

From: Group Concern [REDACTED]
To: panel_itb@legco.gov.hk
Cc: charlesmok@charlesmok.hk

Date: Monday, August 06, 2018 06:39PM

Subject: Fwd: Request for ITB Panel Attention on Excessive Radiation Level in Ho Man Tin

The Hon Mr Charles Peter MOK,
Chairman,
Legislative Council Panel
on Information Technology and Broadcasting

Dear Mr Mok,

Further to our preceding email, we would like to supplement our concerns on the non-ionizing radiation (NIR) level measured in our flats and the problems of the NIR standard adopted in Hong Kong.

The Office of the Communications Authority (OFCA) has measured the NIR level at our flats in July 2018. The maximum reaches some 8 v/m. According to international standards, the radiation level is quite alarming. For instance-

a) According to Building Biology Evaluation Guidelines for RF radiation / HF electromagnetic waves by Institute of Building Biology founded in Germany, the NIR level is already in the category of "Strong Anomaly", that means it is not acceptable for the Building Biology Guidelines, and requires remediation in the short term.

b) According to GB 8702 – 2014 about controlling limits for electromagnetic environment by Ministry of Ecology and Environment of the People's Republic of China, the limit is 12 V/m in the frequency of 30MHz ~ 3000MHz which is a common frequency band width we commonly used for mobile telecommunications daily. Our figures are very close to the limit.

c) According to international *guidelines which are developed based on thousands of home and workplace surveys on the relationships between physical complaints and the various types of electromagnetic radiation, the acceptable radiation level is as follows-*

	Low frequency alternating electric field [Volt per meter (V/m)]	Low frequency alternating magnetic field [nanoTesla (nT)]	High frequency electromagnetic radiation[microwatt per square metre ($\mu\text{W}/\text{m}^2$)]
SBM Target	<1	<20	<0,1
SBM Weak deviation	1-5	20-100	0,1-10
SBM Severe deviation	5-50	100-500	10-1000
SBM Extreme deviation	>50	>500	>1000
IRPA / ICNIRP	5000	200.000	2-10 Million

No matter how hard OFCA defends the Hong Kong standard (i.e. ICNIRP), it cannot address our concerns. The ICNIRP standards are mainly based on acute war effects, which would allow up to one degree of temperature increase. This is far too lenient. Thousands of studies have shown that DNA damage and other biological effects would occur at exposure levels far below the ICNIRP standards.

A detailed study conducted by Starkey in 2016 (Annex A) shows that the ICNIRP guidelines are problematic. In gist, **forty studies demonstrating DNA damage missing**, 40 studies showing that electromagnetic radiation produces free radicals in the body are missing, and 22 studies demonstrating effects on male fertility are ignored. It also emerges that the members of ICNIRP have various conflicts of interest.

Indeed, both the European Parliament (in its resolution 2008/2211(INI)) and the Council of Europe recommend lowering the exposure limits allowed in the ICNIRP guidelines. The Council of Europe in its Opinion of 6 May 2011 on health effects associated with electromagnetic fields (Annex B) **states** :

*“29. The rapporteur underlines in this context that it is **most curious**, to the least, that the applicable official threshold values for limiting the health impacts of extremely low frequency electromagnetic fields and high frequency waves are*

drawn up and proposed to international political institutions (WHO, European Commission, governments) by the ICNIRP, an NGO whose origin and structure are none too clear and which is furthermore suspected of having rather close links with the industries whose expansion is shaped by recommendations for maximum threshold values for the different frequencies of electromagnetic fields.”

“30. If most governments and safety agencies have merely contented themselves with replicating and adopting the safety recommendations advocated by the ICNIRP, this has essentially been for two reasons:

- in order not to impede the expansion of these new technologies with their promise of economic growth, technological progress and job creation;*
- and also because the political decision-makers unfortunately still have little involvement in matters of assessing technological risks for the environment and health.”*

We do not intend to argue on which standard is more representative. Instead, as residents of Ho Man Tin district, we are very worried about the current situation and suffice it to say that our worries are backed up by scientific evidence advocated by international organizations. Indeed, the completion of both Martin Heights and One Homantin, which are just in the opposite of the Football Association HQs, indicates that OFCA should re-assess whether it would allow the Football Association to install some 20+ radio base stations on its rooftop: is it really necessary and is it in the interests of the residents?

We respectfully demand that OFCA should at least direct the relevant telecommunications operators to-

- (a) reduce the transmission power of the RBS;
- (b) adjust the emission angle of the radio base stations to avoid direct irradiation into domestic premises;
- (c) relocate some if not all of the RBS from the roof of Hong Kong Football Association HQs to buildings that are not so close to residential developments;
- (d) reduce the number of RBS on the roof of Hong Kong Football Association HQs; and
- (e) consult the local communities including the Owners Incorporation of both One Homantin and Martin Height when OFCA is prepared to grant additional licences for installing RBS on the roof of Hong Kong Football Association HQs.

We also request your panel to discuss the reply to be

provided by OFCA to prevent it from producing bureaucratic standard replies.

Best regards,
Wong & Ho & Lo & Zhu & Lam

----- Forwarded message -----

From: **Group Concern** [REDACTED]
Date: 2018-07-26 15:36 GMT+08:00
Subject: Request for ITB Panel Attention on Excessive Radiation Level in Ho Man Tin
To: panel_itb@legco.gov.hk
Cc: charlesmok@charlesmok.hk

The Hon Mr Charles Peter MOK,
Chairman,
Legislative Council Panel
on Information Technology and Broadcasting

Dear Mr Mok,

We are a group of residents living in Ho Man Tin. We have recently noticed that there are some 20+ radio base stations (RBS) installed at the roof of the Hong Kong Football Association HQs. The resulting radiation level is alarming.

There are several major buildings around the Hong Kong Football Association HQs, including the Open University of Hong Kong, the Hong Kong Housing Authority HQs, and two residential developments known as One Homantin and Martin Heights.

Having noticed the presence of the RBS, we have requested the Office of the Communications Authority (OFCA) to measure the radiation level of our premises. The measurement showed that the radiation level reached some 8 volt per meter (v/M).

According to Standard of Building Biology Testing Methods and Guidelines 2003, which is adopted by the German telecommunications authority, the figure is already in the category of Strong Anomaly which require immediate remediation. The relevant standard and description are as attached.

We have asked OFCA to consider taking actions but OFCA's replies have been helplessly bureaucratic. OFCA just repeatedly stats that the radio frequency electromagnetic fields generated by RBS are a type of non-ionising radiation (NIR) which cannot cause harm by breaking chemical bonds in the human body.

OFCA officials then keep on repeating that the measurement results are within the acceptable range according to Hong Kong standard as stipulated in “Guidelines for Limiting Exposure to Time-varying Electric, Magnetic, and Electromagnetic Fields”. To add weight to their statement, OFCA officials quote that the Hong Kong standard is adopted having regard to the professional advice of the Department of Health.

These standard replies could not lessen our concerns over radiation level to the slightest extent but to force us to bring this matter in front of you.

The Standard of Building Biology Testing Methods and Guidelines 2003 is an internationally recognized standard. While we understand that Hong Kong may need to adopt a more lenient standard given its population density, the Hong Kong standard is way too lenient and it fails to protect people who needs to stay at the premises round-the-clock, e.g. elderly and infants who have limited mobility. Worst still, the brain development of infants would be severely damaged by the radiation.

We respectfully demand that OFCA should at least direct the relevant telecommunications operators to-

- (a) reduce the transmission power of the RBS;
- (b) adjust the emission angle of the radio base stations to avoid direct irradiation into domestic premises;
- (c) relocate some if not all of the RBS from the roof of Hong Kong Football Association HQs to buildings that are not so close to residential developments;
- (d) reduce the number of RBS on the roof of Hong Kong Football Association HQs; and
- (e) consult the local communities including the Owners Incorporation of both One Homantin and Martin Height when OFCA is prepared to grant additional licences for installing RBS on the roof of Hong Kong Football Association HQs.

We also request your panel to discuss the reply to be provided by OFCA to prevent it from producing bureaucratic standard replies.

Best regards,
Wong & Ho & Lo & & Zhu & Lam

Sarah J. Starkey*

Inaccurate official assessment of radiofrequency safety by the Advisory Group on Non-ionising Radiation

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Abstract: The Advisory Group on Non-ionising Radiation (AGNIR) 2012 report forms the basis of official advice on the safety of radiofrequency (RF) electromagnetic fields in the United Kingdom and has been relied upon by health protection agencies around the world. This review describes incorrect and misleading statements from within the report, omissions and conflict of interest, which make it unsuitable for health risk assessment. The executive summary and overall conclusions did not accurately reflect the scientific evidence available. Independence is needed from the International Commission on Non-Ionizing Radiation Protection (ICNIRP), the group that set the exposure guidelines being assessed. This conflict of interest critically needs to be addressed for the forthcoming World Health Organisation (WHO) Environmental Health Criteria Monograph on Radiofrequency Fields. Decision makers, organisations and individuals require accurate information about the safety of RF electromagnetic signals if they are to be able to fulfil their safeguarding responsibilities and protect those for whom they have legal responsibility.

