi, S., Kazemipour, N., Jelodar, G., & Saeb, S. (2014). Impact of 900 MHz electromagnetic field exposure on main male reproductive hormone levels: a Rattus norvegicus model. *International journal of biometeorology*, *58*(7), 1657-1663. Yüksel, M., Nazıroğlu, M., & Özkaya, M. O. (2016). Long-term exposure to electromagnetic radiation from mobile phones and Wi-Fi devices decreases plasma prolactin, progesterone, and estrogen levels but increases uterine oxidative stress in pregnant rats and their offspring. *Endocrine*, *52*(2), 352-362. Insert your proposed change. Explain the context of your comment.
11	Guidelines	189-190	Technical	ICNIRP claims that it has considered evidence of adverse effects at 'low-level' and 'non-thermal' exposure. Yet when one looks at a number of studies in the ORSAA database for oxidative stress (OS) and DNA damage one finds exposure levels in the conducted experiments that are well below the current draft guideline reference levels: Oxidative stress: see Kumari, 2012; Burlaka, 2013; Deshmukh, 2013; Maaroufi, 2014; Gurier, 2014; Ghazizadeh, 2014; Djordjevic 2015; Hussein, 2016). The ORSAA database contains many more studies (>50) with SAR ranges from .15 W/Kg to 0.000003 W/Kg. DNA Damage: see Burlaka, 2013; Deshmukh, 2013; Sekeroglu, 2013; Tsybulin, 2013; , 2013; Furtado-Filho, 2014; Megha, 2015; Gustavino, 2016). There are many more examples in the ORSAA database. ORSAA requests that ICNIRP identify and document the non-thermal effects it has considered, and provide justification of why it does not see a range of biological effects such as oxidative stress and DNA damage as a threat to health. Explain the context of your comment.

12	Guidelines	216-414	General	ICNIRP has provided a high level of detail of the mechaisms of thermal action and the guidelines go to great lengths towards preventing harmful heating effects. However, thermal effects and the mechanism of action are now well known. Sadly, there is very little discussion of non-thermal effects, despite lines 189-190 suggesting that they have been considered. Mechanisms for non-thermal bio-effects such as oxidative stress are also absent despite plausible mechanisms being discussed; e.g., Barnes et al. (2016). ORSAA requests that ICNIRP provide more details of the non-thermal effects that were considered and to explain why DNA damage and oxidative stress that are occuring at significantly lower exposure levels than ICNIRP reference levels are not considered to be relevant to health. Explain the context of your comment.
13	Appendix B	All	General	A biased review with a lack of attention to important detail that misrepresents the available evidence. Evidence of potential and real harm is being routinely dismissed by ICNIRP via a list of generic statements claiming "methodological limitations" of the studies (in at least 15 instances) or lacking "dosimetry" information, or "other short comings" or "the results have not been replicated in independent studies". In all cases these throw away statements: 1) Have not identified which papers have resulted in the purported shortcomings, nor justified what the specific shortcomings or methodological limitations are; 2) Have not identified which papers lack dosimetry information and what signal source (simuated or real) was used. Some of these papers may relate to epidemiological studies looking at cell towers or even cell phone use. Even though there may be no useful and specific details of exposure levels for setting appropriate limits for safety purposes, the RF sources in such epidemiological studies will most likely be operating within currently permitted levels, and yet effects are still bieng observed. This suggests that the current guidelines are obsolete and are not fully protective. 3) Have not identified how many studies available in the literature claiming to be replications yet showing null results are true attempts at replication. Neither has ICNIRP discussed whether the attempted replicated study was funded by industry. The reader has not been not informed as to the existence of replicated studies that do reproduce the same result. Two examples are Tillman (2010) and Lerchl (2015). Both studies found RF acting as a tumour promotor. ICNIRP dismisess this finding with a statement claiming no obvious dose response relationship (see later). However, Tillman performed an earlier study in 2006 and found that RF was not acting as a tumour promotor. This earlier research was funded by the telecommunications industry (GSM Association, UK/Ireland Mobile Manufacturers Forum (MMF)). Funding source appears to matter, suggesting that much of the research funded by industry (whereby the majority find no significant effects) is potentially unreliable and a source of uncertainty. 4) Have not advised the reader that many independent studies, although not exact replications of prior studies, have found the same bio-effect outcomes, thereby providing converging evidence for such outcomes. In many cases, the balance of evidence supports their findings; e.g. oxidative stress, DNA damage, behavioral changes etc. 5) Have not provided justification as to why other more stringent and scientifically based RF Standards, such as those adopted by Russia and China are incorrect while those adopted by ICNIRP are correct.

