WHO’s International EMF Project
And Results So Far

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ABSTRACT

WHO established the International EMF Project in 1996 to determine if there were adverse health effects that could result from exposure to electromagnetic fields (EMF). Thus the Project was set up in a logical sequence of steps that would address this issue in a valid scientific manner over a reasonable time period.

Briefly the International EMF Project provides: a co-ordinated international response to the concerns about possible health effects of exposure to EMF; assesses the scientific literature and make status reports on health effects; identifies gaps in knowledge needing further research to make better health risk assessments; encourages a high quality, focused research programme to fill important gaps in knowledge; incorporates research results into WHO Environmental Health Criteria monographs, in which formal health risk assessments of exposure to EMF will be made; provides information on risk perception, risk communication and risk management as they apply to EMF; provides advice and publications to national authorities on EMF issues; and facilitates the development of internationally acceptable standards for EMF exposure. This presentation provides an update of activities and results of the EMF Project to date.

INTRODUCTION

The World Health Organization (WHO) takes seriously the concerns raised by reports about possible health effects from exposure to electromagnetic fields (EMF). Cancer, changes in behaviour, memory loss, Parkinson and Alzheimer’s diseases, and many other diseases have been suggested as resulting from exposure to EMF. Everyone in the world is now exposed to a complex mix of EMF frequencies in the range 0-300 GHz. EMF has become one of the most pervasive environmental influences and exposure levels at many frequencies are increasing significantly as the technological revolution continues unabated and new applications using different parts of the spectrum are found. Major sources of EMF exposure include: electric power generation, distribution and use; transportation systems; telecommunications facilities and associated devices such as mobile telephones; medical, commercial and industrial equipment; radars; and radio and television broadcast antennas.

INTERNATIONAL EMF PROJECT

WHO established the International EMF Project to assess health and environmental effects of exposure to static and time varying electric and magnetic fields in the frequency range 0 - 300 GHz. The Project commenced at WHO in 1996 and is scheduled for completion in about 2007. It
has been designed to follow a logical progression of activities and produce a series of outputs to allow improved health risk assessments to be made and to identify any environmental impacts of EMF exposure. The ultimate objectives of the Project are to provide sound advise to national authorities on how best to manage any health risks from EMF exposure, to provide advice on related issues, and to complete health risk assessments that will lead to the development of an international consensus on exposure guidelines. Details on the EMF Project are available on the home page at: http://www.who.int/emf/. An overview of the complete EMF Project is shown in figure 1.

Fig. 1: A Schematic Outline Of The Activities And Outputs Of The International EMF Project.

The International EMF Project has recently conducted in-depth international reviews of the scientific literature on the biological and health effects of exposure to radiofrequency (RF: 10 MHz to 300 GHz), intermediate frequencies (IF: 300 Hz to 10 MHz) and static (0 Hz) and extremely low frequency (ELF: >0 to 300 Hz) fields. These reviews were conducted with the purpose of identifying;
1. Health effects that can be substantiated from the literature, and
2. Biological effects that are suggestive of possible health effects, but require further
research to determine if exposure to EMF at the low levels of exposure normally
encountered in the living and working environment has any impact on health.

Conclusions from the RF and static and ELF field reviews have been published (Repacholi, 1998;
Repacholi & Greenebaum, 1999). The final scientific review of possible biological and health
effects from exposure to EMF in the frequency range intermediate to the static and ELF and
radiofrequency ranges, i.e. the range 300 Hz to 10 MHz, was held in Maastricht, The Netherlands,
7-8 June 1999. The summary report of the meeting has been published (Ltvak et al, 2002). The
proceedings of all papers have been published jointly by WHO and ICNIRP, and are available
from ICNIRP.

RESEARCH AGENDA

Having completed the initial international scientific reviews, WHO is now urging EMF funding
agencies world wide to give priority to this research, if it is their intention to obtain results that
will assist both WHO and the International Agency for Research on Cancer (IARC) to make
better health risk assessments. WHO's EMF research agenda is reviewed and updated during
annual meetings of the Research Coordination Committee. A major review of the RF research
needs took place following the International Advisory Committee meeting in Geneva from 10-12
June 2003. Following this meeting a revised WHO EMF Research Agenda was placed on the web
site at: http://www.who.int/peh-emf/research/rf03/en/

HEALTH RISK ASSESSMENT

Both WHO and IARC have already established a timetable for assessing health effects of EMF
fields. In June 2001 IARC held a meeting to formally identify and evaluate the evidence for
carcinogenesis from exposure to static and extremely low frequency (ELF) fields. This resulted in
ELF magnetic fields being classified as a 'possible human carcinogen'. This result has been
explained in a WHO fact sheet # 263.