Keywords: AGNIR; brain; cognition; development; EEG; electromagnetic; fertility; genotoxicity; health; ICNIRP; immune; membranes; misleading; oxidative stress; proteins; Public Health England (PHE); symptoms; tumours; wireless; WHO.

Introduction

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) set international exposure guidelines for radiofrequency (RF) electromagnetic fields in 1998

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(1). Conclusions from subsequent ICNIRP reviews have supported the guidelines. Within the United Kingdom (UK), Public Health England (PHE) commission scientific reviews by the Advisory Group on Non-ionising Radiation (AGNIR) to assess the safety of RF fields. AGNIR reviews, along with PHE in-house assessments of exposures, form the basis of PHE's advice on the safety of RF signals. This guides the UK government, organisations and decision makers when assessing the safety of wireless devices and infrastructure. The latest AGNIR review (2) has also been relied upon by health protection agencies around the world, including the Australian Radiation Protection and Nuclear Safety Agency (3) and Health Canada (4).

The majority of the global population absorb RF radiation on a daily basis from smartphones, tablet computers, body-worn devices, Wi-Fi and Bluetooth transmitters, cordless phones, base stations, wireless utility meters and other transmitters. For public health to be protected, decisions need to be based on accurate information. The AGNIR report is considered here for conflicts of interest and scientific accuracy.

Conflicts of interest

PHE stated, "*The 2012 AGNIR report considered whether there was evidence for health effects occurring in relation to exposures below the ICNIRP levels*" (5). At the time of writing the report, the chairman of AGNIR was also chair of the ICNIRP standing committee on epidemiology. Currently, six members of AGNIR and three members of PHE or its parent organisation, the Department of Health (DH), are or have been part of ICNIRP (Table 1). When the group charged with assessing whether there is evidence of health effects occurring at exposures below current ICNIRP values have members who are responsible for setting the guidelines, it introduces a conflict of interest. How can AGNIR report that the scientific literature contains evidence of harmful effects below the current guidelines when several of them are responsible for those guidelines? PHE provide

the official advice on the safety of wireless signals within the UK, but having members in ICNIRP introduces a conflict of interest which could prevent them from acknowledging adverse effects below ICNIRP guidelines.

PHE (the then Health Protection Agency) responded to the report with “*The Health Protection Agency welcomes this comprehensive and critical review of scientific studies prepared by the independent Advisory Group on Non-ionising Radiation*” (6). The implication was that an independent group had produced the report and presented it to PHE. However, at the time of writing, 43% of those in AGNIR were from PHE or the DH (2) (Table 1). PHE had misleadingly welcomed the report which they were involved in preparing.

Scientific accuracy

The executive summary of the AGNIR report included “*Taken together, these studies provide no evidence of health effects of RF field exposures below internationally accepted guideline levels*” [page 3 of the report (2)] and “*the evidence considered overall has not demonstrated any adverse health effects of RF field exposures below internationally accepted guideline levels*” [page 4 (2)]. Accuracy is vital when most people only read the executive summary and overall conclusions from a 348-page report and national and international public health decisions and exposures

are based on them. These conclusions did not accurately reflect the evidence, as described in examples below.

(a) Studies were omitted, included in other sections but without any conclusions, or conclusions left out; (b) evidence was dismissed and ignored in conclusions; (c) there were incorrect statements. Terms such as ‘convincing’ or ‘consistent’ were used to imply that there was no evidence. Some examples fall into more than one category.

(a) Studies omitted, included in other sections but without any conclusions, or conclusions left out

Only 7 studies were included in the section on reactive oxygen species [ROS; page 94 (2); Figure 1]. These were summarised by “*production of reactive oxygen species (ROS) were increased in some studies, but not others*” [page 106 (2)]. At least a further 30 studies relevant to ROS or the possible resulting damaging state of oxidative stress were included throughout the report, but with no reference to ROS or oxidative stress within the main text for 16 of these (listed in Supplementary Information, SI) and no mention of this subject in any other summaries or conclusions. At least 40 studies were omitted (using AGNIR restriction to the English language; identified from PubMed and EMF-Portal databases or references within the papers; SI). If these had been included, 79% of studies (61 out of 77) would have demonstrated evidence of significantly increased ROS or oxidative stress in response to

Table 1: AGNIR in 2012 and 2016 and membership of ICNIRP, PHE or DH.

AGNIR 2012		AGNIR 2016	
Swerdlow A.J. (Chair)	ICNIRP Chair of standing committee on epidemiology	Swerdlow A.J. (Chair)	formerly ICNIRP
Conney S.W.	DH	Conney S.W.	DH
Coulton L.A.		Coulton L.A.	
Duck F.A.		Duck F.A.	ICNIRP
Feychting M.	ICNIRP	Feychting M.	Vice-Chair ICNIRP
Haggard P.		Haggard P.	
Lomas D.J.		Lomas D.	
Noble D.			
Mann S.M.	HPA	Mann S.M.	ICNIRP, PHE
Maslanyj M.P.	HPA	Maslanyj M.P.	PHE
Meara J.R.	HPA	Meara J.R.	PHE
		O’Hagan J.O.	ICNIRP, PHE
Peyman A.	HPA	Peyman A.	PHE
		Powers H.	
		Rhodes L.	
Rubin G.J.		Rubin G.J.	
Sienkiewicz Z.J.	ICNIRP, HPA	Sienkiewicz Z.J.	ICNIRP, PHE
		Tedstone A.	PHE
		Young A.	

PHE was formerly known as the Health Protection Agency, HPA. PHE is part of the Department of Health, DH.

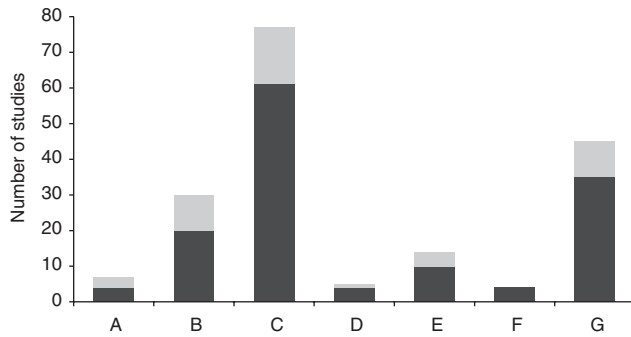


Figure 1: Comparison of the number of studies included in the AGNIR report with those that could have been, for ROS, oxidative stress or male fertility. (A) studies included in the ROS section; (B) studies scattered throughout the report on ROS or oxidative stress (but with no summary or conclusion); (C) studies which could have been included for ROS or oxidative stress; (D) studies included on male fertility in the cellular studies chapter; (E) studies included on male fertility in animal studies; (F) studies included on male fertility in humans (in vivo); (G) studies which could have been included for male fertility. Dark shading indicates evidence of significant increase of ROS or oxidative stress, adverse effect on male fertility or altered male testosterone concentrations in response to a radiofrequency field; light shading indicates no significant increase of ROS or oxidative stress, adverse effect on male fertility or altered male testosterone concentrations. Studies are listed in SI.

RF fields (Figure 1; SI). By only including a few of the available studies, not referring to many scattered throughout the report and not mentioning ROS or oxidative stress in any conclusions or the executive summary, this important area of research was misrepresented. Oxidative stress is a toxic state which can lead to cellular DNA, RNA, protein or lipid damage (7, 8), is accepted as a major cause of cancer (7), as well as being implicated in many reproductive, central nervous system, cardiovascular, immune and metabolic disorders (7–14).

The conclusion for male fertility studies in animals was “A substantial number of studies have investigated the effects of RF fields on testicular function, principally in rats, and most report large, obvious effects. However, these results are largely uninterpretable due to inadequate dosimetry or other shortcomings in the studies, and thus are unsuitable for the purposes of health risk assessment. One well-conducted study reported no effects on testicular function in rats exposed to 848 MHz CDMA signals” [page 191 (2)]. For male fertility in humans (in vivo), it was concluded, “The evidence on the effect of RF fields on sperm quality is still weak and the addition of the two new studies does not allow reliable evaluation of the presence or absence of a health effect. Some suggestive positive results, although not convincing, give justification for

further studies with improved methods. The evidence on effects on male subfertility is very limited, and allows no conclusions”.

At least 22 studies on male fertility were omitted (AGNIR restriction to the English language; identified from PubMed or EMF-Portal databases or references within the papers; listed in SI). Considering those identified as included throughout the report (excluding three subsequently retracted, SI), 78% of studies (18 out of 23) described significant adverse effects on sperm, male reproductive organs or changes in male testosterone concentrations (SI). If the 22 references identified as omitted had also been included, this would have been 35 out of 45, 78% (Figure 1; SI). Isolating small samples of evidence in chapters on cells, animals or humans (Figure 1) may have made it easier to dismiss significant effects on male reproductive health. Inaccurately, in the overall and executive summaries, the evidence for adverse effects on male fertility disappeared: “Despite many studies investigating effects on male fertility, there is no convincing evidence that low level exposure results in any adverse outcomes on testicular function” [page 192 (2)] and for humans, in vivo, “The limited available data on other non-cancer outcomes show no effects of RF field exposure” [page 4 (2)]. The term ‘convincing’ is subjective and can erroneously imply that there is no evidence. The human data on male fertility did not show “no effects of RF field exposure”.

