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Evaluations of International Expert Group Reports on the Biological Effects of Radiofrequency Fields

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1. Introduction

Electromagnetic fields, in particular so-called radiofrequencies are used by mobile or wireless communication systems as for example GSM mobile telephones, DECT telephones, wifi etc. Recent years were characterized by a tremendous increase in applications and types of wireless communication systems and this is responsible for an important increase in human exposure to radiofrequency radiation. Discussions on alleged adverse health effects are going on for years and so far no consensus agreement has been reached. These discussions are held amongst scientists as well as amongst laymen from the general public and authorities. Radio, TV, newspapers and magazines often bring erroneous information to the public. But also scientists do not agree. The scientific literature is full of papers showing that these fields can be dangerous and others showing that they are not. This holds true for virtually all possible endpoints and scientific disciplines that were studied, going from *in vitro* studies on cell proliferation, genetic and immunological effects, over animal experimental data on cancer and non cancer issues and human epidemiological investigations. It is not uncommon that controversial results are reported by the same laboratory. This results in claims of 'danger' when reference is made to essentially 'positive' papers (showing adverse biological effects) or claims of innocuity when only papers showing no effects are emphasized. It is clear that all (peer reviewed) scientific data should be considered and carefully analysed in order to come to a best possible 'weight of evidence' evaluation of risk. According to the WHO (World health Organisation) and ICNIRP (International Committee on Non Ionizing Radiation Protection) a single study does not provide the basis for hazard identification. It can at the best form the basis of a hypothesis. Confirmation of the results of any study is needed through replication and/or supportive studies. Only the resulting body of evidence forms the basis for science-based judgments by defining exposure levels for adverse health effects and no observable adverse effects.

This is recognized by most scientists all over the world and this explains why there were and still are many expert groups issued from the scientific community that evaluate(d) the alleged adverse health effects of radiofrequency fields in general, and mobile telephone frequencies in particular. It should be noted that radiofrequencies pose the additional problem (not encountered with other agents) that effects can be thermal or non thermal. At

high exposure levels cells or tissues can heat and thermal effects can be observed that are not obtained by normal environmental exposure levels as for example. when exposure is to radiation from a mobile phone base station antenna or when using the handset. Thermal effects are well known but experiments where thermal exposure levels were studied are not relevant in the discussion of "mobile phones and health". Yet, often thermal exposure levels were used, even when the authors of the study claimed that they investigated non thermal exposure levels (wrong experimental set up and dosimetry). It is therefore also important to evaluate not only the biology but also the dosimetric aspects of an investigation.

The purpose of the present chapter is to give an overview of the conclusions of different (inter)national expert groups based on their analyses.

2. Evaluation of different expert group reports (2009-2011)

We found 33 expert group reports that were devoted to health effects of radiofrequency fields and that were published in the period 2009-2011.

2.1 ICNIRP reports (2009)

Statement on the "Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)".The International Commission on Non-Ionizing Radiation Protection (ICNIRP). Health Physics 97(3):257-259 (2009).
Juutilainen J, Lagroye I, Miyakoshi J, van Rongen E, Saunders R,de Seze R, Tenforde T, Verschaeve L, Veyret B and Xu Z (2009) Exposure to high frequency electromagnetic fields, biological effects and health consequences (100 kHz – 300 GHz). In: Vecchia P., Matthes R., Ziegelberger G., Lin J., Saunders R., Swerdlow A., eds., Review of Experimental Studies of RF Biological Effects (100 kHz – 300 GHz), ICNIRP 16/2009, ISBN 978-3-934994-10-2 pp. 94-319.

The International Committee on Non Ionizing Radiation Protection (ICNIRP) consists of a main commission (12 members) and 4 subcommittee's: epidemiology (5 members), biology (8 members), physics (7 members) and Optics (7 members). Information on ICNIRP can be obtained at http://www.icnirp.de. ICNIRP works in close collaboration with WHO and publishes guidelines and statements (see above) as well as literature reviews that are prepared by their (subcommittee) members. The most recent review on biological effects of radiofrequency radiation is from 2009 (see above). It is a consensus report that was approved by all (sub) committee members and peer reviewed by other experts that do not belong to ICNIRP. The report took all peer-reviewed publications into consideration. It was later on updated and published as single review papers in the scientific literature (van Rongen et al., 2009; Verschaeve et al., 2010; Juutilainen et al., 2011). Recommendations (guidelines) are exclusively based on scientific grounds. Although many countries in the world do adopt the ICNIRP recommendations they are sometimes criticized for insufficient implementation of the precautionary principle. Yet, on pure scientific grounds the ICNIRP papers, recommendations and reviews may be considered of high quality.

Above mentioned ICNIRP documents indicate that it is not possible to deny the existence of non thermal effects following RF-exposure but they consider evidence in favour of such (adverse) effects very weak. Recent *in vitro* and *in vivo* cancer studies show that these effects are unlikely. Also recent epidemiological investigations (e.g., in 2009 already available results from the interphone study) were considered as being indicative for the absence of

cancer risk from mobile phones. Other studies that allowed a sufficient 'weight of evidence' evaluation did also not show any indication of health-related biological effects. ICNIRP therefore concluded that there are no indications of non thermal adverse health effects and that their recommendations from 1998 (ICNIRP, 1998) do not need to be adapted.

2.2 Scientific Committee on Emerging and newly Identified Health Risks (SCENIHR), EU, January 2009

Health Effects of Exposure to EMF, Directorate general Health & Consumers, European Commission. January 2009, pp. 83.

SCENIHR produces reports and advises on new technologies which may constitute a health risk for humans. Examples are nanoparticles, but also radiofrequency radiation as those applied in wireless communication systems. A detailed report on health effects of electromagnetic fields was published in 2007 and updated in 2009.

SCENIHR expert group members are selected following a call. Apart from 3 permanent members there were 6 nominated members, all well known in the field and covering different scientific disciplines. They discussed all peer reviewed (English) papers. When other papers were considered the reason for doing so was explained. Evaluation was done according to criteria that were well defined in advance. They included a particular attention to the reported study methods, the number of participants in a study (test and control population), the number of cells or animals that were analysed in the study, possible bias and confounders and dosimetry. Therefore not all papers were given the same weight or importance. Explanations were given when some studies were excluded from the discussion or where given less attention. The focus was on papers that were published after the 2007 report.

The summary and conclusions of the SCENIHR (2009) report were that it is unlikely that radiofrequency radiation is carcinogenic although further studies on long-term cancer effects are needed due to the long latency period for most brain tumours. Some investigations showed non reproducible associations between RF-exposure and self-reported symptoms. Most studies were negative. Overall, recent investigations did not show effects of RF-exposure on reproduction and development, whereas findings of effects on the nervous system (e.g., cognitive effects) were not consistent. Effects on EEG should be further investigated.

SCENIHR concludes that it is still not possible to exclude a small risk from RF-exposure. Therefore uncertainties that were identified in the 2007 report were still present. The weight of evidence analysis is nevertheless rather reassuring. There were no minority opinions.

SCENIHR recommends further research, especially long-term prospective studies, including studies on children.