IARC publish the results of this meeting in the IARC Monograph Series in 2002. The
International EMF Project will incorporate the IARC conclusions on carcinogenesis into the
results of a WHO evaluation of health risk assessment of exposure to static and ELF fields in
2003-4. The results and conclusions will be published in the Environmental Health Criteria series.
It is anticipated that sufficient results will be available for IARC to conduct a similar evaluation of
evidence for carcinogenicity of RF fields in 2005. WHO would then complete an overall health
risk assessment of exposure to RF fields in 2006-7.
THERMAL WORKSHOP

A workshop, held in Geneva 2002, entitled “Adverse Temperature Levels in the Human Body” brought together scientists with expertise in biological effects of hyperthermia to review the data and determine the evidence that could be used to evaluate potential adverse effects from human exposures to radiofrequency (RF) electromagnetic radiation in the range of 10 to 2000 MHz. Standards for RF exposure in this frequency range are based currently on thermal effects. Information was reviewed on the ability of hyperthermia, either to the whole body or to part of the body to affect physiology, particularly the heart and circulatory system, to induce other thermoregulatory responses such as sweating, to affect the performance of simple and complex mental tasks, to induce various heat related disorders such as heat stroke, and to damage body tissue, particularly the central nervous system and gut. In addition, thresholds for effects on developing embryos and fetuses and possible carcinogenic effects were also examined. These findings were integrated and discussed in the context of known cellular and biochemical responses of cells and tissues to hyperthermia. The experts judged the relevance of each study for informing policy makers on the scientific basis for establishing safe exposure levels. The results of this workshop have been published as a special volume of the International Journal of Hyperthermia 19(3) May-June 2003 issue.

EMF RISK PERCEPTION, COMMUNICATION AND MANAGEMENT

International seminar were held in Vienna (October 1997) and Ottawa (September 1998) to discuss application of the principles of risk perception and risk management to EMF fields. The seminars were followed by working group meetings to progress draft report on this topic. The proceedings of the Vienna seminar have already been published by ICNIRP (1998) and the Ottawa meeting proceedings were published by WHO in 1999.

A handbook called 'Establishing a dialogue on risks from electromagnetic fields' was published in 2002. Its information will be useful to individuals and capable of helping them better understand the process of scientifically-based risk assessment, the approaches and assumptions involved, and their reliability. The handbook is a user-friendly, how-to publication with a format that is easily read and practical for EMF programme managers who need basic information on EMF risk perception, communication and management.

APPLICATION OF THE PRECAUTIONARY PRINCIPLE

The World Health Organization, The European Commission and the National Institute of Environmental Health Science conducted a 3 day meeting on "Application of the Precautionary Principle to EMF". This meeting, held in Luxembourg on February 24-26, 2003, brought together international experts whose individual perspectives led to the synthesis of an approach that recognizes and accommodates the diverse disciplines necessary for successful implementation of Precautionary Principle.

As the result of the input received at the workshop, WHO drafted a document focusing on the
development of an overarching framework for use of precautionary measures at each stage of the risk management cycle. This document is currently undergoing a review within WHO. Simultaneously, the document is broadly circulated for a comprehensive review by all stakeholders.

Several case studies, which will include ELF and RF, will be added to the final framework. Results of this important meeting will contribute to the WHO International EMF Project’s development of policy options for EMF, and to general WHO policy on the use of a Precautionary Framework on health issues.

ENVIRONMENTAL IMPACTS

As technology has progressed, levels of EMF in our environment have increased steadily over the past 50-100 years. At specific frequencies, EMF emissions from man-made sources now exceed those from natural fields by many orders of magnitude and are detectable everywhere in the world. Significant increases in environmental EMF levels have resulted from major development projects such as high voltage transmission lines, undersea power cables, radars, telecommunication and broadcast transmitters, and transportation systems. Research has been focused to determine if EMF exposure of humans has any deleterious health consequence. By comparison, influences of these fields on plants, animals, birds and other living organisms have been less rigorously examined. Assessments of environmental impacts of EMF fields is important to:

- Ensure the preservation of balances in natural terrestrial and marine ecosystems, since these directly impact on human life.
- Preserve food supplies by ensuring there are no adverse impacts to fisheries, agricultural animals and plants.