Some studies, mostly those which had tested signals from real mobile devices, were dismissed as uninterpretable because they had not described the dosimetry, the process of determining internal electromagnetic quantities relating to exposure in tissues, in enough detail. Limited descriptions restrict possible interpretations, but do not make them uninterpretable. If the question is ‘do mobile phone signals damage male fertility?’, real phone signals are highly relevant because they allow possible effects of the complex patterns of fields to which humans are exposed to be investigated. ICNIRP only accept thermal effects of RF fields and focus on average energy absorbed. Highly controlled, simulated signals with descriptions of overall specific absorption rates (SARs) are suited to the assessment of temperature rises in cells or tissues. Real signals make it more difficult to measure average energy, but have characteristics which controlled, simulated signals lack. The complex field patterns, with variable peak field strengths and intervals between transmissions, may influence biology in ways that controlled, simulated patterns cannot, but they are not represented by time-averaged, duty factor reductions of described energy absorption. Responses to RF fields can be greater for intermittent exposures than continuous

(15, 16) and depend upon the pulse characteristics for the same average power (17). Effects can be dependent on frequency, modulation, signal strength (intensity windows), durations of exposure and polarisation (18, 19). For the nervous system, complex signals from real devices may modulate neuronal activity, similar to endogenous electric field ephaptic (non-synaptic) coupling in the brain (20). There is evidence that endogenous electric fields feedback to modulate neuronal activity (21). Fields with amplitudes similar to those found in vivo, applied to neocortical brain slices, modulated and entrained neuronal spiking activity (21). Irregular patterns of fields with complex dynamics, which mimicked in vivo fluctuations, entrained neuronal activity more strongly than sine waves (21). There are valid reasons for testing the effects of signals from real mobile devices, and dismissing these limited and misrepresented the evidence.

The summary for neurocognitive effects in humans stated, “*Studies of cognitive function and human performance do not suggest acute effects of exposure to RF fields from mobile phones and base stations*” [page 226 (2)]. But acute detrimental effects on cognition were omitted from the report (22–25) or mentioned in different sections (26–29). Increased errors during a memory task (26), slowed performance (27) or decreased accuracy in a cognitive test (28) were reported in the electroencephalogram (EEG) section [pages 209–213 (2)]; slowed performance in cognitive tests (29) were reported under sleep [page 215 (2)]. Omitting the studies which found effects in the relevant section led to an incorrect conclusion.

For symptoms in humans, “*Sufferers differ in terms of the type of symptoms that they report, the speed with which symptoms develop and the types of electromagnetic field that appear to be problematic*” [page 232 (2)]. Acute provocation studies in humans expose all subjects to the same short electromagnetic signal to see whether they all respond with the same immediate symptoms. If the speed with which symptoms develop and types of trigger differ between individuals, then in a group overall a lack of significance might be expected for identical acute provocations, but this does not mean that some individuals cannot respond to certain fields given adequate exposure durations, intervals between provocations and low background electromagnetic fields, as has been reported (30, 31). The executive summary concluded, “*The evidence suggests that RF field exposures below guideline levels do not cause acute symptoms in humans*” [page 3 (2)], without explaining limitations.

Many of the longer-term observational studies described significant associations of RF exposures with symptoms, albeit with limitations in study designs: “*While*

some, though by no means all, of the studies reviewed above appear to suggest an association between mobile phone use and symptoms...” [page 245 (2)], followed by “*almost all of the studies share a fundamental methodological problem which makes it difficult to draw any firm conclusions from them: these studies relied upon the participants’ own descriptions of their mobile phone usage as the exposure variable for their analysis and on self-description of symptoms while knowing exposure status*” (2). Longer-term studies on symptoms were omitted from the executive summary.

No mention was made of the World Health Organization (WHO) International Agency for Research on Cancer (IARC) classification of RF fields as a possible human carcinogen in 2011, which was based on limited evidence supporting carcinogenicity below ICNIRP guideline values (32).

(b) Evidence dismissed and ignored in conclusions

For in vitro membrane effects, the report showed that all studies included (seventeen (33–49); non-blood-brain barrier (BBB)) described significant responses to RF signals except for one, which had tested extremely high powers, far greater than ICNIRP guidelines, that heated the tissue [250–3600 W/kg time-averaged SAR (50); pages 102 and 103 (2)]. This heating study had reported an effect, an in vitro recoverable decrease in population spike amplitude in the hippocampus in response to the RF signal, but no effect on long-term potentiation (50). The report text also mentioned that Falzone et al. had found no changes to the cell membrane [(51), page 101 (2)], but they had measured markers of apoptosis, programmed cell death, not direct effects on membranes; this paper was not included in the table of studies on membrane effects. The membrane studies were weakly dismissed: “*In general, most studies report finding effects on cell membranes when exposures are made at mobile phone frequencies. However, the effects reported are varied and, although the majority find effects, neither is this unanimous nor does it necessarily provide supporting evidence of a consistent effect. The variety of cellular systems and exposures makes comparisons of the effects on the cell membrane problematic and without independent replication it is difficult to assess the robustness or even the validity of the findings.*” Studies had looked at a range of effects and all, below high power heating, reported significant changes, strengthening the validity of the findings.

For direct effects on proteins, 15 out of 16 studies listed found significant effects of RF fields [pages 103–105 (2); (52–67) effect; (53) no effect]. The conclusion was “*In general, most of the studies that have investigated changes*

in protein function or structure due to exposure to RF fields have found effects. However, at the present time the effects have not been demonstrated to be robust by independent replication; so although the concept of a direct effect of RF field exposure on protein structure is interesting, further research is needed to establish if this is a real phenomenon.” Ninety-four percent of the studies listed on direct effects on proteins, from 14 different groups, found significant effects, but the conclusion was turned around to imply that these may not be real.

“Where replications have been undertaken they do not support the original findings. This continued lack of robust evidence makes the possibility of an effect of RF fields on cells more unlikely” [page 105 (2)]. An effect on cells is not unlikely when there were significant effects in all of the relevant studies on membranes (excluding BBB), all of the studies except one on direct protein effects, the majority of the studies on oxidative stress or male fertility, all of the included in vitro genotoxicity studies on epithelial cells [see c; page 84 (2)] and 47% of in vitro genotoxicity studies which could have been included in the report (see c; SI).

“Studies on cell membranes and direct effects on proteins mostly found effects of RF field exposure. However, no conclusions can be made as there are no common patterns of exposure conditions or types of effects caused by the exposure” [page 106 (2)]. Out of 33 studies on direct effects on proteins or cell membranes, 32 described significant effects of RF signals below high power heating, but these disappeared in the conclusions.

By the end of the report, the conclusion on cellular studies had incorrectly become “There are now several hundred studies in the published literature that have looked for effects on isolated cells or their components when exposed to RF fields. None has provided robust evidence for an effect” [page 318 (2)].

A summary for human brain EEG recordings stated, “the EEG studies published since 2003 do provide some evidence that RF fields could influence brain function, and this should remain an area of interest” [page 226 (2)]. Many EEG studies (awake or asleep subjects) reported changes in electrical field potential oscillations, evoked responses or interhemispheric coupling, but these were dismissed: “it remains unclear whether these RF effects, if they exist, are material to human health or not”. Electrical field potential oscillations can synchronise activity of local networks (21) or propagate signals over large regions, controlling brain developmental processes, including neurogenesis, apoptosis, neuronal migration, differentiation and network formation (68). Oscillations have been linked with active processing or inhibition of cognitive functions (69) and cyclic modulations of neuronal excitability (21).

References available at the time of the report describing behavioural problems (70–72) and changed psychomotor performance (73) associated with pre-natal or childhood RF exposures, cell death and reduced cell numbers in the brain (74–83) and cognitive inhibition (22–29, 78, 79, 84–88) supported the possibility that RF-induced changes in electrical activity could contribute to altered brain development or cognition.

The executive summary included “There has been no consistent evidence of effects on the brain, nervous system or the blood-brain barrier, on auditory function, or on fertility and reproduction” [page 3 (2)]. The term ‘consistent’ dismissed areas for which the majority of studies had found adverse effects, such as male fertility. Of the studies included in the report on pregnancy and development, which quantified effects of pre-natal or early neonatal RF exposures on neuronal cell numbers in the developing brain [pages 184–187 (2)], four found significant decreases: pyramidal cells in the rat hippocampus (74), granule cells in the rat dentate gyrus (75), Purkinje cells in the mouse cerebellum (76) and a transient increase in neurogenesis of the subventricular zone following 8 h of RF exposure over 2 days, but a long-lasting decrease in neurogenesis following a 24 h exposure over 3 days (77), measured from proliferating cells in the rat rostral migratory stream. One study described no effect on neuronal numbers in the mouse hippocampus (89). Whilst not all reported effects, the studies supported RF exposures decreasing neuronal numbers in the brain during pre-natal and early neonatal development at least in some circumstances (74–77). The executive summary misleadingly implied that because not all studies reported the same effects, RF signals have no effect.