2.3 Reports from the Dutch health council

Health Council of the Netherlands. Electromagnetic Fields: Annual Update 2008. The Hague: Health Council of the Netherlands, 2008; publication no.2009/02.
http://www.gezondheidsraad.nl/sites/default/files/200902.pdf

The Health Council is an independent scientific advisory body. Its task is to provide the government and parliament with advice in the field of public health and health/healthcare

research. The Standing Committee on Radiation and Health deals with questions relating to the health effects of exposure to radiation and questions surrounding the use of medical imaging techniques. Following the rise of technologies such as mobile telephony, attention has in recent years mainly focused on the risks of non-ionizing radiation. Applications, such as high-voltage power lines, also give rise to queries from time to time. The standing committee also monitors scientific developments in the field of ionizing radiation, ultraviolet radiation and ultrasound. Members of the standing committees are carefully selected so as to form a multidisciplinary group of independent experts.

The annual update 2008 (published in 2009) considered two different aspects of RF-bio effects: RF-effects on brain function and 'Electromagnetic Hypersensitivity'. It was prepared by the members of the "electromagnetic field committee" and discussed and approved by the standing committee "Radiation". The report includes a description of the criteria used in the evaluation process. These were inclusion of peer reviewed scientific papers of 'sufficient' quality only, attention for dose-effect relationships and reproducible or consistent results that were supported by quantitative and statistical analyses. Possible working mechanisms were also taken into consideration although absence of such mechanisms did not necessarily exclude plausibility of a causal relationship between exposure and effect. For human studies further attention was paid to 'double blind studies', the constitution of the control populations and other methodological aspects of the study (exposure regimes etc.). Minority opinions were allowed.

The Health Council's conclusion was that effects on brain function were described in some papers but that there were no indications that they might be hazardous. They also concluded that good quality papers do not support the existence of a causal relationship between RF-exposure and symptoms like headache, migraine, fatigue, itching, insomnia etc. But there was a relationship between supposed RF-exposure and subjective symptoms indicating the presence of a nocebo effect. No advises were formulated.

The Dutch health council also published other reports or advises on the subject that we do not consider here (see http://www.gezondheidsraad.nl/en).

2.4 Statens strålskyddsinstitut (SSI = Swedish radiation protection agency)

Recent Research on EMF and Health Risks; Sixth annual report from the Independent Expert Group on Electromagnetic Fields, 2009
http://www.stralsakerhetsmyndigheten.se/Allmanhet/

The Swedish Radiation Protection Agency has appointed an independent international expert group for the evaluation of scientific developments and in order to provide advises on the possible health effects of electromagnetic fields. This working group takes into consideration other expert group reports as a basis for its discussions and reports that should be updated each year. The report from 2009 is the 6th and latest report that was published so far. It concerns *in vitro* and *in vivo* effects of radiofrequencies, in particular genotoxic and non genotoxic endpoints, effects on reproduction, neurodegenerative effects, immunological effects, behavioural effects, cancer etc. Also human studies were evaluated including investigations on brain activity, cognitive functions, sleep disorders, subjective complaints and epidemiological (cancer) studies. The working group consisted of 9 internationally renowned experts.

The report does not give an extensive description of the used methodology but it is clear that peer reviewed scientific papers were carefully evaluated. The conclusion of the report was that "*…there are no new positive findings from cellular studies that have been well established in terms of experimental quality and replication.*" It also stated that "*…recent animal studies have not identified any clear effects on a variety of different biological endpoints following exposure to RF-radiation typical of mobile phone use, generally at levels too low to induce significant heating.*" The SSI furthermore concluded that there are no indications of an increased cancer risk in mobile phone users (up to 10 years of exposure to mobile phone radiation). Absence of cancer risks (as by 2009) is consistent with the results from laboratory investigations in animals as well as with *in vitro* studies that did not identify a possible working mechanism. The working group also considered two studies on children that did not found any effect. In their evaluation of "electromagnetic hypersensitivity" the conclusion was that there were no indications other than the presence of a nocebo effect. The self-declared hypersensitivity is however considered a real health problem (but not caused by the radiation) that should receive sufficient attention.

The SSI did not formulate particular advises but it emphasised the need of further studies, especially on children.

2.5 EFHRAN reports

Report on the analysis of risks associated to exposure to EMF: in vitro and in vivo (animals) studies, July 2010
http://efhran.polimi.it/docs/IMS-EFHRAN_09072010.pdf
Risk analysis of human exposure to electromagnetic fields, July 2010
http://efhran.polimi.it/docs/EFHRAN_D2_final.pdf

Members of the "European Health Risk Assessment Network on Electromagnetic Fields Exposure" (EFHRAN) belong to research institutes from 7 different European countries and are supported by external collaborators from 12 countries. All are international experts in research on non ionizing radiation. Some industrial groups, as for example the European 'consumer voice' in standardisation – ANEC and the GSM Association (GSMA) or the Network Operators' Association AISBL (ETNO) were associated to EFHRAN. The working group evaluated investigations on animals and humans. The role played by EFHRAN members and associated groups in the realisation of the report was not made very clear. The evaluation of effects were done according to a scoring method that is similar to the one used by IARC (International Agency for Research on Cancer). For each endpoint the evidence was evaluated as being "sufficient", "limited", "inadequate" or "inexistent" (= lack of evidence). A critical evaluation was performed of the relevant scientific literature which was based on the data provided by the SCENIHR (2009) report and on data that were published afterwards. The EFHRAN report was devoted to different kinds of non ionising radiation but we will here only consider the evaluation of studies on radiofrequency radiation.

The EFHRAN conclusions were as follows:

Cancer related studies:

- Limited evidence *in vitro* and lack of evidence with respect to *in vivo* investigations
- Inadequate evidence for non genotoxic effects
- Inadequate evidence from cancer studies in humans

Effect on the nervous system:

- Lack of evidence for effects on the blood brain barrier
- Limited evidence of effects on stress response genes and gene expression
- Lack of evidence with respect to behavioural effects
- Limited evidence from *in vitro* investigations
- Inadequate evidence in humans related to neurodegenerative diseases and RF-exposure

Effects on reproduction and development:

- Inadequate evidence concerning development and teratology
- Inadequate evidence for reproductive effects in animals and *in vitro* studies
- Inadequate evidence for effects in humans (e.g., behavioural effects in children from RF-exposed mothers)

Other effects:

- Lack of evidence for auditory effects
- Inadequate evidence of *in vivo* immunological effects
- Inadequate evidence for cardiovascular effects in humans
- No indications of electromagnetic hypersensitivity

2.6 Latin American expert committee on high frequency electromagnetic fields and human health, June 2010

Latin American Expert Committee on High Frequency Electromagnetic Fields and Human Health. Scientific review: Non Ionizing electromagnetic radiation in the radiofrequency spectrum and its effects on human health.
www.wireless-health.org.br/downloads/LatinAmericanScienceReviewReport.pdf

The goal of this study was to comply with the increasing anxiety of the population from Latin American countries with regard to their exposure to non ionizing radiations, especially from wireless communication systems (mobile phones, handset and base station antennas). The report was written by an expert panel which consisted of 5 scientists from different South American countries and a number of renowned international experts. The study was performed on request of the Eduled Institute for Medicine and Health which is a non-profit research- and development institute at Campinas, Sao Paulo (Brazil).