				The shortcomings mentioned above undermine ICNIRP's credibility and create a level of distrust within the international research community. ICNIRP has failed to acknowledge or address such concerns as those raised by more than 200 well respected international scientists (see EMF appeal by 244 EMF scientists, Aug 2018: www.emfscientist.org). ORSAA recommends that ICNIRP make clear the specifc papers that have made findings identified as troublesome along with their specific methodological deficiencies. A holistic approach to evaluating the evidence needs to be taken, and more importantly, a risk determination needs to be made along with probabilities around possible disease outcomes. Such risk determinations need to be conducted by those with appropriate qualifications. To wait until established evidence of harm is found would mean that the risk has already materialised. Given the size of the population exposed such an approach is negligent. Lack of impartiality and dismissal of important findings that challenge the validity the draft Guidelines.
14	Appendix B	15-16	General	Refer to comment #9 above for Guidelines. ORSAA recommends ICNIRP remove that the reference to WHO as the EHC work was not completed and may never be published. Lack of impartiality, evidence of confirmation bias and conflicts of interest
15	Appendix B	17	General	ICNIRP claims the WHO technical document was an "independent review". ORSAA recommends that ICNIRP remove this claim This claim is clearly contestable for the reasons covered in comment #9 above for Guidelines. The majority of the EHC review group were ICNIRP members. The EHC did not include any representation from countries that have adopted RF Standards that are more restrictive.
16	Appendix B	19	General	SCENIHR has also been accused of evaluating the science using the wrong methodology (Carpenter, 2015). Insert your proposed change. Explain the context of your comment.
17	Appendix B	25-27	General	ICNIRP also considered research published subsequent to that included in the WHO and SCENIHR reviews in the development of the current guidelines. ORSAA recommends that ICNIRP provide a list of papers reviewed for transparency and specify who the reviewers were for these studies. Without this necessary information it cannot be validated as to whether all the latest available research was considered or whether important papers were missed.
18	Appendix B	47	Technical	"ICNIRP bases its guidelines on substantiated adverse health effects". ORSAA does not consider this apprach to be reasonable, due the following limitations: 1. Risk management is not about waiting for a risk to materialise before taking action. 2. The clear majority of studies are based on short–term acute exposures. This is equivalent to looking to establish cancer as a health effect after someone has smoked a single cigarette, or after smoking one packet of cigarettes over a month.