The AGNIR report suggested that symptoms in humans may be caused by people’s perception of being exposed, rather than the actual electromagnetic fields [page 246 (2)]. Imagining a signal to be present is unlikely to explain all responses, particularly symptoms reported in response to RF signals under blind or double-blind conditions (30, 31, 90). Many other studies support biological responses being related to the electromagnetic signal, including evidence from cultured cells, in vitro preparations, animals, plants or asleep humans, none of which reacted with significant changes because they imagined that RF signals were present. That living things can respond to low power RF signals is now supported by a large body of research.

(c) Incorrect statements

For child development [page 260 (2)], maternal mobile phone use during pregnancy was associated with

behavioural problems in children at the age of 7 (70, 71) and lower psychomotor performance was described for children of mothers who had the highest mobile phone use during pregnancy (73). The report said, “*these results are only suggestive of an effect, rather than being conclusive evidence of one*”. Increased conduct problems were reported in 8–17-year-olds with the highest quartile of RF exposures (72) [page 250 (2)]. As studies suggested an effect on child development, the executive summary incorrectly stated, “*data on other non-cancer outcomes show no effects of RF field exposure*” [page 4 (2)].

For risks of brain tumours or acoustic neuromas in humans, “*the similar results of all investigators except the Hardell group, with no methodological inferiorities in these other investigators’ studies overall, suggest that the results of the Hardell group are the problematic ones*” [page 308 (2)]. However, some significantly increased risks of brain tumours or acoustic neuromas were described in Hardell and non-Hardell studies [pages 282–306 (2), (91)], although non-Hardell significant data were omitted from the data tables and only mentioned in the text. For example, for gliomas with an ipsilateral mobile phone use of ≥ 1640 cumulative hours (ages 30–59), the international Interphone study reported a significant odds ratio (95% confidence interval) of 1.96 (1.22–3.16) and Hardell et al. reported a significant odds ratio of 2.32 (1.14–4.73) (91). Had the data tables included results for ipsilateral exposures, duration of use and more detail of the pooled Interphone studies, it would have been clearer that significantly increased risks had been reported. “*With no methodological inferiorities in these other investigators’ studies*” was incorrect. The Interphone study did not take cordless phone use into account in the analysis for mobile phones (91); the Danish cohort study misclassified corporate mobile phone users as non-users, as well as those who took subscriptions out after 1995 (92).

The comment in the executive summary, “*the accumulating evidence on cancer risks, notably in relation to mobile phone use, is not definitive, but overall is increasingly in the direction of no material effect of exposure*” [page 4 (2)], was misleading. Significant risks were most common for ipsilateral exposures, latencies of 10 years or more since first use or the highest cumulative hours of use (2), (91). If anything, as use increased, the evidence increasingly pointed towards possible risks.

The executive summary stated for cells in vitro: “*In particular, there has been no convincing evidence that RF fields cause genetic damage or increase the likelihood of cells becoming malignant*” [page 3 (2)] and in the chapter on cellular studies: “*Results from studies using other cell*

types are also contradictory. Epithelial cells exposed to ...” [page 86 (2)]. However, all in vitro studies included on epithelial cells [four, one retracted, page 84 (2), (93–95)], from more than one laboratory, found damage to DNA or chromosomal aberrations in response to RF signals. Forty-six percent of genotoxicity studies identified as included in the report (36 out of 78; SI) described evidence for genotoxicity in response to RF fields, but at least 40 genotoxicity studies were omitted (SI). If these had been included, 52% (61 out of 118) of genotoxicity studies overall and 47% of in vitro (36 out of 76) would have described evidence for genotoxicity (SI; AGNIR restriction to the English language; identified from PubMed and EMF-Portal databases). AGNIR found the genotoxicity evidence unconvincing, but a more accurate conclusion could have been that RF signals appear to be genotoxic under certain circumstances, but not others.

For the immune system [page 174 (2)], a Russian study was included (96), which mostly replicated earlier Russian studies and a French one which did not (97). The conclusion was “*it is clear that the results of the original Soviet studies have not been confirmed*”. It was not clear, as the report also referred to the Russian study with “*These results do not appear to be identical to the original, although they do show the same tendency. Results of ELISA reinforced this conclusion. Grigoriev and colleagues also reported that very few pregnant animals receiving serum from exposed animals gave birth to live animals (4 out of 12), which is also supportive of the previous results*”.

The report described cognitive performance of RF-exposed and sham-exposed Alzheimer’s disease-like transgenic mice (98) [pages 144–147 (2)]. However, there were no shams in the study, as controls were housed in a separate room without a Faraday cage; exposed mice (two 1 h exposures per day, 918 MHz, SAR 0.25 W/kg) were continuously housed within a Faraday cage for up to 9 months (98). Cognitive improvements in the exposed groups compared to controls may have been the result of long-term protection from environmental electromagnetic fields by the Faraday cage. Because background man-made electromagnetic fields may alter experimental results and are often present in experimental environments, they ought to be described in the Methods section for all biological studies, but are often omitted, as in this paper. The AGNIR report conclusions [page 318 (2)] described this as a well-performed study, whilst other effects of RF signals on cognition were dismissed as inconsistent. Varied responses might indicate dependency upon physiological or experimental conditions and do not automatically justify ignoring evidence.

Conclusions

Decisions about involuntary, continuous and widespread RF exposures in schools, hospitals, workplaces and public and private spaces in the UK and around the world have been made based upon inaccurate conclusions of the AGNIR report. Published in 2012, it continues to be used to justify RF exposures and dismiss concerns about possible adverse effects on health, well-being or development.

The denial of the existence of adverse effects of RF fields below ICNIRP guidelines in the AGNIR report conclusions is not supported by the scientific evidence. Studies have, as described as examples in this review, reported damage to male reproductive health, proteins and cellular membranes, increased oxidative stress, cell death and genotoxicity, altered electrical brain activity and cognition, increased behavioural problems in children and risks of some cancers. For future official RF reports, it is important to check that conclusions accurately reflect available evidence before decisions which impact on public health are made based on the executive summary and overall conclusions.

The involvement of ICNIRP scientists in the misleading report calls into question the basis and validity of the international exposure guidelines. To protect public health, we need accurate official assessments of whether there are adverse effects of RF signals below current international ICNIRP guidelines, independent of the group who set the guidelines.

The anticipated WHO Environmental Health Criteria Monograph on Radiofrequency Fields, due in 2017, is being prepared by a core group and additional experts (99), with 50% of those named, being, or having been, members of AGNIR or ICNIRP (Table 2). Considering the importance of the Monograph for worldwide public health and the inaccuracies described here, independence from AGNIR would increase confidence in the report findings. Independence from ICNIRP is necessary to remove the conflict of interest when effects below ICNIRP exposure guidelines are being assessed.

Schools, hospitals, employers, organisations and individuals have legal responsibilities to safeguard the health, safety, well-being and development of children, employees and members of the public. But they are unable to fulfil their legal responsibilities when they have been provided with inaccurate information and the evidence of possible harm has been covered up.

Individuals and organisations who/that have made decisions about the often compulsory exposures of others to wireless RF communication signals may be unaware of the physical harm that they may have caused, and may

Table 2: Named contributors to the WHO Environmental Health Criteria Monograph on Radiofrequency Fields [(99), in preparation] and membership of ICNIRP or AGNIR.

Core group	
Feychting M.	Vice-Chair ICNIRP, AGNIR
Mann S.M.	ICNIRP, AGNIR
Oftedal G.	ICNIRP
van Rongen E.	Chair ICNIRP
Scarfi M.R.	
Zmirou D.	
Additional experts	
Aicardi G.	
Challis L.	Formerly AGNIR
Curcio G.	
Hug K.	
Juutilainen J.	ICNIRP
Lagorio S.	
Loughran S.	ICNIRP
Marino C.	ICNIRP
McNamee J.	
Naarala J.	
Peyman A.	AGNIR
Rööslä M.	ICNIRP
Rubin G.J.	AGNIR
Schoemaker M.	
Selmaoui B.	
de Sèze R.	ICNIRP
Sienkiewicz Z.J.	ICNIRP, AGNIR
Simko M.	
Vijaylaxmi	
Zeni O.	

still be causing, because they have not been accurately informed of the risks. This has been a safeguarding failure and the health of some children or adults may have been damaged as a result. To prevent further possible harm, restrictions on exposures are required, particularly for children, pregnant women and individuals with medical conditions. All children in schools and care environments need protection from the potential harmful effects of RF exposures and not, as is now often the case, a compulsory use of wireless devices in the classroom. Children may unjustly face losing their human right to an education if they do not want to absorb RF fields every day at school and no alternative environments are available. Attention also needs to be given to the provision of safe working environments for employees and safe public spaces, particularly where exposures are involuntary.

PHE and AGNIR had a responsibility to provide accurate information about the safety of RF fields. Unfortunately, the report suffered from an incorrect and misleading executive summary and overall conclusions,

inaccurate statements, omissions and conflict of interest. **Public health and the well-being of other species in the natural world cannot be protected when evidence of harm, no matter how inconvenient, is covered up.**

Conflict of interest statement: The author states no conflict of interest.

Ethical approval: The conducted research is not related to either human or animal use.