An international seminar, organized by WHO and ICNIRP, and supported by the German Federal Office of Radiation Protection, was held in Ismaning, Germany 4-5 October 1999. It provided a summary of scientific knowledge about any consequences to the environment from man-made sources of EMF in the frequency range 0-300 GHz. Overviews of current knowledge in key areas were presented by a selected panel of recognized specialists. On the day following the seminar, working groups met (6 October 1999) to prepare conclusions and recommendations. The results of the working group meetings has been used to prepare a scientific paper for publication in a scientific journal. This has now been completed and awaits publication. The proceedings of all presentations have been published and are available from ICNIRP.

It is not anticipated that further meetings will be organized on this topic. The main purpose of this activity under the EMF Project is to provide information that specifically addresses environmental impacts of EMF fields. A comprehensive summary report on this topic will have at least two benefits. It will:

- Be useful for both governmental and non-governmental institutions when conducting environmental impact assessments, and
- Address any public concerns that EMF could be adversely affecting our environment.

HARMONIZATION OF EMF STANDARDS
The WHO initiative to harmonize EMF standards is a response to the fact that many countries are considering new EMF standards. Globalization of trade and the rapid introduction of mobile telecommunications worldwide have focused attention on the large differences existing in standards. Differences in the EMF limit values in standards in some Eastern European and Western countries are, in some cases, over 100 times. This has raised concerns about their safety and has led to public anxiety about increasing EMF exposures from the introduction of new technologies.

The purpose of this activity is to work towards, and hopefully achieve, international agreement on a framework for developing guidelines on protection of the public and workers from exposure to EMF.

Development of the framework has been carried out by working groups formed to address the key components. Working group meetings have been held, generally in conjunction with scientific meetings in key geographical regions that will allow the input of scientists and government officials in those regions. One goal of setting up the working groups is to enhance the quality of communication among scientists and government officials, in examining the scientific basis for the standards and the assumptions that underlie them.

Scientific conferences organized to include working group meetings in key regions.

3. WHO/Peru Government regional seminar: Bioeffects and EMF Standards Harmonization, Lima, Peru 7-9 March 2001
4. WHO EMF Standards Harmonization regional meeting, Bulgaria 28 April - 3 May 2001
5. WHO EMF Biological Effects and Standards Harmonization regional meeting, South Korea 22-25 October 2001
6. WHO EMF Biological Effects and Standards Harmonization regional meeting, Cape Town, South Africa 5-7 December 2001
7. WHO EMF Biological Effects and Standards Harmonization, Moscow and St Petersburg 17-25 September 2002
8. WHO EMF Biological Effects and Standards Harmonization regional meeting, Guilin, Guangxi, China 18-24 October 2003 (Incorporates a working group meeting to finalize the framework prior to submitting to the international congress)

The overall plan is to comply with the World Trade Organization (WTO) recommendation that any standards that affect trade should be developed in conjunction with both developed and developing countries. Meetings have been established to cover all geographical regions to allow scientists to have input to a process that is envisaged to lead to a common international standard.
PUBLICATIONS

Home page
Visit our new EMF Project home page at http://www.who.int/emf/ for much useful and up to date information.

Brochures
Establishing a dialogue on risks from electromagnetic fields (ISBN 92 4 154571 2) (see previous paragraph on EMF Risk Perception and Communication).

An extensive booklet on Electromagnetic Fields was drafted for the WHO European Regional Office. It is written for the lay public and local authorities, and was published in early 1999. This booklet gives details on the physical characteristics and biological effects of EMF, standards and protective measures, and is presented in a glossy format with many colour pictures and diagrams for ease of comprehension. Copies can be ordered directly on the web site at: www.who.dk/environment/pamphlets or from the Chartered Institute of Environmental Health, Chadwick Court, 15 Hatfields, London SE1 8DJ, UK.

Fact Sheets
The following WHO Fact Sheets concerning EMF have been published:

- Video Display Units (VDUs) and Human Health. WHO Fact Sheet #201 July 1998
- Electromagnetic Fields and Public Health: Extremely low frequency fields and cancer. WHO Fact Sheet #263 October 2001

Many published Fact Sheets are now available multiple languages.