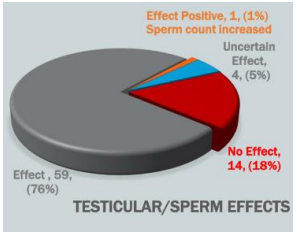
				3. Animals are sacrificed to evaluate changes, so any long-term developmental effects cannot be observed. All that the results of such studies can reveal is that an acute exposure is unlikely to cause disease; however, they are unable to deterine whether chronic exposures are harmless. 4. Most sudies are not designed to look at health outcomes. 5. Very limited controlled experiments on humans and none that are long term have been conducted. Many experiments (see ORSAA database) are showing biological effects, some of which have been associated with disease pathways; e.g., oxidative stress. Some diseases take many years to manifest. There are indicators that ICNIRP does not appear to take seriously nor include: 1. Increase in neoplasms: animal studies and human epidemiological studies; 2. Leukemia, breast cancer, brain tunours, salivery gland malignancy; 3. DNA damage: *in vitro*, *in vivo* and epidemiological studies 4. Oxidative stress – In vitro, In vivo and epidemiological studies; 5. Inflammation; 6. Tumour promotion and initiation. Some of the above biological effects, if sustained for many years, can lead to disease. When looking at clinical studies and historical studies on humans, there are clear signs that physical and mental health is impacted by long term chronic exposures. The DIA highlighted this in their paper. The key points are given below: ▪ "*Personnel exposed to microwave radiation below thermal levels experience more neurological, cardiovascular, and haemodynamic disturbances than do their unexposed counterparts*." (page 6) ▪ *"Subjects exposed to microwave exhibited a variety of neurasthenic disorders against a background of angiodystonia (abnormal changes in the tonicity of the blood vessels). The most common subjective complaints were headache, fatigue, perspiring, dizziness, menstrual disorders, irritability, agitation, tension, drowsiness, sleeplessness, depression, anxiety, forgetfulness and lack of concentration." (page 8)* Most of the "disorders" listed will definitely impact well-being. Many of the symptoms described match what is being claimed by members of the public today as occurring as a result of exposure to Wi-Fi, mobile phones, smart meters and cell towers. Unfortunately, ICNIRP and government radiation protection agencies are intimating that such symptoms are due to the "nocebo effect". Insert your proposed change. Explain the context of your comment.
19	Appendix B	67-69	General	ORSAA recommends that ICNIRP provide specific examples of those more rigorous studies that are have failed to show effects. Insert your proposed change. Explain the context of your comment.

20	Appendix B	75	Technical	Spatial memory has also been shown to be impacted within animal experiments, which fairly consistently show reduced exploratory activity in exposed animals compared to the controls. Insert your proposed change. Explain the context of your comment.
21	Appendix B	88	General	Please provide examples of alternative explanations to support the statement "alternative explanations for observed effects are plausible" Insert your proposed change. Explain the context of your comment.
22	Appendix B	90	Technical	There is evidence that RF alters neurotransmitter levels in animal studies and human epidemiological studies. ▪ Hippocampus injured by long-term exposure to microwaves leads to impairment of cognitive function due to neurotransmitter disruption (Zhao 2012) ▪ Microwaves influences monoamine neurotransmitter levels and their key regulating enzymes (Megha 2015) ▪ Impacts brain, heart and digestive system ▪ Many studies looking at learning and spatial memory deficiencies also find neurotransmitter profiles changed (Shtemberg 2000, Zhao 2012, Maaroufi 2014, Qin 2014, Wang, 2015 etc.) ▪ Key neurotransmitters are all impacted by RF: ▪ GABA (e.g., Qiao, Peng, Yan, et al., 2014) ▪ Dopamine (e.g., Ezz, Khadrawy, Ahmed et. al, 2013) ▪ Serotonin (e.g., Li, Peng and Wang, et. al, 2015) ▪ Norepinephrine (noradrenaline) (e.g., Megha, Deshmukh and Ravi et. al, 2015). ▪ Epinephrine (adrenaline) (e.g., Kulkybaev and Pospelov, 2000) ▪ Glutamate (e.g., Noor, Mohammed and Ahmed et. al, 2011) ▪ Acetylcholine (e.g., Testylier, Tonduli and Malabiau et. al, 2002). Imbalances of these key neurotransmitters can lead to the following: ▪ GABA imbalances: anxiety, restless mind, Inner tension and excitability, tinnitus, blurred vision, chest discomfort, irritability and oversensitivity; ▪ Dopamine imbalances: depression, fatigue, learning disorders, Attention Deficit Disorder (ADD), irritability and outbursts and easily distracted; ▪ Serotonin imbalances: migraines/headaches, rapid heart rate/irregular heart-beat, tremor, strong sugar cravings, insomnia, fatigue, depression and reduced emotional control; ▪ Acetylcholine imbalances: learning disabilities, memory lapses, diminished comprehension, slowed mental responsiveness and Attention Deficit Disorder (ADD). Many of the symptoms described above fit the profile of those who complain of suffering microwave sickness and/or electromangentic hypersensitivity. Many of the symptoms above are also becoming common in modern society. For example, a real-life exposure condition is detailed below (Buchner 2011):