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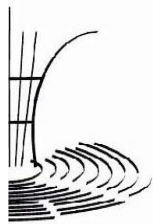
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The potential dangers of electromagnetic fields and their effect on the environment

Report¹

Committee on the Environment, Agriculture and Local and Regional Affairs

Rapporteur: Mr Jean HUSS, Luxembourg, Socialist Group

Summary

The potential health effects of the very low frequency of electromagnetic fields surrounding power lines and electrical devices are the subject of ongoing research and a significant amount of public debate. While electrical and electromagnetic fields in certain frequency bands have fully beneficial effects which are applied in medicine, other non-ionising frequencies, be they sourced from extremely low frequencies, power lines or certain high frequency waves used in the fields of radar, telecommunications and mobile telephony, appear to have more or less potentially harmful, non-thermal, biological effects on plants, insects and animals, as well as the human body when exposed to levels that are below the official threshold values.

One must respect the precautionary principle and revise the current threshold values; waiting for high levels of scientific and clinical proof can lead to very high health and economic costs, as was the case in the past with asbestos, leaded petrol and tobacco.

A. Draft resolution²

1. The Parliamentary Assembly has repeatedly stressed the importance of states' commitment to preserving the environment and environmental health, as set out in many charters, conventions, declarations and protocols since the United Nations Conference on the Human Environment and the Stockholm Declaration (Stockholm, 1972). The Assembly refers to its past work in this field, namely [Recommendation 1863](#) (2009) on environment and health, [Recommendation 1947](#) (2010) on noise and light pollution, and more generally, [Recommendation 1885](#) (2009) on drafting an additional protocol to the European Convention on Human Rights concerning the right to a healthy environment and [Recommendation 1430](#) (1999) on access to information, public participation in environmental decision-making and access to justice – implementation of the Aarhus Convention.

¹ Reference to the committee: [Doc. 11894](#), Reference 3563 of 29 May 2009.

² Draft resolution adopted unanimously by the committee on 11 April 2011.

2. The potential health effects of the very low frequency of electromagnetic fields surrounding power lines and electrical devices are the subject of ongoing research and a significant amount of public debate. According to the World Health Organisation, electromagnetic fields of all frequencies represent one of the most common and fastest growing environmental influences, about which anxiety and speculation are spreading. All populations are now exposed to varying degrees of electromagnetic fields, the levels of which will continue to increase as technology advances.

3. Mobile telephony has become commonplace around the world. This wireless technology relies upon an extensive network of fixed antennas, or base stations, relaying information with radio frequency signals. Over 1.4 million base stations exist worldwide and the number is increasing significantly with the introduction of third generation technology. Other wireless networks that allow high-speed internet access and services, such as wireless local area networks, are also increasingly common in homes, offices and many public areas (airports, schools, residential and urban areas). As the number of base stations and local wireless networks increases, so does the radio frequency exposure of the population.

4. While electrical and electromagnetic fields in certain frequency bands have wholly beneficial effects which are applied in medicine, other non-ionising frequencies, be they sourced from extremely low frequencies, power lines or certain high frequency waves used in the fields of radar, telecommunications and mobile telephony, appear to have more or less potentially harmful, non-thermal, biological effects on plants, insects and animals as well as the human body even when exposed to levels that are below the official threshold values.

5. As regards standards or threshold values for emissions of electromagnetic fields of all types and frequencies, the Assembly recommends that the ALARA or "as low as reasonably achievable" principle is applied, covering both the so-called thermal effects and the athermic or biological effects of electromagnetic emissions or radiation. Moreover, the precautionary principle should be applicable when scientific evaluation does not allow the risk to be determined with sufficient certainty, especially given the context of growing exposure of the population, including particularly vulnerable groups such as young people and children, which could lead to extremely high human and economic costs of inaction if early warnings are neglected.

6. The Assembly regrets that, despite calls for the respect of the precautionary principle and despite all the recommendations, declarations and a number of statutory and legislative advances, there is still a lack of reaction to known or emerging environmental and health risks and virtually systematic delays in adopting and implementing effective preventive measures. Waiting for high levels of scientific and clinical proof before taking action to prevent well-known risks can lead to very high health and economic costs, as was the case with asbestos, leaded petrol and tobacco.

7. Moreover, the Assembly notes that the problem of electromagnetic fields or waves and the potential consequences for the environment and health has clear parallels with other current issues, such as the licensing of medication, chemicals, pesticides, heavy metals or genetically modified organisms. It therefore highlights that the issue of independence and credibility of scientific expertise is crucial to accomplish a transparent and balanced assessment of potential negative impacts on the environment and human health.

8. In light of the above considerations, the Assembly recommends that the member states of the Council of Europe:

8.1. in general terms:

8.1.1. take all reasonable measures to reduce exposure to electromagnetic fields, especially to radio frequencies from mobile phones, and particularly the exposure to children and young people who seem to be most at risk from head tumours;

8.1.2. reconsider the scientific basis for the present electromagnetic fields exposure standards set by the International Commission on Non-Ionising Radiation Protection, which have serious limitations and apply "as low as reasonably achievable" (ALARA) principles, covering both thermal effects and the athermic or biological effects of electromagnetic emissions or radiation;

8.1.3. put in place information and awareness-raising campaigns on the risks of potentially harmful long-term biological effects on the environment and on human health, especially targeting children, teenagers and young people of reproductive age;

8.1.4. pay particular attention to "electrosensitive" persons suffering from a syndrome of intolerance to electromagnetic fields and introduce special measures to protect them, including the creation of wave-free areas not covered by the wireless network;

- 8.1.5. in order to reduce costs, save energy, and protect the environment and human health, step up research on new types of antennas and mobile phone and DECT-type devices, and encourage research to develop telecommunication based on other technologies which are just as efficient but have less negative effects on the environment and health;
- 8.2. concerning the private use of mobile phones, DECT phones, WiFi, WLAN and WIMAX for computers and other wireless devices such as baby phones:
- 8.2.1. set preventive thresholds for levels of long-term exposure to microwaves **in all indoor areas**, in accordance with the precautionary principle, not exceeding 0.6 volts per metre, and in the medium term **to reduce it to 0.2 volts per metre**;
- 8.2.2. undertake appropriate risk-assessment procedures for all new types of device prior to licensing;
- 8.2.3. **introduce clear labelling indicating the presence of microwaves or electromagnetic fields**, the transmitting power or the specific absorption rate (SAR) of the device and any health risks connected with its use;
- 8.2.4. raise awareness on potential health risks of DECT-type wireless telephones, baby monitors and other domestic appliances which emit continuous pulse waves, if all electrical equipment is left permanently on standby, and recommend the use of wired, fixed telephones at home or, failing that, models which do not permanently emit pulse waves;
- 8.3. concerning the protection of children:
- 8.3.1. develop within different ministries (education, environment and health) **targeted information campaigns aimed at teachers, parents and children** to alert them to the specific risks of early, ill-considered and prolonged use of mobiles and other devices emitting microwaves;
- 8.3.2. **ban all mobile phones, DECT phones or WiFi or WLAN systems from classrooms and schools**, as advocated by some regional authorities, medical associations and civil society organisations;
- 8.4. concerning the planning of electric power lines and relay antenna base stations:
- 8.4.1. introduce town planning measures to keep high-voltage power lines and other electric installations at a safe distance from dwellings;
- 8.4.2. apply strict safety standards for sound electric systems in new dwellings;
- 8.4.3. reduce threshold values for relay antennas in accordance with the ALARA principle and install systems for comprehensive and continuous monitoring of all antennas;
- 8.4.4. determine the sites of any new GSM, UMTS, WiFi or WIMAX antennas not solely according to the operators' interests but in consultation with local and regional government officials, local residents and associations of concerned citizens;
- 8.5. concerning risk assessment and precautions:
- 8.5.1. make risk assessment more prevention oriented;
- 8.5.2. improve risk-assessment standards and quality by creating a standard risk scale, making the indication of the risk level mandatory, commissioning several risk hypotheses and considering compatibility with real life conditions;
- 8.5.3. pay heed to and protect "early warning" scientists;
- 8.5.4. formulate a human rights oriented definition of the precautionary and ALARA principles;
- 8.5.5. increase public funding of independent research, *inter alia* through grants from industry and taxation of products which are the subject of public research studies to evaluate health risks;

- 8.5.6. create independent commissions for the allocation of public funds;
- 8.5.7. make the transparency of lobby groups mandatory;
- 8.5.8. promote pluralist and contradictory debates between all stakeholders, including civil society (Aarhus Convention).

B. Explanatory memorandum by Mr Huss, rapporteur

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1. Introduction

1. Electromagnetic fields, whether emitted by high-voltage lines, domestic appliances, relay antennas, mobile telephones or other microwave devices, are increasingly present in our techno-industrial environment.

2. Obviously, in evolutionary terms, living or working in artificial electromagnetic extremely low frequency and high frequency fields, on top of the electromagnetic fields naturally occurring in the environment, is still a relatively new experience for human beings, fauna and flora. It goes back no further than fifty years or so, when intensive industrial and domestic exposure began with radars, radio waves and televisions and electromagnetic fields generated by high-voltage lines and household electrical appliances.