The study reviewed some 350 scientific investigations that were published since February 2010, with emphasize on studies that were performed in South America. Special attention was devoted to Risk Communication and application of the precautionary principle (which are usually not considered in other expert group reports). Attention was also given to regional and international exposure standards and recommendations from international bodies such as ICNIRP (International Committee on Non Ionizing Radiation Protection), IEEE (Institute of Electrical and Electronics Engineers), ITU (International Telecommunication Union) and the FCC (Federal Communication Commission, USA).

This is a well done study but it should be stressed that it is written by a limited number of persons that were assisted by an advisory group with obvious ICNIRP/WHO signature. It is therefore not surprising that the conclusions were similar to those of ICNIRP and WHO. The

conclusions were that there is insufficient evidence and lack of consistent data in favour of a causal relationship between low intensity radiofrequency radiation and short term adverse biological effects. The report acknowledge the existence of some alarming studies, e.g., on the blood brain barrier, but they were interpreted as due to thermal effects that are not relevant with respect to public exposures. Provocation studies in humans did not support the presence of health effects below thermal exposure levels. There were no indications of effects from mobile phone radiation on well being and no consistent indications of effects on cognitive functions, neurophysiologic and other physiologic or behavioural disorders. Epidemiological evidence is so far reassuring but it was acknowledged that we should await more studies on long term RF-exposures before any definite conclusion can be reached. The authors also stressed that it is not only important to investigate adverse health effects but that attention should also be paid to the benefits of wireless communication devises. They emphasize the need of correct information of the public via, for example, a central Latin American information centre for the general public and stakeholders. Not only biological effect studies are needed but also studies on socio-economic aspects of the mobile phone technology.

2.7 The Bioinitiative report (2007 – updated 2010)

BioInitiative: A Rationale for a Biologically-based Exposure Standard for Electromagnetic Radiation
www.bioinitiative.org/report/index.htm

This report was written by a number of individual scientists and public health and public policy workers who believe that existing public exposure standards for as well extreme low frequency fields (power lines) as radiofrequency radiation (mobile phones) are inadequate. Notably, not all authors were scientists and not all can be considered 'independent'. Possible conflicts of interest were not assessed. The purpose of this report was to assess scientific evidence on health impacts from electromagnetic radiation below current public exposure limits and to evaluate what changes in these limits are warranted now to reduce possible public health risks in the future. The report is a collection of a number of chapters, called 'sections', written by the individual authors. The sections were not written in a standardised way and there was apparently no consultation or discussion on these sections between the authors. The methods used to collect literature data were not defined. In most cases a selection of the available scientific material has been made in favour of those reporting alarming data (also from the non peer-reviewed literature) whereas negative (reassuring) data were often not reported. The selection criteria for inclusion or rejection of papers were not stated. The report is not a consensus report and the overall summary is often an over exaggeration that does not always comply with the content of the sections.

According to the report it is obvious that exposure to the electromagnetic fields, even at environmental exposure levels, constitute an important health risk for humans and that positive (alarming) data are reported (and considered very likely if not proven) for almost all biological endpoints that were investigated. The report therefore contains recommendations on establishing limits for exposure to electromagnetic fields that are much lower than the limits that are currently applied in many countries all over the world.

The report certainly has some merits but as stated above there are many shortcomings. A detailed evaluation of the Bioinitiative report and its shortcomings is for example given on the website of the Dutch Health Council and will therefore not be further detailed in this paper (http://www.gezondheidsraad.nl/sites/default/files/200817E_0.pdf).

2.8 The AFSSET report (2010)

Agence française de sécurité sanitaire de l'environnement et du travail (Afsset), Comité d'Experts Spécialisés liés à l'évaluation des risques liés aux agents physiques, aux nouvelles technologies et aux grands aménagements, Octobre 2009. Groupe de Travail Radiofréquences, mise à jour de l'expertise relative aux radiofréquences (Saisine n°2007/007) (2009).
www.afsset.fr/index_2010.php

The AFSSET became since 2010 the "French agency for Food, Environment and Occupational Health and Safety (now ANSES)". It was asked by the French government to provide an overview and evaluation of the scientific knowledge on biological effects from mobile phone frequencies. The request was especially focussed on alleged effects on the blood brain barrier and epidemiological investigations on brain cancer in relation with mobile phone and other wireless applications of radiofrequency radiation. A working group was constituted according to strict criteria following a call for experts. Members were experts in the different relevant area of the subject, including medical doctors, biologists, biophysicists, epidemiologists, engineers (dosimetry) and human and social sciences (1 chairman and 12 members). The working group produced a report that was submitted to another expert committee (CES) of 26 members comprising 4 members of the AFSSET working group. There were also approximately 30 external auditors.

The report was written following several (13) meetings that were held between September 2008 and October 2009 comprising 19 auditions. A large database of publications was used essentially including peer reviewed (English) papers. Other reports (SCENIHR, Bioinitiative, etc.) were also consulted in order to identify publications that might have been overlooked.

It may be interesting to know that many of the members were not the usual players involved in research on non ionizing radiation bio effects and no members of other expert groups on the subject. They all possessed of course the necessary expertise to fulfil their tasks.

According to the AFFSET report there are no indications for short or long term adverse health effects as a result of exposure to radiofrequency radiation. Epidemiological investigations were reassuring but nothing can be said about long term effects that were not yet (sufficiently) investigated. Upon receipt of the report from the working group AFFSET concluded a little bit more mitigated. Due to the presence of some studies showing effects and hence remaining uncertainties further research is encouraged.

2.9 IARC (2011)

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 102: Non-Ionizing Radiation, Part II: Radiofrequency Electromagnetic Fields [includes mobile telephones, microwaves, and radar] – in press (2011)
www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

In May 2011, 30 scientists from 14 countries met at the international Agency for Research on Cancer (IARC) in Lyon, France, to assess the carcinogenicity of radiofrequency electromagnetic fields. The results of this meeting will be published in the IARC Monographs (nr. 102; *in press*). This monograph will contain information on (1) exposure data, (2) studies of cancer in humans, (3) studies of cancer in experimental animals, (4) mechanistic and other relevant data, together with a summary and final evaluation and rationale. A summary report is already

published (Baan et al., 2011). As for all other evaluations performed by IARC the evaluation of carcinogenic risks to humans of radiofrequency electromagnetic fields resulted from discussions that were held in different working groups (human cancer studies, animal cancer studies and other relevant topics + supporting group related to dosimetry) and in plenary sessions. Working group members were essentially chosen by IARC staff members based on their scientific merits as judged by their peer reviewed publications.

The general principles and procedures as well as the scientific review and evaluation process is well described in the IARC preamble document which can be found on the IARC website (http://monographs.iarc.fr/ENG/Preamble/CurrentPreamble.pdf). All participants have carefully filled in a conflict of interest document well in advance of the meeting as well as at the start of the meeting. Discussions were based on scientific reviews that were written before the meeting by some of the experts on subjects that belong to their field of expertise.