				▪ A long-term study conducted in Germany to investigate the influence of base station RF emissions on neurotransmitters under true-to-life conditions; ▪ 24 out of 60 participants were exposed to a power density of < 60 µW/m², 20 participants to 60 - 100 µW/m², and 16 participants to more than 100 µW/m²; ▪ The levels of stress hormones adrenaline and noradrenaline grew significantly during the first 6 months after starting the GSM base station; ▪ The levels of the precursor substance dopamine substantially decreased in this time period; ▪ The initial condition was not restored even after 1.5 years; ▪ The effects showed a dose-effect relationship even though exposures were situated well under public exposure limit values. **References** Ezz, H. A., Khadrawy, Y. A., Ahmed, N. A., Radwan, N. M., & El Bakry, M. M. (2013). The effect of pulsed electromagnetic radiation from mobile phone on the levels of monoamine neurotransmitters in four different areas of rat brain. *Eur Rev Med Pharmacol Sci*, *17*(13), 1782-1788. Kulkybaev, G. A., & Pospelov, N. I. (2000). Changes in gastric electric activity and serum catecholamine level under the influence of electromagnetic microwaves (experimental studies). *Meditsina truda i promyshlennaia ekologiia*, (5), 8-11. Li, H. J., Peng, R. Y., Wang, C. Z., Qiao, S. M., Yong, Z., Gao, Y. B., ... & Li, Z. (2015). Alterations of cognitive function and 5-HT system in rats after long term microwave exposure. *Physiology & behavior*, *140*, 236-246. Megha, K., Deshmukh, P. S., Ravi, A. K., Tripathi, A. K., Abegaonkar, M. P., & Banerjee, B. D. (2015). Effect of low-intensity microwave radiation on monoamine neurotransmitters and their key regulating enzymes in rat brain. *Cell biochemistry and biophysics*, *73*(1), 93-100. Noor, N. A., Mohammed, H. S., Ahmed, N. A., & Radwan, N. M. (2011). Variations in amino acid neurotransmitters in some brain areas of adult and young male albino rats due to exposure to mobile phone radiation. *Eur Rev Med Pharmacol Sci*, *15*(7), 729-742. Qiao, S., Peng, R., Yan, H., Gao, Y., Wang, C., Wang, S., ... & Su, Z. (2014). Reduction of phosphorylated synapsin I (ser-553) leads to spatial memory impairment by attenuating GABA release after microwave exposure in Wistar rats. *PloS one*, *9*(4), e95503. Testylier, G., Tonduli, L., Malabiau, R., & Debouzy, J. C. (2002). Effects of exposure to low level radiofrequency fields on acetylcholine release in hippocampus of freely moving rats. *Bioelectromagnetics: Journal of the Bioelectromagnetics Society, The Society for Physical Regulation in Biology and Medicine, The European Bioelectromagnetics Association*, *23*(4), 249-255. Insert your proposed change. Explain the context of your comment.
23	Appendix B	98-99	Technical	ORSAA recommends that ICNIRP consider the issue of electromagnetic hypersensitivity (EHS) more seriously. EHS is primarily a medical and biophysics issue that requires investigation by medical doctors as well as psychologists trained in psychophysics and physicists trained in biophysics. Objective tests performed by Hocking et al. 2001, 2002, 2003 clearly show neurological changes (c-nerve fibres). Belpomme et al. 2015 has identified plausible biomarkers. Heuser 2017 has identified functional differences in fMRI scans between healthy individuals and those who are EHS. Further medical research is required with central sensitisation syndrome and kindling effects as possible avenues for investigation.