3. It was only from the 1990s onwards that the new telephony and wireless mobile communication technologies began to boom ever faster Europe-wide and even worldwide thanks to increasingly diverse and sophisticated applications: mobile telephones, cordless telephones, WiFi, WLAN (wireless local area network), etc.

4. The term "electromagnetic fields" covers all the fields emitted by natural and man-made sources. A distinction is drawn between static fields and alternating fields. In the latter case there is essentially a differentiation between extremely low frequency (ELF) fields, such as domestic electricity, and hyper-frequency (HF) fields, which include mobile telephones. Electrical fields are measured in volts per metre (v/m), whereas magnetic fields are measured in terms of current-induced exposure in microteslas (μT). Since very weak electrical currents are part of human physiology, at the level of communication between cells for example, the question of the possible disruptive effects of present levels of artificial exposure on the human environment and any consequences they might have for health may legitimately be raised.

5. It should be noted with satisfaction that a major contribution was made by the technological innovations resulting from electrification and new radio-telecommunication techniques to economic growth and the material well-being of the populations of industrialised countries. Domestic appliances, for example, have greatly helped to lighten the load from everyday chores in millions of households and played a not inconsiderable role in the women's liberation movement.

2. Background to the debate

6. Nevertheless, it must be said that, since some of these new technologies were first introduced, environmental or health problems have emerged and become a topic of discussion in certain countries, both in scientific circles and in the field of health and occupational medicine. From the 1930s onwards, radar waves were linked to certain "microwave syndromes" among operators and technicians subjected to intensive and prolonged exposure. The former USSR and Eastern bloc countries adopted very low preventive thresholds aimed at protecting operators' health.

7. In the United States and western Europe, discussion of potential harm to health resulting from electromagnetic fields focused, in the 1970s and 1980s, essentially on the problem of high- or very high-voltage lines and protection in the workplace (for those working on computers, in electrically powered steelworks, etc). As far as the risks from high-voltage lines are concerned, an American epidemiological study (Wertheimer and Leeper, 1979) demonstrated a link between the proximity of high-voltage lines and child leukaemia, corroborated in 2001 by the International Agency for Research on Cancer (IARC), which classified these fields as "possibly carcinogenic to humans" (category 2B). At the same time, from the early 1980s onwards, another issue relating to electromagnetic fields and chemical pollution was raised at international conferences: discomforts due to office computer screens, health effects in the form of headaches, fatigue and eye and skin problems. Regarding the electromagnetic aspect of those effects, stringent preventive standards (TCO standards) were proposed at the beginning of the 1990s by the Swedish Confederation of Employees and then widely adopted.

8. The 1990s saw a boom in mobile telephony and its rapid expansion, first in the industrialised countries and then increasingly in the developing countries of Africa, Asia and Latin America.

9. Mobile telephony and ever more sophisticated wireless telecommunication applications have not only been taken on board in professional spheres but have also quite literally invaded our private life. This affects even very young children, at home, at school, on transport, etc.

3. Growing concerns in Europe

10. However, for a good ten years or so, Europe's populations have begun to show increasing concern over the potential health risks of mobile telephony, with reliable information on these questions in short supply. In a recent Eurobarometer study (European Commission), 48% of Europeans stated that they were concerned or very concerned over the potential health risks posed by mobile telephony. The presumption of risk was noted among 76% of Europeans concerning relay antennas and 73% concerning the potential effects of mobile telephones respectively.

11. Such concerns over electromagnetic fields or waves have triggered the emergence and growth of a multitude of citizens' initiatives in many countries. These initiatives are mostly directed against the installation of relay antenna stations, above all close to schools, nurseries, hospitals or other institutions caring for children or vulnerable individuals, and also increasingly challenge other aspects of wireless telecommunication such as WiFi in schools for example.

12. The Committee on the Environment, Agriculture and Local and Regional Affairs organised two hearings with experts on 17 September 2010 and 25 February 2011.

13. At the first hearing of experts, Mr Ralph Baden of the Occupational Medicine Department of the Ministry of Health of the Grand-Duchy of Luxembourg spoke generally about the issue of very low frequency and high frequency electromagnetic fields and waves and the respective applicable threshold values. He listed the different sources of those electromagnetic fields outside dwellings: relay antennas, high-voltage lines, radio stations, television, radars, etc, but laid special emphasis on the results of measurement readings, on sources of such fields in homes or public buildings and provided concrete examples of simple and practical means of reducing exposure to these "indoor" fields and eliminating certain health problems, such as headaches, insomnia, coughs, depression, etc.

4. Effects on the environment: plants, insects, animals

14. At the same hearing of experts, Dr Ulrich Warnke of the Institute of Technical Biology and Bionics in Saarbrücken described the biological effects of certain microwave frequencies on plants. Depending on the frequencies, their intensity and modulation and the length of exposure, scientific studies demonstrated stress reactions and disruptions of gene expression. Recent studies by the cellular biology laboratory of Clermont-Ferrand University (2007), for example, clearly show the effects of mobile telephony microwaves on plant genes, in particular tomato plants.

15. Other scientific international studies show comparable stress reactions in certain types of beans, as well as deciduous and coniferous trees exposed to various frequencies (relay antennas, TETRA frequency).

16. Dr Warnke highlighted the innate magnetic compass used by certain animals or insects to orient themselves in time and space and which dictates the internal functioning of their organism, before going on to demonstrate how extremely weak artificial fields or waves could adversely affect the sense of direction, navigation and communication of certain animals or insects: migratory birds, pigeons, certain kinds of fish (sharks, whales, rays) or certain insects (ants, butterflies and especially bees). He suggested that malfunctions induced by artificial electromagnetic waves might be one of the major causes – besides problems of exposure to chemicals – of repeated incidents of whales being washed up on beaches or the death or disappearance of bee colonies (colony collapse disorder) observed in past years.

17. The great multitude of scientific studies quoted during the hearing of experts should certainly prompt policymakers to reflect on their decisions and act accordingly. One final aspect mentioned during the hearing concerned the potentially pathogenic effects observed in livestock – calves, cows, horses, geese, etc. – following the installation of mobile telephone masts nearby: unaccountable deformities of new-born calves, cataracts, fertility problems.

18. In the face of fast-growing concerns and opposition in many Council of Europe member states, the response of top executives of electricity companies and mobile telephone operators is to deny that their industrial and commercial activities have any adverse effect on human health. At the hearing in Paris on 25 February 2011, the official representatives of French and European mobile telephone operators passionately argued that the official threshold values applicable in most countries in the world were adequate to protect human beings from the thermal effects of mobile telephones and that any biological effects, if these could be demonstrated, would not have any adverse effects on human health.

19. To back up their argument, the experts quoted the scientific assessments carried out by associations such as the International Committee on Non-Ionisation Radiation Protection (ICNIRP), a small private NGO near Munich, or by official organisations: the World Health Organization, the European Commission and a number of national protection agencies. It appears that these European and national organisations or international bodies have based their thinking on the threshold values and recommendations advocated by the ICNIRP when that private association was set up near Munich at the beginning of the 1990s.

20. Yet, at the same hearing, leaders of associations of citizens and representatives of the NGOs such as "Robin des toits", laid heavy emphasis on the numerous risks and harmful biological effects and related health problems which they believed to be linked to electromagnetic fields or waves from mobile telephony, relay antennas, high-voltage lines and other artificially generated electromagnetic fields, even at very low levels that were well below the officially applicable threshold values.

21. The representative of the European Environment Agency in Copenhagen, an official advisory body to the European Union, stressed the importance of the precautionary principle written into the European treaties and accordingly pointed to the need for effective preventive measures to protect human health and avoid painful health issues or scandals of the kind already experienced over asbestos, tobacco smoking, lead and PCBs (polychlorobiphenyls), to name but a few. He presented a convincing analysis of the scientific assessment methods currently used and the different levels of evidence to conclude, on the basis of the "Bioinitiative" scientific report and other more recent studies by the Ramazzini Institute in Bologna, that the indices or levels of proof were sufficient at this stage to prompt action by governments and international bodies.

22. Finally, another expert specialising in clinical medicine and oncology confirmed, on the basis of the findings of biological and clinical analysis of several hundred French patients describing themselves as "electrosensitive", that a syndrome of intolerance to electromagnetic fields (SIEMF) does exist and that those people are not feigning illness or suffering from psychiatric disorders.

5. Biological effects of electromagnetic fields in medicine

23. It has been established since the beginning of the 20th century that electromagnetic fields operating at various frequencies can have useful and beneficial effects in clinical medicine, whether for diagnosis or treatment.

24. Scientific developments since the Second World War have revealed that the human organism does not function solely on the basis of biological or biochemical cellular reactions but that humans are also electromagnetic beings. It is now well known that nerve cells communicate between one another using electrical impulses. The most powerful electrical signals detected in humans are those generated

by nervous and muscular activity. In the case of the heart, which is the most important muscle group in the body, cardiac functioning is medically diagnosed by recording the electrical signals emitted by it (electrocardiogram – ECG). Again at the level of diagnosis, electroencephalography (EEG) allows non-invasive monitoring of the brain's electrical activity. The EEG has been widely used in the clinical areas of brain disorders, sleep pattern monitoring or confirmation of clinical death.