Press Releases
The following have been published by WHO on the Project:


WHO clarifies its position on health effects of mobile phone use. Note for the press No 14 10 October 2001


EMF Project Scientific Journal Publications


WHO/IARC PUBLICATIONS


Scientific Meeting Proceedings
- Non-Thermal Effects of RF Electromagnetic Fields. R Matthes, JH Bernhardt and MH Repacholi (eds) Proceedings of Munich meeting, November 1996. ICNIRP Pub. 3/97. From: ICNIRP C/- Bundesamt für Strahlenschutz, Institut für Strahlenhygiene, Ingolstädter Landstraße 1, D-85764 Oberschleißheim, Germany. Tel:+49 89 31603288, Fax:+49 89 316 03289, E-mail: RMatthes@bfs.de
- Biological Effects of Static and ELF Fields. R Matthes, JH Bernhardt and MH Repacholi (eds), Proceedings of Bologna meeting, June 1997. ICNIRP Pub. 4/97. From: ICNIRP C/- Bundesamt für Strahlenschutz, Institut für Strahlenhygiene, Ingolstädter Landstraße 1, D-85764 Oberschleißheim, Germany. Tel:+49 89 31603288, Fax:+49 89 316 03289, E-mail RMatthes@bfs.de
- Risk Perception, Risk Communication and its Application to EMF Exposure. R Matthes, JH Bernhardt and MH Repacholi (eds) Proceedings of Vienna meeting, October 1997. ICNIRP Pub 5/98. From: ICNIRP C/- Bundesamt für Strahlenschutz, Institut für Strahlenhygiene, Ingolstädter Landstraße 1, D-85764 Oberschleißheim, Germany. Tel:+49 89 31603288, Fax:+49 89 316 03289, E-mail RMatthes@bfs.de


Health Effects of Electromagnetic Fields in the Frequency Range 300 Hz to 10 MHz. R Matthes, E van Rongen and MH Repacholi (eds) Proceedings of International Meeting, Maastricht, The Netherlands 7-8 June 1999. ICNIRP Pub 8/99. From: ICNIRP C/-Bundesamt für Strahlenschutz, Institut für Strahlenhygiene, Ingolstädter Landstraße 1, D-85764 Oberschleißheim, Germany. Tel:+49 89 31603288, Fax:+49 89 316 03289, E-mail RMatthes@bfs.de

Effects of Electromagnetic Fields on the Living Environment. R Matthes, JH Bernhardt and MH Repacholi (eds). Proceedings of International Seminar, Ismaning, Germany 4-5 October 1999. ICNIRP Pub 10/2000. From: ICNIRP C/- Bundesamt für Strahlenschutz, Institut für Strahlenhygiene, Ingolstädter Landstraße 1, D-85764 Oberschleißheim, Germany. Tel:+49 89 31603288, Fax:+49 89 316 03289, E-mail RMatthes@bfs.de

Biological effects, health consequences and standards for pulsed radiofrequency fields. R Matthes, JH Bernhardt and MH Repacholi (eds). Proceedings of International seminar on biological effects, health consequences and standards for pulsed radiofrequency fields. Erice, Sicily, Italy, 21-25 November 1999. ICNIRP publication 11/2001. From: ICNIRP C/-Bundesamt für Strahlenschutz, Institut für Strahlenhygiene, Ingolstädter Landstraße 1, D-85764 Oberschleißheim, Germany. Tel:+49 89 31603288, Fax:+49 89 316 03289, E-mail RMatthes@bfs.de


Electronic Proceedings on EMF Project Website
There are several proceedings from meetings available electronically on the EMF Project website at: http://www.who.int/peh-emf/meetings/archive/en/

Application of the Precautionary Principle to EMF. 24-26 February 2003, European Commission, Luxembourg.

2nd International Workshop on Biological Effects of Electromagnetic Fields. 7-11 October 2002, Rhodes – Greece

WHO/ICNIRP Conference on EMF Biological effects, WHO Standards Harmonization for the African region, WHO RF Research coordination meeting. 4-7 December 2001, Cape Town, South Africa.

WHO Meeting on EMF Biological Effects, Standards Harmonization in Asia & Oceania. 22-24 October 2001, Seoul, South Korea.
‐ WHO Workshop: Selection Bias in EMF - Childhood Leukemia Epidemiologic Studies  
‐ WHO EMF Standards Harmonization - Eastern European. 28 April-3 May 2001, Varna, 
Bulgaria.
‐ Americas Regional Seminar on Bioeffects, and WHO EMF Standards Harmonization.  
7-9 March 2001, Lima, Peru