Section 16

International Reports on Radiofrequency Exposures and Health Effects

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Several recent comprehensive reports review the published scientific literature concerning exposure to radiofrequency (RF) and electromagnetic fields (EMF) and the associated biological and health effects. In this section, reference is made to eight recent international reports (listed in alphabetical order) along with a brief description of their contents and citation to access the reports online.

16.1 Advisory Group on Non-Ionizing Radiation (AGNIR, UK)

Health Effects from Radiofrequency Electromagnetic Fields.

Report of the Independent Advisory Group on Non-ionising Radiation.

Documents of the Health Protection Agency, April 2012.

Chairman: Professor AJ Swerdlow, Institute of Cancer Research, University of London

Citation: Health Protection Agency. Advisory Group on Non-ionising Radiation (AGNIR). London, UK.

Available from:
http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1317133826368

The AGNIR became an independent advisory group in 1999 and published a review in 2003 of the health effects of RF EMF. This update (324 pages) concentrates on new scientific evidence published since 1993, up to early 2011.

The review evaluates individual human and epidemiological studies, with the exposure and health content of the review organized as follows:

Ch 2 Exposures, characteristics of RF fields, interaction mechanisms between RF fields and the body, dosimetry and sources of exposure to RF fields

Ch 3 Cellular studies on genotoxic effects, gene expression, and potential mechanisms leading to carcinogenesis

Ch 4 Experimental studies of RF effects using animal models of brain and nervous system function, behaviour, endocrine and auditory effects, immunology, reproduction and cancer assays.

Ch 5 Acute cognitive and neurophysiological effects from mobile phone use as determined by provocation and observation studies

Ch 6 Effects on symptoms, as evaluated by experimental and observational studies, and the issue of hypersensitivity to RF fields

Ch 7 Possible reproductive effects from exposure to RF fields, including fertility, sexual function, birth outcomes and child development, in addition to cardiovascular function

Ch 8 Cancer risks, emphasizing brain tumours and acoustic neuromas in relation to mobile phone use as well as cancers (primarily leukemia) associated with residence near RF transmitters and lymphoma with certain occupations

16.2 BioInitiative Report

Citation: BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors.

BioInitiative Report: a rationale for a biologically-based public exposure standard for electromagnetic radiation.

Available from:
http://www.bioinitiative.org/report/wp-content/uploads/pdfs/BioInitiativeReport2012.pdf

This large report (1,484 pages) includes original chapters from the 2007 BioInitiative report (Blackman CF, Blank M, Kundi M, Sage C, Carpenter DO, et al. BioInitiative report: a rationale for a biologically-based public exposure standard for electromagnetic fields) accompanied by a 2012 supplement of newer studies. The purpose of the report is to update evidence from science, public health, and public policy over the past five years regarding the health issues pertaining to exposure to EMF and RF.

The first four sections by Cindy Sage provide an overview, a statement of the problem, existing public exposure standards and evaluation of their adequacies for managing ELF and RF. For RF, sections on biological effects include evidence of gene and protein expression (transcriptomic and proteomic research), genotoxic effects, response by stress proteins, and immune function. Effects on neurologic function and behaviour include a comprehensive review of studies on cellular changes, animals, electrophysiology, cognitive function, auditory effects and human subjective effects.

Separate sections include the effects on the blood-brain barrier and evaluating epidemiological studies of brain tumours and acoustic neuromas (authored by Dr. Lennart Hardell and colleagues). The aim of the final chapter is to provide an overview of the complex dependence of non-thermal microwave effects on various biological and physical parameters (e.g., bandwidth, frequency, modulation, and polarization). Reproductive health effects and fertility are discussed as are fetal and neonatal effects. Studies evaluating a possible link to autism are reviewed. The final three sections relate to precautions and public health policy recommendations.

16.3 EFHRAN – European Health Risk Assessment Network on EMF Exposure

Citation: EFHRAN – European Health Risk Assessment Network on EMF exposure. Risk analysis of human exposure to electromagnetic fields (revised).

Milan, Italy: European Health Risk Assessment Network on Electromagnetic Fields Exposure; 2012 Oct.

Available from: http://efhran.polimi.it/docs/D2_Finalversion_oct2012.pdf

EFHRAN was funded by the European Commission to establish a network of experts from seven European countries. The purpose was to develop a risk assessment network on low, intermediate, and high frequency EMF and health issues. For the section on high frequencies (RF), current consensus of opinions are followed by evidence from more recent epidemiological and experimental studies, followed by a discussion of interaction mechanisms. A four-point rating of the evidence of specific health risks associated with exposures to RF is provided: a) sufficient; b) limited; c) inadequate; and d) evidence suggesting a lack of effects.