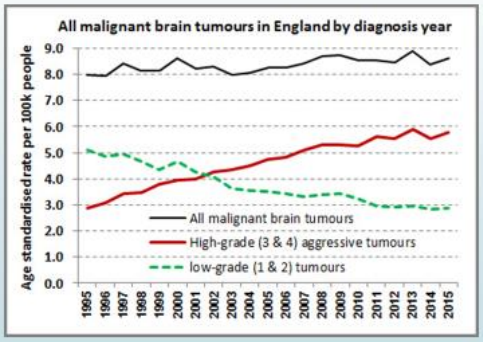
				When it comes to research on EHS, there are a number of serious issues with existing studies: ▪ Many studies are not designed to demonstrate causation i.e. survey based studies, subjective tests etc. ▪ Most studies look at short term, one off, acute exposures, rathe rather than the required longitudinal studies. ▪ Many provocation studies are subjective and do not include objective biological and/or neurological tests. ▪ There is limited research looking at genetic differences, metabolic disorders, biological, neurological and immunologic responses between sensitive and non-sensitive people. ▪ Very few clinical studies investigate RF-occupational worker's health versus a less exposed population. ▪ There has been very limited biological and controlled exposure testing on humans. ▪ People who have health problems are excluded from tests. Therefore, it is difficult to determine whether people whose health is compromised are especially vulnerable to everyday RF-exposures. Provocation studies are not the gold standard for investigating EHS, because most provocation studies suffer design, methodological and statistical deficiencies. Some examples include: ▪ Provocation studies are unreliable in that the participants often respond according to their beliefs about the conditions, or expectations about the outcomes; ▪ Not representing real life exposure situations because studies focus on a single or narrow frequency range, power level and often lack signal variability; ▪ Symptoms may not be tracked for long enough and may vary between test subjects by type, onset time, intensity and duration; ▪ The way in which the symptoms are recorded and the method for constructing a numerical differential score can introduce bias; ▪ Environments are not always controlled; e.g., EMR leakage within the testing environment (i.e. other power sources, fluorescent lights) or even from the test device; ▪ Other confounders are not considered; e.g., many EHS people have been found to be also sensitive to odours and noise (not controlled); ▪ Subjective tests are often not supplemented with useful objective tests (HRV, blood and urine chemistry changes, skin voltage, nerve conductivity, fMRI etc.); ▪ Provocation studies do not always identify and test genuine EHS sufferers separately (pooling of data tends to wash out potential findings); ▪ Provocation studies can be affected by memory recall issues when comparing feelings to past exposures. Insert your proposed change. Explain the context of your comment.

24	Appendix B	101	Technical	When it comes to the suggestion of nocebo effects this psychological paradigm is unproven and speculative. Nocebo is not likely to be responsible for the initial EHS development but may certainly exacerbate the situation once RF is identified as the source of complaint, as suggested by Dieudonne (2016). The suggestion of EHS being of nocebo origin ignores clinical study findings and biological effects that can be associated with many symptoms; e.g., the experiences of EHS sufferers can be tied to changes in neurotransmitters. To continue pushing nocebo and purposefully exclude EMR as a likely cause is both dangerous and disingenuous, and harmful to EHS sufferers who may end up being treated inappropriately using psychiatric models and methods. Insert your proposed change. Explain the context of your comment.
25	Appendix B	113-115	Technical	Epidemiological studies are not designed to provide causation. ICNIRP to correct their statement Epidemiological studies are not not controlled, nor do they investigate the mechanism of harm so it is impossible to demonstrate causation. At best they can only provide “a possible association“ between RF exposure and an endpoint being investigated.
26	Appendix B	297-298	Technical	Immune system RF bio-effects have been clearly related to health. Immunology expertise is required to correctly interpret the implications to health. Below are some example papers showing RF effects on the immune system: ■ Inflammation: ■ Interleukin 1 beta (IL-1β) levels increased (Eser, 2012; Megha, 2012) ■ Tumour necrosis factor alpha (TNF-α) levels increased (Megha, 2012) ■ Neuroinflammation (Bouji, 2012) ■ Changes in Cytokine profile (Gapeev, 2010) ■ Lymphocyte percentage and total white blood cell counts changes: ■ IgM and IgG levels significantly changed (Yuan, 2004; El-Gohary, 2017) ■ Pancytosis (an increase in RBCs, WBCs, and platelets) (Otitoloju, 2012) ■ Leukocyte cell surface antigens (CD antigens) expression changes ■ Skin disorders/dermatitis (Johansson, 2001): ■ Migration of mast cells towards the uppermost dermis ■ Mast cell degranulation ■ Histamine release ■ Autoimmune changes (Grigoriev, 2010*) ■ Supressed phagocytic activity of neutrophils (Kolomytseva, 2002) ■ Increased allergies and asthma (Saravanamuttu, 2016) *Replicated Soviet studies conducted between 1974 and 1991 that showed immunological effects. Immune system effects are key bio-effects that were used to establish the Soviet RF Standard.