The evaluation of the carcinogenic risks to humans of radiofrequency fields results in a classification in one out of 5 categories (group 1, 2A, 2B, 3 or 4) as indicated in table 1. The decision is based on the human evidence and evidence in experimental animals where the designation "sufficient" evidence, "limited" evidence, "inadequate" evidence or "evidence suggesting lack of carcinogenicity" is given by voting. This results in an overall classification of the carcinogenic risk as indicated in figure 1. The overall evaluation can be changed (e.g., from group 2B to 2A, or 2B to 3) according to the arguments (evaluations) provided by the working group on mechanistic and other relevant data.

Group 1	*Carcinogenic to humans*	107 agents
Group 2A	*Probably carcinogenic to humans*	59
Group 2B	*Possibly carcinogenic to humans*	267
Group 3	*Not classifiable as to its carcinogenicity to humans*	508
Group 4	*Probably not carcinogenic to humans*	1

Table 1. Agents Classified by the *IARC Monographs*, Volumes 1–102 (http://monographs.iarc.fr/ENG/Classification/index.php)

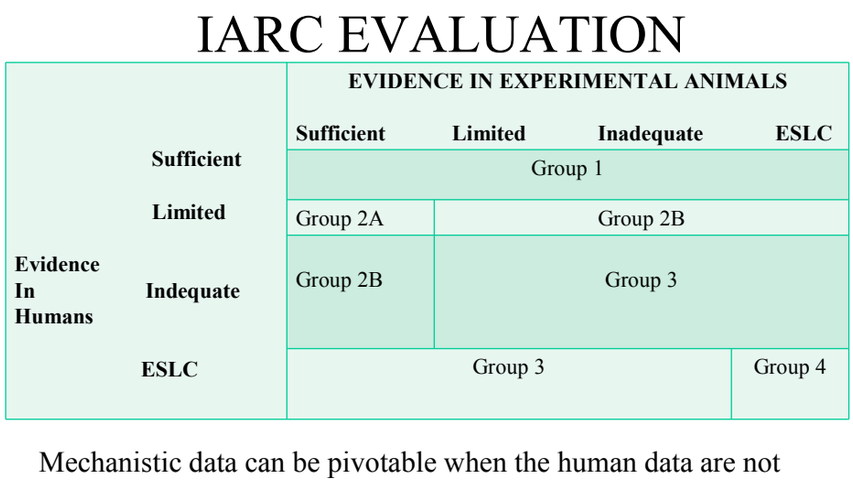


Fig. 1. IARC evaluation based on evidence from human and animal data (figure provided by IARC).

According to IARC useful information was available regarding associations between the use of wireless phones and glioma, and to a lesser extent acoustic neuroma. The international Interphone study and studies from a Swedish research group (dr. Hardell) were found of most importance in the evaluation process. Both studies were found to be susceptible to bias – due to recall errors and selection for participation- but the working group nevertheless concluded that the findings of an increased risk at the highest exposed groups could not be dismissed as reflecting bias alone. A causal interpretation between exposure to mobile phone radiation and glioma and acoustic neuroma was therefore considered possible. The working group therefore decided that there is limited evidence in humans for the carcinogenicity of radiofrequency radiation. The working group also concluded that there is limited evidence in experimental animals for the carcinogenicity of RF-radiations. Although there was evidence of an effect of RF-radiation on some of the 'other relevant endpoints' the working group reached the overall conclusion that these results provided only weak mechanistic evidence relevant to RF-induced cancer in humans. Therefore, the conclusion is that radiofrequency fields should be classified in group 2B (possible carcinogenic; see Figure 1).

Radiofrequency radiation is thus classified in the same group (2B) than extreme low frequency magnetic fields, coffee and styrene. This raises some questions. Are their effects really comparable? Maybe the classification is not discriminative enough to allow differentiation in the overall EMF frequency range nor does it allow to sufficiently [account] for different qualities of underlying data. According to Leitgeb (2011a,b) other classification systems, e.g., the system developed in 2001 by the German Commission on Radiation Protection (SSK), allows categorization of evidence in other and more classes. Using this system Leitgeb assigned microwave radiation to class E0: "Lack of/or insufficient evidence for causality". This illustrates that a classification in the IARC group 2B should not be interpreted by the public as proof of carcinogenicity at the same level as group 2A and 1. This is of course not correct but very often done.

2.10 French national academy of medicine (2009)

The academy stated that the precautionary principle may not be 'misused' to impose unscientific opinions. Scientific data are needed, not a subjective interpretation of the precautionary principle. According to the Academy *" No mechanism is known through which electromagnetic fields in the range of energies and frequencies used for mobile communication could have a negative effect on health."*

2.11 French academy of medicine, academy of sciences en academy of technologies (2009)

The National Academy of Medicine, the Academy of Science and the Academy of Technologies deplore the conclusions drawn by AFSSET from their experts' report. The three Academies congratulate the experts for their work but roundly criticize the Agency's recommendations. It does not understand why the presentation of the report does not insist on the reassuring aspects that are much more important than the few studies reporting effects. The latter are not to be considered credible alert signals. The academies also do not agree with the AFSSET recommendation to reduce exposure to cellular antennas that they consider scientifically not justified.

2.12 French health ministry (2009)

The website (www.sante.gouv.fr/effets-sur-la-sante.html) of the French Health Ministry was updated in August 2009. It states that the hypothesis that radiation from mobile phone base station antennas can be hazardous to man is no longer valid. It also stated that there are no indications so far that radiation from the handset poses a health risk but did not exclude that this may be the case. The Ministry proposed a number of simple measures to reduce the radiation exposure, especially for children.

2.13 French Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST; 2009)

According to the report of this parliamentary organisation one cannot be completely sure that mobile phone radiation is absolutely safe but there are no proven effects so far. For this reason the report states that the ICNIRP guidelines remain valid.

2.14 Report from the Belgian superior health council (2009)

http://www.health.belgium.be/eportal/Aboutus/relatedinstitutions/SuperiorHealthCouncil/index.htm?fodnlang=en

The Belgian Superior Health Council (SHC) was founded in 1849. It is the scientific advisory body of the Federal Public Service "Health, Food Chain Safety and Environment". In order to guarantee and enhance public health, the council draws up scientific advisory reports that aim at providing guidance to political decision-makers and health professionals. The working group on Non Ionizing radiation of the SHC already made several reports/advises on topics related to wireless communication devices.

This advisory report nr. 8519 on standards for mobile phone masts is one of these. It follows previous advises on this topic and was issued in response to a request from the Minister of Public Health to supply the necessary elements for answering a letter sent by the GSM Operators' Forum (GOF) concerning masts that emit radio waves. In this letter, the GOF claims that the proposed standard of 3 V/m (at 900 MHz) is too rigid.