6. Therapeutic use of electric currents or electromagnetic waves

25. Without going into detail, the rapporteur wishes to point out that certain electrical currents or electromagnetic waves used at certain frequencies may have a perfectly beneficial effect in medical terms. There are a number of examples illustrating the therapeutic benefits of electrotherapy: clinical effects of direct electric currents (electrolysis), clinical effects of external electrical impulses on the cardiac muscle (defibrillators, pacemakers), clinical effects of micro-currents generated by pulsed magnetic fields to improve healing in tissue repair and bone fractures, to mention only the best known of these non-ionising frequency band applications.

26. But while electrical and electromagnetic fields in certain frequency bands have fully beneficial effects, other non-ionising frequencies, be they sourced from extremely low frequencies, power lines or certain high frequency waves used in the fields of radar, telecommunications and mobile telephony, appear to have more or less potentially harmful biological effects on plants, insects and animals as well as the human body even when exposed to levels that are below the official threshold values.

7. Technological progress and economic growth at the expense of environment and health protection

27. It should be noted that the problem of electromagnetic fields or waves and the potential consequences for the environment and health has clear parallels with other current issues, such as the licensing of chemicals, pesticides, heavy metals or genetically modified organisms (GMOs), to mention only the best known examples. It is certain that one cause of public anxiety and mistrust of the communication efforts of official safety agencies and governments lies in the fact that a number of past health crises or scandals, such those involving asbestos, contaminated blood, PCBs or dioxins, lead, tobacco smoking and more recently H1N1 flu were able to happen despite the work or even with the complicity of national or international agencies nominally responsible for environmental or health safety.

28. Indeed, it is in this connection that the Committee on the Environment, Agriculture and Local and Regional Affairs is currently working on the question of conflicts of interest and the urgent need for real independence of scientists involved in the official agencies tasked with evaluating the risks of products prior to licensing.

29. The rapporteur underlines in this context that it is most curious, to say the least, that the applicable official threshold values for limiting the health impact of extremely low frequency electromagnetic fields and high frequency waves were drawn up and proposed to international political institutions (WHO, European Commission, governments) by the ICNIRP, an NGO whose origin and structure are none too clear and which is furthermore suspected of having rather close links with the industries whose expansion is shaped by recommendations for maximum threshold values for the different frequencies of electromagnetic fields.

30. If most governments and safety agencies have merely contented themselves with replicating and adopting the safety recommendations advocated by the ICNIRP, this has essentially been for two reasons:

- in order not to impede the expansion of these new technologies with their promise of economic growth, technological progress and job creation;
- and also because the political decision-makers unfortunately still have little involvement in matters of assessing technological risks for the environment and health.

31. With regard to the frequently inconclusive if not contradictory findings of scientific research and studies on the possible risks of products, medicines or, in this case, electromagnetic fields, a number of comparative studies do seem to suggest a fairly strong correlation between the origin of their funding – private or public – and the findings of risk assessments, a manifestly unacceptable situation pointing to conflicts of interest which undermine the integrity, the genuine independence and the objectivity of scientific research.

32. Concerning the assessment of health risks resulting from mobile telephone radio frequencies, for example, in 2006 Swiss researchers from Bern University presented the findings of a systematic

analysis of all research results and concluded that there was a strong correlation between how the research was funded and the results obtained: 33% of studies funded by industrial concerns conclude that exposure to mobile telephone radio frequencies has an effect on our organism. That figure rises to over 80% in studies carried out with public funding.

33. Accordingly, in this field and in others, one should call for genuine independence on the part of the expert appraisal agencies and for independent, multidisciplinary and properly balanced expert input. There must no longer be situations where whistleblowers are discriminated against and renowned scientists with critical opinions are excluded when experts are selected to sit on expert committees or no longer receive funding for their research.

8. Contending forces and arguments: the dispute over the incidence of biological effects and over threshold values

34. It seems obvious that the prime considerations for societies dependent on electricity, mobile telephony and telecommunication are the economic and financial parameters, hence profits and market shares. Understandably, in this context more stringent regulations and threshold values which ostensibly inhibit their business dealings are viewed with disfavour and forcefully resisted – as could be seen from the irritated and sometimes emotional statements of a representative of French mobile telephony at our committee's hearing for contrastive expert opinion.

35. The representatives of mobile telephony have for years espoused the same paradigm and the same line of argument, in which they invoke the soothing discourse of most international agencies and institutions. For example, the threshold values of 100 microtesla for low or high frequency electromagnetic fields and 41/42 volts/metre for the very high frequencies of mobile telephony on 900 megahertz (MHz) are claimed to be quite adequate for protecting the public against thermal effects. At very high levels, the radio frequency fields are plainly liable to produce harmful thermal effects on the human body, in the estimation of all parties moreover.

36. Of course there remains the very vexed question whether there are non-thermal or athermic, hence biological, consequences for the environment and the human body. The operators' representatives totally deny the existence of nefarious long-term biological effects for electromagnetic fields below the threshold values in force. To illustrate the nature and extent of these threshold values, let us mention by way of an example Article 5.1 of Directive 2004/40/EC of the European Parliament and of the Council of 29 April 2004 concerning the minimum standards for protecting workers: "... However, the long-term effects, including possible carcinogenic effects due to exposure to time-varying electric, magnetic and electromagnetic fields for which there is no conclusive scientific evidence establishing a causal relationship, are not addressed in this Directive. ..." (Introduction, paragraph 4).

37. So the protection of workers is only valid for averting thermal effects, and only in the short term!

38. Any potentially harmful biological effects are disregarded by the operators, agencies and official regulations, and to justify this attitude they abide by the contention that firstly, the ascertainment of a biological effect need not signify its being of a pathological character dangerous to the human constitution. Furthermore, they discern no absolutely conclusive scientific evidence of a cause and effect relationship between electromagnetic fields and radio frequencies and long-term pathological consequences of their non-thermal or athermic effects. And to emphasise these statements they invoke numerous scientific publications said to indicate no significant biological effect.

39. The operators' arguments on the whole can be summed up as follows:

- The threshold values recommended by the ICNIRP are values ensuring health security;
- Child mobile phone users are no more sensitive than adults;
- There are no significant biological effects apart from thermal effects;
- If there were any possibly harmful biological effects, moreover, there would be no scientifically acceptable mechanism of action to account for them.

9. Scientific studies and arguments pursued by associations and NGOs, by groupings of scientists, by the European Environment Agency and by the European Parliament

40. Serious scientific and medical studies revealing biological effects of a pathological nature have existed since the 1930s concerning radio frequencies and microwaves from radar installations. It also points out that harmful effects of protracted exposure to the low or very low frequency electromagnetic

fields of electrical transmission lines or computer screens were observed already in the late 1970s, and the WHO's IARC (International Agency for Research on Cancer) classified these fields as "possibly carcinogenic" for humans (Group 2B) in 2001.

41. The rapporteur recalls the proven positive biological effects of certain medical applications (electrotherapies) of electromagnetic fields and microwaves at very low intensity. If there are such beneficial effects in certain frequency bands, then adverse biological effects on the human body should be just as much in the realm of plausibility or possibility.

42. Scientific studies concerning the negative effects of certain microwave frequencies on plants, insects and wildlife or farm animals are disturbing in more than one respect, and the scientific studies disclosing potentially pathogenic biological effects on the human body are also important and not to be merely brushed aside.

43. These studies are very numerous indeed: the 2007 "Bioinitiative" report analysed over 2 000 of them, and more were added by an important monograph published in 2010 by the Ramazzini Institute, the national institute for study and control of cancer and environmental diseases "Bernardo Ramazzini" in Bologna, Italy.

44. A significant number of top scientists and researchers have banded together in a dedicated international body entitled ICEMS, "International Commission for Electromagnetic Safety", in order to carry out independent research and recommend that the precautionary principle be applied in the matter. In 2006 (Benevento Resolution) and 2008 (Venice Resolution), these scientists published instructive resolutions calling for the adoption of far tougher new safety standards and rules.

45. Scientific studies disclose athermic or biological effects of electromagnetic fields or waves on cells, the nervous system, genetics, etc., which essentially fall into three categories: biological effects influencing the metabolism, sleep, the electrocardiogram profile; effects observed in experimentation on animals or in cell cultures (in vitro); effects emerging from epidemiological studies on prolonged use of mobile telephones or on living near high voltage power lines or base stations of relay antennas.

46. The term "biological effect" is used to refer to a physiological, biochemical or behavioural change brought about in a tissue or a cell in response to an external stimulus. Not every biological effect necessarily poses a serious threat to health; it may simply show the normal response of the cell, tissue or organism to that stimulus.

47. A medical or pathological biological effect, on the other hand, is an effect that may imperil the organism's normal functioning by causing more or less severe symptoms or pathologies. Precisely, a growing number of scientific studies made by teams of high-level academic researchers demonstrate the existence of potentially or definitely pathological biological effects.