27	Appendix B	320-322	Technical	The basis on which ICNIRP claims there is no strong evidence for an association between EMF and sperm quality is questionable. ORSAA has identified more than 80 papers from *in vitro, in vivo* and human epidemiology studeis that show a strong association between EMF and sperm quality attributes (see the ORSAA database) For example, the cohort study by Zhang (2016), epidemiological studies looking at at radar exposures and fertility (Ding, 2004; Ye, 2007; Yan, 2007), and long term and short term exposure studies showing: ▪ Defective and degenerative testicular function; ▪ Increased oxidative stress; ▪ Atrophy of the seminiferous tubules; ▪ Degenerative changes in the epithelium of the testes; ▪ Reduction of serum testosterone levels; ▪ Reduction in the number of sertoli cells; ▪ Malformed sperm; ▪ Reduced sperm count and quality; ▪ Reduced sperm viability; ▪ Reduced sperm motility; ▪ Increased sperm DNA damage.  Source: ORSAA database 23/05/2017 Many of the above parameters are associated directly with exposure duration. Insert your proposed change. Explain the context of your comment.
28	Appendix B	342	Technical	There are numerous studies showing a non linear dose response relationship. Linear relationships are a simplification. In contrast, biological systems are complex with amplification and feedback mechanisms. Research is suggsting frequency and intensity windows exist and that higher power does not necessarily mean a larger effect. To dismiss evidence because it does not follow a linear dose response is an engieering approach that is inadequte for describing biological systems. Insert your proposed change. Explain the context of your comment.
29	Appendix B	379	Technical	A regular user in the Interphone study was defined as someone who hardly used the phone i.e. at least one call on their cell phone each week for at least 6 months. This classification is not an accurate reflection of regular usage today. Insert your proposed change. Explain the context of your comment.

30	Appendix B	390--392	General	If ICNIRP is looking for increases in cancer incidences aross a large number of countries in order to establish a trend, the doubling in brain tumour rates over the last 20-25 years in the UK, the Netherlands and Denmark (see graph below) should be sufficient.