The SHC stresses that it takes the view that, on account of the scientific uncertainties, the precautionary principle must be applied in this case in order to protect the population and therefore it maintained its proposal of 3V/m. The SHC recommends once again that there should be a policy that favours independent measurements and research (biological effects, epidemiological studies, etc.). This should be done with the assistance of an administration that is competent in this matter and has sufficient staff at its disposal. Advise nr. 8519 (and previous ones) were promulgated before election of the new working group members who do not all agree with the conclusions and advises of the former working group. A revision of the advise in the light of new developments may be envisaged.

2.15 Bundestag (Germany, 2009)

This federal German authority confirmed the validity of the German radiofrequency exposure limits. This is based on the results of German research programmes on mobile

phones. According to the Bundestag the exposure limits in force indeed offer sufficient protection against mobile phone radiation.

2.16 The German Mobile Telecommunication Research Programme (DMF, 2009)

The "German Mobile Telecommunication Research Programme" (http://www.emf-forschungsprogramm.de/) started in 2002 and came to an end in 2008. It contained 54 research projects on mobile telecommunication including many different topics (laboratory research, epidemiology, dosimetry) but also aspects of risk communication. The general conclusion was that there is *no reason to question the protective effect of current limit values. Yet, because of the remaining question on health risks from long-term exposure for adults and children and the existence of some studies showing effects one should remain careful with wireless communication technologies.*

2.17 Commission on Radiological Protection (SSK, Germany, August 2009)

The German Commission on Radiological Protection (SSK) has issued a statement in which they reaffirm that there is no scientific evidence of a genotoxic effect (effects on the DNA) of radiofrequency fields or of an influence on gene regulation.

2.18 The Bundesambt für Strahlenschutz (BfS, German, 2009)

According to the German Federal office for radiation protection (BfS) recent studies have failed to demonstrate effects of mobile phone radiation on human fertility. No adverse effects were found on testes and sperm cells. The few papers that showed such effect(s) were considered of low or no scientific value. Experiments on animals have not shown relevant effects whereas *in vitro* studies only showed effects in case of thermal exposure conditions.

2.19 German expert group on children by the Jülich research institute (2009)

http://juwel.fz-juelich.de:8080/dspace/bitstream/2128/3683/1/Gesundheit_16.pdf

This report should be seen as an opinion document written by a limited number of international experts. It gives essentially a summary of different workshops that were held on mobile phones and children. The purpose of the report was to inform the public and authorities about the risks for children from the mobile phone technology. In the report on "Children's Health and RF EMF Exposure" the expert group concluded that *the review of the existing scientific literature does not support the assumption that children's health is affected by RF EMF exposure from mobile phones or base stations.* It is not very clear on what grounds this expert group was constituted. This study was supported by the telecom industry.

2.20 Radiation and Nuclear Safety Authority (STUK, Finland, 2009)

The Finnish Radiation and Nuclear Safety Authority stated in its 2009-report that there are no indications so far for long-term adverse health effects from radiofrequency radiation. However, everybody can reduce its own exposure easily if this is found useful.

2.21 Radiation authority of the five nordic countries (2009)

Five Northern European countries (Denmark, Finland, Iceland, Norway and Sweden) have joined to form the "Radiation Authority of the five Nordic Countries". They have issued a common statement which says that *"the Nordic authorities agree that there is no scientific evidence for adverse health effects caused by radiofrequency field strengths in the normal living environment at present. […] The Nordic authorities therefore at present see no need for a common recommendation for further actions to reduce these radiofrequency fields." "Furthermore, in terms of overall public exposure, mobile phones are a much more significant source of radiofrequency radiation than fixed antennas. If the number of fixed antennas is reduced, mobile phones will need to use higher power to maintain their connection, thereby the exposure of the general public may increase."*

The authorities emphasize the need of further well conducted research on the alleged effects of radiofrequency fields on health.

2.22 CCARS scientific committee (Spain, 2009)

The "Comité Cientifico Asesor en Radio-frecuencias y Salud" (CCARS) published a literature survey and opinion on mobile phones and health. This was essentially based on the most recent reports and opinions from national and international authorities. They concluded that recent scientific/technical breakthroughs do not justify changes in the present RF benchmark levels and exposure limits for the public and workers.

2.23 Council of ministers of the isle of man (United Kingdom, 2009)

According to a working group report there is no general risk to the health of people living near mobile phone base station antenna. The exposures are limited and well below the guidelines. The group also stated that there is no proven relationship between self reported electromagnetic hypersensitivity and electromagnetic fields. At least some of the symptoms may be related to anxiety about the presence of the new technologies. They finally consider that the precautionary principle can be applied yet, especially with respect to children.

2.24 Institute of Engineering and Technology (IET, 2010)

Position statement on low level electromagnetic fields up to 300 GHz.
www.theiet.org/factfiles/bioeffects/postat02final.clin?type=pdf

This is an update of a previous position statement on *"The possible Harmful effects of low-level electromagnetic fields of frequencies up to 300 GHz"*. It claims that there are still no data in favour of adverse health effects from low level (normal) exposure to the radiofrequency fields. The IET has formulated its statement after consultation of the scientific literature using scientific databases (Medline, biosis, inspec) which provided a total of 813 relevant publications over the period 2008-2009. About half of them were on radiofrequency fields. They included cancer studies (e.g., Interphone study results), laboratory investigations in animals and cells, studies on non thermal working mechanisms and others. The statement also emphasize the need of independent replication studies and asks scientific journals to publish results from well sound scientific research only, whatever the results are. Scientists were encouraged to perform good science and to publish only when their work is of excellent quality.

2.25 Reports from the Health Protection Agency (HPA)

http://www.hpa.org.uk/

The Health Protection Agency (formerly National Radiological Protection Board) issues different reports and information booklets on different aspects of (amongst others) mobile phone effects. According to their 2010 statement "there are thousands of published scientific papers covering research about the effects of various types of radio waves on cells, tissues, animals and people. The scientific consensus is that, apart from the increased risk of a road accident due to mobile phone use when driving, there is no clear evidence of adverse health effects from the use of mobile phones or from phone masts".

2.26 The Austrian ministry of health (2009)

The ministry states in a brochure that there is no scientific evidence that cellular phones are hazardous to man. The brochure yet recommends a reasonable use of a mobile phone and limited use by children.

2.27 Australian Radiation Protection and Nuclear Safety Agency (ARPANSA, 2009)

www.arpansa.gov.au/
www.arpansa.gov.au/pubs/eme/fact1.pdf

In an update of its fact sheet on mobile telephony and health ARPANSA says that "*there is essentially no evidence that microwave exposure from mobile telephones causes cancer, and no clear evidence that such exposure accelerates the growth of an already-existing cancer. More research on this issue has been recommended. "Users concerned about the possibility of health effects can minimize their exposure to the microwave emissions by limiting the duration of mobile telephone calls, using a mobile telephone which does not have the antenna in the handset or using a 'hands-free' attachment. "There is no clear evidence in the existing scientific literature that the use of mobile telephones poses a long-term public health hazard (although the possibility of a small risk cannot be ruled out).*"

2.28 Health Canada, July (2009)

http://www.hc-sc.gc.ca/ewh-semt/radiation/cons/stations/index-eng.php
http://www.hc-sc.gc.ca/ewh-semt/radiation/cons/radiofreq/index-eng.php
http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct-eng.php

Health Canada is the Federal department responsible for helping Canadians maintain and improve their health, while respecting individual choices and circumstances. It publishes different documents and fact sheets (see for example website addresses given above). According to these the consensus of the scientific community is that RF energy from cell phone towers is too low to cause adverse health effects in humans. In fact, worst-case RF exposure levels emitted from cell phone towers are typically thousands of times below those specified by science-based exposure standards. The RF energy from cell phones also poses no confirmed health risk but it is acknowledged that cell phone use is not entirely risk-free due to distraction, possible interference with some (medical) devices or other sensitive electronic equipment.