16.4 International Commission on Non-Ionizing Radiation Protection (ICNIRP)

Citation: Vecchia P, Matthes R, Ziegelberger G, Lin J, Saunders R, Swerdlow A, Editors. Exposure to high frequency electromagnetic fields, biological effects and health consequences (100 kHz–300 GHz). Oberschleissheim, Germany: International Commission on Non-Ionizing Radiation Protection (ICNIRP); 2009.

Available from: http://www.icnirp.de/documents/RFReview.pdf

Each chapter of this 354-page report is written by a group of authors active in the field. The major topics include (1) dosimetry of high frequency electromagnetic fields; (2) review of experimental studies of RF biological effects (100 kHz–300 GHz) and (3) epidemiological evidence on the health effects of RF exposure and on tumour risks from mobile phones.

The content of each section includes:

(1) Physical characteristics, sources and exposures, RF measurement, mechanism of interaction of RF exposure and biological systems, and dosimetry, including SAR.

(2) Biological evidence for interaction mechanisms, cellular studies (genotoxic efects), animal studies (cancer, reproduction, nervous, auditory and cardiovascular systems, immunology and eye and skin tissues); human studies (nervous, endocrine and cardiovascular systems).

(3) Epidemiology, with sections on exposure, mechanisms, outcomes, occupational exposures, environmental exposure from transmitters and on mobile phone use. A separate section reviews epidemiological evidence on mobile phones and risk of tumours, with consideration of exposure, laterality of tumour and recall of phone use, induction and latency period, case and control considerations, response rates and precision of risk estimates. Results and interpretation are provided for studies on RF effects on the head and neck tumours of glioma, meningioma, acoustic neuroma, and of the salivary gland.

16.5 Latin American Experts Committee on High Frequency Electromagnetic Fields and Human Health

Citation: Latin American Experts Committee on High Frequency Electromagnetic Fields and Human Health. Non-ionizing electromagnetic radiation in the radiofrequency spectrum and its effects on human health.

Campinas/SP, Brasil: Instituto Edumed – Edumed Institute for Education in Medicine and Health Independent Research Group on the Impacts of Mobile Technologies on Health; 2010 Jun.

Available from:
http://www.wireless-health.org.br/downloads/LatinAmericanScienceReviewReport.pdf

The literature review examines the scientific evidence for possible biological and health effects of RF, due to exposures relevant to base stations or use of mobile phones, as follows:

- Biological effects covered include changes in cell cycle and regulation, membrane transport, apoptosis, genotoxicity, mutation rates, gene and protein expression, as well as damage to genetic material including cell proliferation, transformation, and differentiation of cells and tissues.
- In vivo animal studies include evaluation of the disruption of the blood-brain barrier and the induction and promotion of tumours or blood neoplasms.
- Human provocation studies cover possible effects on the nervous system, including many cognitive and behavioural responses, in response to low-level RF fields emitted by mobile telephones near children, as well as in adults. Other effects considered are pain, vision, hearing and vestibular function, as well as endocrine and cardiovascular system function.
- Epidemiological observational studies include assessment of community exposures and health complaints due to base stations antennas. The majority of the epidemiological studies covered investigate possible effects of RF exposure of mobile phone handset users. The principal outcomes considered are malignant and benign tumours of the nervous system, especially gliomas and acoustic neuromas.
- Other epidemiological studies relate exposure of populations to RF from mobile phones or base stations to several other health problems such as neurodegenerative disorders, cardiovascular diseases, cataracts, reproductive health changes, behavioural changes and nonspecific symptoms including “RF hypersensitivity symptoms.”

16.6 Norwegian Institute of Health Expert Committee

Citation: Norwegian Institute of Health Expert Committee. Report 2012:3 Low level radiofrequency electromagnetic fields – an assessment of health risks and evaluation of regulatory practice. Norway; 2012

Available from: http://www.fhi.no/dokumenter/545eea7147.pdf

The mandate for the Expert Committee, formed in 2010, was to summarise the knowledge regarding exposure and potential health effects related to weak RF fields particularly from mobile masts, base stations, and wireless networks. In addition to consideration of the suitability of threshold limit values, an assessment was undertaken of how the potential risks related to exposure from electromagnetic fields should be managed in Norway.

Part I assesses current exposure to RF fields, summarizes knowledge of potential health hazards including cancer, reproductive health and nervous system effects and provides a risk assessment

Part II addresses the general health problems attributed to EMF (electromagnetic hypersensitivity)

Part III describes risk management, risk perception, and concern for harmful effects of RF fields

Part IV reviews the present regulations of RF fields in other countries, as well as in Norway

Part V assesses the current regulations in Norway and offers recommendations on regulating public exposure to RF fields

16.7 Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR)

Citation: Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR). Health effects of exposure to EMF. Brussels, Belgium: European Commission; 2009.