48. The rapporteur acknowledges that it is not possible within the compass of this report to analyse and summarise the findings of all these studies. A synopsis of the greater number of them (some 2 000) was produced in the "Bioinitiative" report, a report drawn up by 14 scientists of international standing who concurred, regarding mobile telephony and other radio frequencies, as to abnormally high incidence of brain tumours and acoustic neuroma, effects on the nervous system and cerebral functions, and effects on genes, cell stress proteins and the immune system. In this context, it has been observed for instance that radio frequency exposure can cause inflammatory and allergic reactions and impair the immune function even at levels well below the norms of exposure for the public.

49. A major programme of research into the specific features of these effects such as genotoxicity of waves (REFLEX programme), funded by the European Commission and involving 12 European research teams, was launched and the results were made public in December 2004. The conclusions of the report were disturbing on several counts as the results bore out genotoxic effects of mobile telephone waves, and in particular greater frequency of chromosomal deletions and breakup of DNA molecules in different types of cultivated human and animal cells. In addition, stress protein synthesis was greatly increased and gene expression was modified in various types of cells.

50. Concerning the Interphone study, the biggest epidemiological survey carried out on mobile phone users and their exposure to glioma, meningioma, acoustic neuroma and tumours of the parotid gland after protracted use of their mobile telephones, the partial early results published on 18 May 2010 by IARC more than ten years after the commencement of the study point to profound disagreement between the different teams of researchers (16 teams from 13 countries) over the interpretation of these results. The study co-ordinator, Ms Elisabeth Cardis, summed up a kind of compromise by saying that the study did not reveal an increased risk, but one could not conclude that there was no risk because there were sufficient results suggesting a possible risk. Indeed, some results show that lasting intensive

use very significantly increases the risks of glioma (40% and even 96% looking at ipsilateral use, that is to say where the glioma has appeared at the side of the head to which the telephone was held) and the meningioma risks (15%; 45% for ipsilateral use).

51. The rapporteur feels that one of this epidemiological study's principal weaknesses lies in the fact that the period of mobile phone use analysed, extending until the early years of the 21st century, is probably too short at less than 10 years to reach altogether conclusive results given the period of latency and growth of cerebral tumours. In fact, ionising radiation (radioactivity) is recognised as a cause of brain cancer, but cases due to radioactivity rarely become apparent before 10 or 20 years of exposure.

52. The Interphone study, performed solely on adults, nevertheless raises serious speculation as to what will happen, after 15 or 20 years of intensive use, to the young adults, teenagers or even children who are currently the biggest users and in whom absorption of the radiation is still greater and more problematic.

53. The rapporteur would like to emphasise another side of the potential risks: while attention is focused at present on the radiation from mobile phones, and while he appeals for the wisest possible use of this device, by children and young people especially, it is inescapable that for some years there have been many other sources of electromagnetic fields and radio frequencies.

54. Whether outside or inside offices and dwellings, we are now exposed to a whole variety of electromagnetic frequencies on top of the chemical pollutants in the air that we breathe or accumulated in the food chain. Outdoors or indoors, we encounter the electromagnetic fields or the radio frequencies of the (nearby) electric power lines and of the base stations of GSM, UMTS and WiFi relay antennas or of, for example, radio or radar stations. Besides these, inside offices or private residences there is very often the radiation of cordless telephones (DECT), baby phones and other devices of wireless technology.

55. What is more, industrialists seek a further expansion of mobile telephony infrastructures for hosting the "fourth generation" 4G facility with the intention of delivering a secure, comprehensive broadband mobile system for the cordless modems of laptop computers, "smart" mobile phones and other portable backup devices for broadband mobile Internet access, games services, etc.

56. In Israel, the ministries concerned (environment, health, communication) fall back on the application of the precautionary principle, opposing the introduction of these new infrastructures on the ground that the effects of the irradiations should be verified before authorising new systems.

57. A question that always strongly arouses the European populations is the problem of where base stations and relay antennas are sited. In parallel to certain local or regional studies (mainly Swiss and German) describing the advent of health problems in farm animals after the installation of mobile telephone relay antennas near some farms, describing unaccountable problems of fertility, deformity, cataracts, etc., certain local or regional epidemiological studies, carried out by groups of scientists and doctors, have succeeded in also showing certain disease symptoms in residents of districts or villages near relay antennas installed a few months or years ago. These local studies were carried out in France, Germany, Switzerland, Austria, etc.

58. According to these epidemiological and also partly clinical studies, symptoms appearing or increasing some time after relay antennas were commissioned or after the beams emitted were intensified by raising the number or the power of the antennas were sleeping disorders, headaches, blood pressure problems, dizziness, skin trouble and allergies. The scientific value of such local studies is regularly queried by the operators and very often the security and regulatory bodies too, and so a most recent study released early in 2011 in a German medical publication (Umwelt-Medizin-Gesellschaft 1/2011) is nonetheless worthwhile and revealing, although the number of participants in the study (60 persons) remains quite small. These persons, from the locality of Rimbach in Bavaria, underwent analysis before a new relay antenna base station came into service in January 2004, then afterwards in July 2004, January 2005 and July 2005. In this study, as in similar epidemiological studies, the symptoms that increased or became aggravated after the station began operating were sleep disorders, headaches, allergies, dizziness and concentration problems.

59. The worth of this study spanning a year and a half is that the doctors and scientists could measure and determine significant changes in concentrations of certain stress-related or other hormones in urine samples. To sum up the results, there is a significant increase of adrenalin and noradrenalin over several months and a significant reduction of dopamine and phenylethylamine (PEA), changes indicating a state of chronic stress which, according to the authors of the study, caused the aforesaid heightened symptoms. The authors correlate the lowered PEA levels with impaired attention and hyperactivity of children, disorders which hugely increased in Germany over the years 1990-2004.

60. Here, too, the rapporteur stresses that some people may be more sensitive than others to electromagnetic radiation or waves. The research performed, for instance, by Professor Dominique Belpomme, President of the Association for Research and Treatments Against Cancer (ARTAC), on more than 200 people describing themselves as “electrosensitive” succeeded, with corroborative results of clinical and biological analyses, in proving that there was such a syndrome of intolerance to electromagnetic fields across the whole spectrum of frequencies. According to these results, not only proximity to the sources of electromagnetic emissions was influential, but also the time of exposure and often concomitant exposure to chemicals or to (heavy) metals present in human tissues. In this context, Sweden has granted sufferers from electromagnetic hypersensitivity the status of persons with reduced capacity so that they receive suitable protection.

61. In connection with the proven or potential risks of electromagnetic fields, it should also be noted that after a Lloyd’s report, insurance companies tended to withhold coverage for risks linked with electromagnetic fields under civil liability policies, in the same way as, for example, genetically modified organisms or asbestos, which is hardly reassuring given the potential risks that stem from these electromagnetic fields.

62. Finally, the rapporteur wonders whether it might not be expedient and innovative to try and develop new wireless communication technologies, equally powerful but more energy-efficient and above all less problematic in terms of the environment and health than the present microwave-based wireless communication. Such systems, optical or optoelectronic communication technologies employing visible and infrared light, are reportedly being developed in the United States and Japan and could largely replace the present technologies. Should such changes in transmission and communication systems prove realistic, it would then be a case of technological and economic innovations not to be missed or obstructed.

10. Conclusions

63. The potentially harmful effects of electromagnetic fields on the environment and human health have not yet been fully elucidated and a number of scientific uncertainties continue to exist in that regard. Nevertheless, anxieties and fears remain in wide sectors of the population over the health hazards posed by the waves, and also of the demands voiced by high-level scientists, by groupings of doctors and by the associations of concerned citizens which abound in many Council of Europe member states.

64. The precautionary principle and the right to a healthy environment, particularly on behalf of children and future generations, must be key factors in all economic, technological and social development of society. In that regard, the Parliamentary Assembly has decided on several previous occasions (see [Recommendation 1863](#) (2009) on environment and health: better prevention of environment-related health hazards and [Recommendation 1959](#) (2011) on preventive health care policies in the Council of Europe member states) that coherent, effective preventive measures must be taken to protect the environment and human health.

65. After analysing the scientific studies available to date, and also following the hearings for expert opinions organised in the context of the Committee on the Environment, Agriculture and Local and Regional Affairs, there is sufficient evidence of potentially harmful effects of electromagnetic fields on fauna, flora and human health to react and to guard against potentially serious environmental and health hazards.

66. That was moreover already the case in 1999 and 2009 when the European Parliament overwhelmingly passed resolutions upholding the precautionary principle and efficient preventive actions vis-à-vis the harmful effects of electromagnetic fields, in particular by substantially lowering the exposure thresholds for workers and the general public according to the ALARA principle, by restoring genuine independence of research in that field, and through a policy of enhanced information and transparency towards the anxious populations (see European Parliament Resolution of 2 April 2009 on health concerns associated with electromagnetic fields, 2008/2211 INI).

67. Lastly, the Assembly could endorse the analyses and warnings issued first in September 2007, then in September 2009, by the European Environment Agency (EEA) concerning the health hazards of electromagnetic fields, mobile telephony and not least mobile phones. According to the EEA, there are sufficient signs or levels of scientific evidence of harmful biological effects to invoke the application of the precautionary principle and of effective, urgent preventive measures.

¹ Reference to the committee: [Doc. 11894](#), Reference 3563 of 29 May 2009.

² Draft resolution adopted unanimously by the committee on 11 April 2011.