2.29 Food and Drug Administration (FDA, USA, 2009 – 2010)

http://www.fda.gov/
http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116282.htm
http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116331.htm

The FDA updated its pages on cellular telephones and health. It states that the weight of scientific evidence has not linked cell phones with any health problems. The steps adults can take to reduce RF exposure apply to children and teenagers as well.

2.30 National Cancer Institute (NCI, USA, September 2009)

http://www.cancer.gov/cancertopics/factsheet/Risk/cellphones

A fact sheet from the National Cancer Institute stated that studies thus far have not shown a consistent link between cell phone use and cancers of the brain, nerves, or other tissues of the head or neck. More research is however needed because cell phone technology and how people use cell phones have been changing rapidly.

2.31 US Health Physics Society (2010)

http://hps.org/
http://hps.org/documents/Mobile_Telephone_Fact_Sheet_update_May_2010.pdf

This society also publishes different fact sheets on mobile phones and wireless communication technologies. A recent one on mobile telephones does not deflect from previous ones as it still stated that the available evidence does not show that use of mobile phones or exposure to emissions from their base stations (cell towers) causes brain cancer or any other health effect.

2.32 Committee on Man and Radiation (COMAR, 2009)

http://ewh.ieee.org/soc/embs/comar/

This committee is a technical committee of the "Engineering in Medicine and Biology Society" (EMBS) of the "Institute of Electrical and Electronics Engineers" (IEEE). This committee is particularly interested in the biological effects of non ionizing radiations, including radiofrequency fields. The conclusions from their scientific evaluation stated that the scientific evidence is absolutely not in accordance with what the Bioinitiative project asserted. Indeed the weight of evidence does not support the safety limits recommended by the Bioinitiative group. COMAR recommends on the contrary that the public health officials continue to base their policies on RF safety limits recommended by established and sanctioned international organisations such as ICNIRP, IEEE etc.

2.33 WHO reports

http://www.who.int/en/
http://www.who.int/peh-emf/publications/facts/factsheets/en/

http://www.who.int/mediacentre/factsheets/fs193/en/index.html

WHO published different fact sheets on electromagnetic fields and their effects on human health. An update of the "mobile phone fact sheet 193 (June 2011) is not very different from the previous version(s). It still states that to date, no adverse health effects have been established as being caused by mobile phone use. It also says that it is still too early to fully assess long term effects in humans but that results of animal studies consistently show no increased cancer risk for long-term exposure to radiofrequency fields.

2.34 Council of Europe's Committee on the Environment, Agriculture and Local and Regional Affairs (2011)

Committee on the Environment, Agriculture, and Local and Regional Affairs of the Council of Europe. The potential dangers of electromagnetic fields and their effect on the nvironment. 2011 May 6.
http://assembly.coe.int/main.asp?Link=/documents/workingdocs/doc11/edoc12608.ht
Jowitt T. GSMA slams Euro call for ban on wireless in schools. eWeek Europe. 2011 May 16.
www.eweekeurope.co.uk/news/gsma-slams-euro-call-for-ban-on-wireless-in-schools-29363
http://assembly.coe.int/Mainf.asp?link=/Documents/AdoptedText/ta11/ERES1815.htm

This committee referred to the precautionary principle in order to ask for a reconsideration of the existing guidelines or exposure standards.

This committee consists of 47 members. It can influence decisions of the European Union but is not entitled to adapt existing regulations or to adopt new ones. According to the committee several measures should be taken. These include (1) adoption of reasonable measures to reduce exposure of children to electromagnetic fields, (2) a reconsideration of the ICNIRP guidelines and advises, (3) adoption of campaigns to alert the public, especially concerning health effects on children and adolescents, (4) adoption of measures to protect hypersensitive subjects, (5) encourage new scientific research to develop new less hazardous technologies, (6) A 0.6 V/m exposure limit for radiofrequency technologies such as wifi, WLAN, wiMAX, DECT and mobile phones and indication of SAR-values on the appliances, (7) increasing public information to protect children and a ban on RF-sources in schools (DECT, mobile phones, wifi, WLAN, WiMAX), (8) siting of antenna for wireless communication devises only after a public consultation and all antennas should be at a reasonable distance from dwellings, (9) creation of risk assessment procedures and protection of "early warning scientists", and (10) research in biological effect studies should be encouraged by increasing research funds.

The report does not take into consideration the many other reassuring reports. Its conclusions are not based on a weight of evidence evaluation. The report has the merit that it brings forward the concerns of the public and that it proposes a number of measures that can be taken into consideration. Some of the proposed measures are however not very realistic, especially on the short run.

3. Summary of expert group evaluations

Table 2 gives a summary of the different expert group evaluations together with the main topics to which this evaluation refers and eventually formulated advises. The main result is

formulated as "-" when the group concluded that there is no strong or insufficient evidence in favour of adverse health effects, or "+" when in their opinion evidence is sufficient to conclude that there is a real health risk.

	EXPERT REPORT	CONCLUSION	ADVISES	+/-
1.	ICNIRP (2009) (all topics covered, advises/exposure standards)	No changes needed compared to previous advises	Recommandations (1998) remain valid	-
2.	SCENIHR (2009) (all topics covered, *in vitro, in vivo, epidemiological investigations)*	-no cancer risk identified -insufficient evidence for electromagnetic hypersensitivity, cognitive effects and reproductive and developmental disorders -Uncertainties remain	-Need for more long-term investigations - Further research needed on effects on EEG during sleep	-
3.	HEALTH COUNCIL OF THE NETHERLANDS (2008-2009) (electromagnetic hypersensitivity and effects on brain activity)	-No indications of effects on brain activity -No causal relationship between RF-exposure and complaints (hypersensitivity)	-	-
4.	SSI (2009) (epidemiological investigations, *in vitro*, *in vivo studies)*	-No strong indications of effects on health	-More research on children needed	-
5.	EFHRAN (2010) (human, *in vitro* and *in vivo* studies)	-No strong indications of effects on health. *-In vitro studies show at the most some 'limited evidence'*	-	-
6.	LATIN AMERICAN EXPERT GROUP (2010) (all topics covered, includes exposure standards and risk communication)	-Insufficient evidence for adverse health effects from *in vitro* and *in vivo* studies -Epidemiological investigations are reassuring but uncertainty remains regarding long-term effects -Also advantages of mobile phones are highlighted	-Need to continue research -Attention to and funds for socio-economical studies are also needed	-