Brain tumours: rise in Glioblastoma Multiforme incidence in England 1995–2015



Source: Microwave News

Brain tumours: rise in Glioblastoma incidence in Netherlands 1989–2010

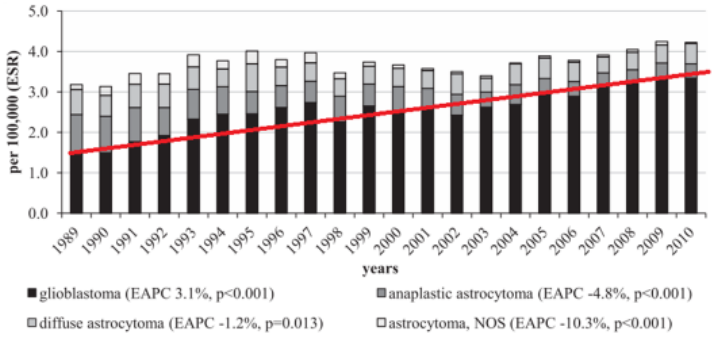
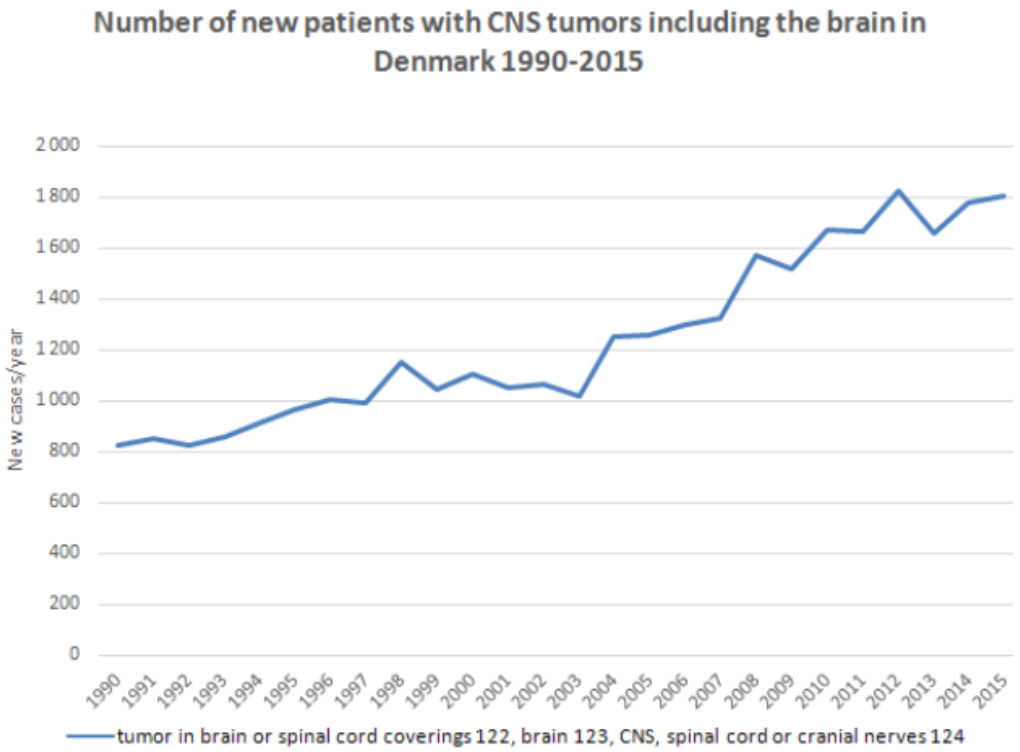


Fig. 1. Age-standardised incidence rates for astrocytic tumours in the Netherlands from 1989 to 2010.

Source: European Journal of Cancer (2014) 50, 2309– 2318

				 Insert your proposed change. Explain the context of your comment.
31	Appendix B	399-401	Technical	This statement is not true. Hocking (1996) found an association between increased childhood leukaemia incidence and mortality in proximity to TV towers. Dode (2011) also found an association between increased neoplasms with proximity to cell towers. Insert your proposed change. Perhaps ICNIRP has not considered older studies which would have already been considered at the time of the original 1998 guidelines.
32	Appendix B	406	Technical	The ORSAA database contains cohort studies showing an association between heavy cell phone usage and acoustic neuroma (schwanomma) as well as Gliobastoma multiforme. There are recent animal studies confirming the same (NTP and Ramazzini), as well as evidence that cell phone radiation damages DNA (a precursor to tumour development). A significant number of papers suggest that RF causes oxidative stress; i.e., free radicals which can damage DNA. Insert your proposed change.

				ORSSA recommends that CNIRP reconsider its claim of *no substantiated effects*. There is sufficient converging evidence, which is all that is required in the scientific arena. ORSAA stresses the importance of understanding that risk management is about potential risks and management of risks; i.e., not waiting for proof of harm (established evidence of harm) which is irresponsible given the size of the human population as well as the diversity of lifeforms being exposed globally to this form of man-made radiation.