Available from:
http://ec.europa.eu/health/archive/ph_risk/committees/04_scenihr/docs/scenihr_o_022.pdf

This report (44 pages) from the European Commission updates the SCENIHR opinion (March 2007) on the health effects of exposure to EMF and includes guidelines for assessing recent published evidence.

For RF, the sections include sources of exposure and their distribution, a section on dosimetric aspects of children's exposure and reviews of health effects, including

sections on the epidemiology and in vivo and in vitro cancer studies, symptoms, nervous system effects, and reproduction and development.

The section on methodological frameworks presents the criteria for how studies were selected and how the scientific evidence was synthesised into an assessment of the evidence for a causal effect of exposure to EMF and health effects. The section includes consideration of dosimetry and exposure assessment, epidemiology, and human laboratory studies, as well as in vivo and in vitro studies.

16.8 Swedish Radiation Safety Authority

Citation: SSM:s Independent Expert Group on Electromagnetic Fields. Recent research on EMF and health risk. Seventh annual report. Stockholm, Sweden: Swedish Radiation Safety Authority; 2010 Dec.

Available from:
http://www.stralsakerhetsmyndigheten.se/Global/Publikationer/Rapport/Stralskydd/2010/SSM-Rapport-2010-44.pdf

The SSM report (44 pages) summarizes the recent literature on Extremely Low Frequency (ELF) fields and RF fields according to cell, animal, human laboratory, and epidemiological studies.

The experimental studies reviewed on RF include cell studies (with endpoints of DNA damage, production of reactive oxygen species (ROS), gene expression and effects on spermatozoa); animal studies; human laboratory studies (including EEG, sleep, cognition and symptoms, and epidemiological studies on mobile phone use, with emphasis on the INTERPHONE study); and transmitter studies, including reproductive effects.

List of selected recent international reviews on studies of biological and health effects associated with exposure to RF-EMF:

- Health Protection Agency. Advisory Group on Non-ionising Radiation (AGNIR). London, UK: HPA; [updated May 11, 2012; cited 2012 Oct 16];
  Available from:
  http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1317133826368
- BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors.BioInitiative Report: a rationale for a biologically-based public exposure standard for electromagnetic radiation.
  Available from: http://www.bioinitiative.org/report/wp-content/uploads/pdfs/BioInitiativeReport2012.pdf

- EFHRAN - European Health Risk Assessment Network on EMF exposure. Risk analysis of human exposure to electromagnetic fields (revised). Milan, Italy: European Health Risk Assessment Network on Electromagnetic Fields Exposure; 2012 Oct.
  Available from: http://efhran.polimi.it/docs/D2_Finalversion_oct2012.pdf
- Vecchia P, Matthes R, Ziegelberger G, Lin J, Saunders R, Swerdlow A, editors. Exposure to high frequency electromagnetic fields, biological effects and health consequences (100 kHz-300 GHz). Oberschleissheim, Germany: International Commission on Non-Ionizing Radiation Protection (ICNIRP); 2009.
  Available from: http://www.icnirp.de/documents/RFReview.pdf
- Latin American Experts Committee on High Frequency Electromagnetic Fields and Human Health. Non-ionizing electromagnetic radiation in the radiofrequency spectrum and its effects on human health. Campinas/SP, Brasil: Instituto Edumed - Edumed Institute for Education in Medicine and Health Independent Research Group on the Impacts of Mobile Technologies on Health; 2010 Jun.
  Available from: http://www.wireless-health.org.br/downloads/LatinAmericanScienceReviewReport.pdf
- Norwegian Institute of Health Expert Committee. Report 2012:3 Low level radiofrequency electromagnetic fields – an assessment of health risks and evaluation of regulatory practice. Norway; 2012
  Available from: http://www.fhi.no/dokumenter/545eea7147.pdf
- Scientific Committee on Emerging and Newly Identified Health Risks (SCEHIHR). Health effects of exposure to EMF. Brussels, Belgium: European Commission; 2009.
  Available from:
  http://ec.europa.eu/health/archive/ph_risk/committees/04_scenihr/docs/scenihr_o_022.pdf
- SSM:s Independent Expert Group on Electromagnetic Fields. Recent research on EMF and health risk. Seventh annual report. Stockholm, Sweden: Swedish Radiation Safety Authority; 2010 Dec.
  Available from:
  http://www.stralsakerhetsmyndigheten.se/Global/Publikationer/Rapport/Stralskydd/2010/SSM-Rapport-2010-44.pdf