	EXPERT REPORT	CONCLUSION	ADVISES	+/-
7.	BIOINITIATIVE REPORT (2007-2010) (all topics covered)	-RF-radiation is hazardous to humans, even at low (daily life) exposure levels (= below the current exposure standards). Hazards were identified for virtually all possible endpoints	-Much stronger exposure standards than the current ones are needed	+
8.	BELGIAN SUPERIOR HEALTH COUNCIL (2009-2010) (exposure standards for fixed antennas for mobile communication)	-Previous advises (3V/m at 900 MHz) remain valid	Exposure standards should be 3V/m based on the precautionary principle	(+)
9.	AFSSET (2010) (Effects of mobile phones, especially on the blood-brain-barrier and brain cancer)	-So far no indications of short-term and long-term effects -Long-term effects remain uncertain yet	-Further research needed -Exposure levels can be reduced	-
10.	FRENCH ACADEMY OF SCIENCES (2009) (all topics covered)	-No risks identified	-	-
11.	FRENCH ACADEMY OF SCIENCES AND TECHNOLOGIES (2009) (all topics covered)	-No risks identified	-Reassuring results should also be highlighted	-
12.	FRENCH MINISTRY OF HEALTH (2009) (all topics covered)	-No risks from base station antennas -No indications for risks from mobile phones (but still uncertainty)	-	-
13.	OPEST (F) (2009) (all topics covered)	-Adverse effects from mobile phone technology are not proven yet	-	-
14.	BUNDESTAG (D) (2009) (all topics covered)	-No risks -Adequacy of current German exposure standards is confirmed	-	-
15.	SSK (D) (2009) (Genetic effects)	-No scientific evidence in favour of genotoxicity of RF-radiation	-Existing exposure limits should not be adapted	-

	EXPERT REPORT	CONCLUSION	ADVISES	+/-
16.	BfS (D) (2009) (Fertility)	-No significant effects on testes and sperm	-	-
17.	GERMAN EXPERT GROUP ON CHILDREN (Jülich Research Institute) (2009) (risks for children)	-No indications of adverse health effects in children	-	-
18.	DMF (D) (2009) (general)	-No reasons to lower current exposure limits	-Further attention needed	-
19.	STUK (FIN) (2009) (general)	-No indications of long term effects	-	-
20.	RADIATION SAFETY AUTHORITY OF 5 NORDIC COUNTRIES (Scandinavia) (2009) (all topics covered)	-There is no scientific base to conclude that RF-radiation at "normal exposure levels" is hazardous to humans - There is no reason to lower existing exposure standards	-Further research is needed	-
21.	SSM (S) (2009) (*in vitro*, *in vivo*, human studies)	-No significant evolution in research data -No evidence for increased cancer risk	-	-
22.	CCARS (E) (2009) (general)	-No increased incidence of brain cancer -Uncertainties remain with respect to long-term effects -No reasons to lower existing exposure limits	-	-
23.	COUNCIL OF MINISTERS OF ISLE OF MAN (UK) (2009) (Antennas)	-No health risks for humans -Electromagnetic hypersensitivity related to mobile phones is not proven	-	-
24.	INSTITUTE OF ENGINEERING & TECHNOLOGY (IET) (UK) (2010) (all topics covered)	-No indications of health risks	-	-
25.	HEALTH PROTECTION AGENCY (HPA) (UK) (2010) (all topics covered)	-No danger from mobile phones (except traffic accidents)	-	-

	EXPERT REPORT	CONCLUSION	ADVISES	+/-
26.	AUSTRIAN MINISTRY OF HEALTH ((2009) (all topics covered)	- No danger from mobile phones	-Reasonable use of a mobile phone should be recommended, in particular by children	-
27.	ARPANSA (AUS) (2009) (all topics covered)	-No evidence for an increased cancer risk from mobile phone radiation	-Advises for reduction of exposure levels for those who wish to do so	-
28.	HEALTH CANADA (CAN) (2009) (all topics covered)	-No risks -Current exposure limits remain valid	-	-
29.	FDA (USA) (2010) (general)	-No risks from mobile phones (also in children)	-	-
30.	NCI (USA) (2009) (all topics covered)	-No adverse effects from a mobile phone -Uncertainty related to long-term effects warrants some care	-	-
31.	COMAR (INT) (2009) (all topics covered)	-Scientific data are not at all in accordance with the conclusions and assertions of the Bioinitiative report -Exposure limits (IEEE and other) are certainly adequate	-	-
32.	WHO (INT) (2010) (all topics covered)	-Adverse effects from mobile phones are not proven	-	-
33.	IARC/WHO (2011) (cancer)	RF-radiation is possibly carcinogenic in humans (group 2B in IARC classification)	-	(+)

Table 2. Summary of the expert group reports (scientific disciplines, conclusions and advises; -/+: overall conclusion in terms of respectively absence of sufficient evidence for adverse health effects (-), or sufficient evidence for adverse health effects (+).

It can be seen from the table that the vast majority of the reports *do not* consider that radiofrequency fields at current exposure levels (especially from mobile phone base-station antennas and handsets) pose a serious health risk to humans. The only exception comes from the Bioinitiative report. All reports, except the Bionitiative report, conclude that there is so far no clear indication of adverse health effects from RF-exposure from applications for wireless communication purposes. They usually remain prudent with regard to long-term bio-effects, not because of strong indications that such effects might occur, but only because

there are so far not enough data available to draw a sound conclusion. The same holds true for the IARC evaluation on carcinogenicity where the conclusion "possible carcinogenic" (group 2B) only means that, despite overall reassuring data, there is some limited evidence for carcinogenicity at long term exposures that cannot be ruled out so far. The Belgian Superior Health Council recommended more severe exposure limits (compared to most limits in application) but this recommendation is based on the precautionary principle rather than on solid arguments in favour of hazard or risk.

4. Evaluation of expert group reports based on 10 criteria

An evaluation of the different reports should take into account a great number of aspects. Amongst them the composition of the working group, the topics that were taken into account and the methods that were used are certainly some of the important aspects. We therefore tried to identify the members or participants in the working group activities and tried to see whether they constituted a *multidisciplinary* and *independent* group of experts. Did they evaluate all scientific (peer reviewed) publications, or did they make a selection of papers, and if so, what was the rationale for doing so? Was this satisfactory? Was the report a consensus report? Where minority opinions mentioned?

An evaluation of the reports bases on the answer to these questions can for example be done according to 10 criteria as indicated in Table 3. It is obvious that such an evaluation is always to a certain extent subjective. However, the purpose was not to make a ranking of the expert group reports according to their quality but especially to try to explain why they may (eventually) come to divergent conclusions on radiofrequency induced health effects. Because it is not possible to give in this chapter detailed answers to all the questions for each of the working groups the reports were given a score based on the answers and criteria indicated in table 3 (score of 0 when not a single criterion was met, up to 10 when all criteria were met).

Expert group:
- selection procedure of members and presence or absence of declarations of interest - composition, complementarity and expertise of expert group members - possibility to include minority statements
Methods used in the evaluation of the scientific data:
- peer reviewed publications, transparent procedure for selection of data - method employed
Criteria for evaluation of scientific data:
- transparant and clearly described criteria - attention to the number of participants/animals/cells considered in the studies - attention to potential bias and confounding factors - attention to dosimetry - evaluation of used study methods and experimental set up in the studies under consideration

Table 3. Evaluation of expert group reports based on 10 criteria.

We did not made a full evaluation of all reports because some did not provide sufficient information or were not expert group reports *as such* as they were for example only opinion papers or short evaluations or advises as formulated in leaflets or fact sheets from certain organisations. In such cases a (re)examination of all available scientific data was not necessary and hence not attempted. Here, a "quality comparison" with the "bigger" reports would not be fair. The results of the evaluation are therefore only given as an example for a number of important reports (based on the criteria in Table 3, and summarized in Table 4).

It can be seen that most expert group reports got an excellent score, except the Bioinitiative report. This report certainly has merits and individual sections were often written by well renowned scientists, but overall it was deficient against most of the criteria as indicated before (see also http://www.gezondheidsraad.nl/sites/default/files/200817E_0.pdf). As mentioned before the purpose of the Bioinitiative report was to demonstrate that RF-radiation (at low-exposure levels as from mobile phones and their base station antennas) may be hazardous to humans. The purpose was to indicate that exposure limits should be considerably revised. The report was written in such a way that the outcome was in accordance with these goals.

As indicate above any such evaluation is always subjective to a certain extent, also because it is not always possible to fully appreciate the work that was done. Reports may mention that all peer reviewed papers were consulted but obviously this cannot be verified. They can mention that particular attention was paid to "conflict of interests" of the participating members, or report that literature data was carefully analysed and that particular attention was paid to, for example, aspects of biological dosimetry, but it was also not always possible to understand how this was done. Table 4 nevertheless can be useful as a general appraisal. It shows that most reports got a good to excellent 'score'. Reports from ICNIRP, SCENIHR or the Dutch Health council got a maximal score of '10' as they all fulfilled satisfactorily the 10 criteria of Table 3. All ICNIRP members are experts in non ionizing radiations bio-effects and/or dosimetry. Some questions can be raised on how the members were elected and in how far they constitute a balanced representation of opinions, but the methodology, through literature evaluations by subcommittee members and a careful and strong 'peer reviewed' process of their work can be seen as sufficient guarantee of quality. This justifies a high score although this does not automatically imply that ICNIRP opinions should be accepted without questions. ICNIRP was for example often accused of insufficiently applying the precautionary principle and hence of being not careful enough in its advises. This opinion can be defended. The same holds true for the reports from the Dutch Health Council. All criteria were met (= high score) which does not mean that the council is never criticized or criticisable. It is indeed often criticized, again for not applying the precautionary principle and insisting on absence of proof and lack of convincing data, hence not taking the few alarming data sufficiently into account. The Belgian Superior Health Council is on the contrary often criticized for emphasizing too much on the precautionary principle and providing advises that are scientifically not well sound. We have not extensively described their reports as they were *only* advises from a working group which did not perform a complete literature search and evaluation. The report from the IARC working group on Radiofrequency Electromagnetic Fields (including mobile telephones; Baan et al., 2011, and Monograph Volume 102, *in preparation*) also received a maximum score as it is based on an extensive evaluation of the scientific literature performed by a great number of experts and according to a well described and rigid procedure (see also

http://monographs.iarc.fr/ENG/Preamble/index.php). Special attention was also taken to conflict of interests.

We already mentioned that most of the reports express the same opinion. This is not surprising knowing that they are all based on the same scientific data and evidence and usually also similar and well defined criteria. Another reason for fairly concordant conclusions may be yet that different expert groups were often partly composed of the same scientists. The Swedish SSI report was written following constitution of an expert group from which some members were also members from ICNIRP. The same holds true for EFRAN and EDUMED. It is not surprising then that these expert groups expressed the same opinion or did not substantially deviate from the ICNIRP position.

Study	Subject	Expert group	Method	Quality	Score
ICNIRP, 2009	RF– Epidemiology, animals & in vitro studies	+++	++	+++++	10
SCENIHR, 2009	RF-ELF-IF-Static fields ; Epidemiology, *in vitro & in vivo* studies	+++	++	+++++	10
Dutch Health Council (2009)	RF– Epidemiology and experimental human studies	+++	++	+++++	10
SSI (IEG), 2009	RF – Epidemiology and *in vitro & in vivo* studies	++	+	+++++	8
EFRAN, 2010	RF – Epidemiology and in vitro & in vivo studies	++	++	+++++	9
EDUMED, Latin American Expert Group, 2010	RF- epidemiology, experimental human, *in vitro & in vivo* studies	+	++	+++++	8
BIOINITIATIVE, 2007/2010	RF-ELF- epidemiology, experimental human, *in vitro & in vivo* studies	+	+	+	3
AFSSET, 2010	RF– especially blood-brain-barrier, epidemiology and psychosocial and cultural aspects	+++	++	++++	9
IARC, 2011	RF– studies on cancer and cancer related aspects (epidemiology, *in vitro & in vivo* studies)	+++	++	+++++	10

Table 4. Evaluation of a number of important expert Group reports based on well defined criteria (cf. Table 3).

5. Conclusion

From the more than 30 expert group opinions that were published during the 2009-2011 period the vast majority did not consider that there is a demonstrated health risk from RF-exposure from mobile telephones and other wireless communication devices. Because of remaining uncertainties, especially with respect to long-term exposures, some caution is still expressed. This is the reason why IARC recently classified RF-electromagnetic fields as 2B-carcinogens (= possibly carcinogenic).

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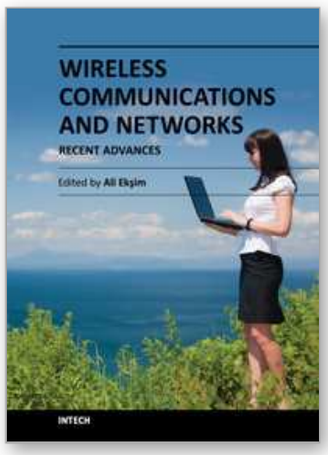
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Wireless Communications and Networks - Recent Advances

Edited by Dr. Ali Eksim

ISBN 978-953-51-0189-5
Hard cover, 596 pages
Publisher InTech
Published online 14, March, 2012
Published in print edition March, 2012

This book will provide a comprehensive technical guide covering fundamentals, recent advances and open issues in wireless communications and networks to the readers. The objective of the book is to serve as a valuable reference for students, educators, scientists, faculty members, researchers, engineers and research strategists in these rapidly evolving fields and to encourage them to actively explore these broad, exciting and rapidly evolving research areas.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Verschaeve Luc (2012). Evaluations of International Expert Group Reports on the Biological Effects of Radiofrequency Fields, Wireless Communications and Networks - Recent Advances, Dr. Ali Eksim (Ed.), ISBN: 978-953-51-0189-5, InTech, Available from: http://www.intechopen.com/books/wireless-communications-and-networks-recent-advances/evaluations-of-international-expert-group-reports-on-the-biological-effects-of-radiofrequency-fields

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