



THE INTERNATIONAL EMF PROJECT

PROGRESS REPORT 2001-2002

SUMMARY

This seventh progress report for the International EMF Project covers activities and outputs for the period May 2001 to May 2002. The report has been formatted according to scheduled EMF Project activities: scientific reviews; research co-ordination; health risk assessments; harmonization of EMF standards; risk perception and communication; and environmental impacts of EMF. Current details of the EMF Project, its activities and outputs can be found on the home page at: <http://www.who.int/emf/>

A scientific paper has been completed on the review of possible impacts of EMF on the environment. It was submitted to the journal *Environmental Health Perspectives* in January 2002 and is going through the peer review process. This report will be particularly useful as a reference for environmental impact assessments for major EMF development projects.

Bioelectromagnetics Journal has published the paper on the WHO review of possible health consequences of exposure to EMF in the intermediate frequency range (300 Hz to 10 MHz). The reference is: Health and safety implications of exposure to electromagnetic fields in the frequency range 300 Hz to 10 MHz. E Litvak, KR Foster and MH Repacholi, *Bioelectromagnetics* 23(1) 68-82: 2002.

A workshop on the effects of heating on the human body was held at WHO/HQ in March 2002. The results will be published as a special volume of the *International Journal of Hyperthermia* in the next few months.

Formal health risk assessments for exposure to static and ELF fields have been scheduled over the period 2002 to 2003. The first IARC review to both identify and classify whether static and ELF fields are carcinogenic has produced the result that ELF magnetic fields were classified as "possible human carcinogens" based on the epidemiological studies of childhood leukaemia. Results of these reviews have been published in the IARC monograph series:- *Non-ionizing radiation, Part 1: Static and extremely low-frequency (ELF) electric and magnetic fields*, IARC Monographs 80, IARC Press: Lyon, (2002), pp 429.

The Handbook on "Establishing a dialogue on risks from electromagnetic fields" has been completed following extensive reviews and is now in the publication process.

The standards harmonization activity has reached the stage where all 6 regions of WHO have had meetings allowing input from scientists and government officials in each region. A draft framework has been compiled from all the discussion and comments and will now be extensively reviewed prior to an international meeting to approve it in 2003.

SCIENTIFIC REVIEWS

Scientific reviews of the literature are conducted for two main purposes: to provide a status report on current knowledge related to possible health effects of EMF; and to identify gaps in knowledge that need further research leading to better health risk assessments. Special meetings have been conducted in countries having large research programmes, but where most of the results are published in their own language (other than English) and so are not widely available for the scientific review process. These meetings also provide the opportunity to allow key scientists to summarize their results so that they can become part of WHO's world wide review process for determining possible EMF health risks.

The scientific review process for the EMF Project has now been completed. Biological effects from exposure to EMF in the RF range (10 MHz to 300 GHz) were reviewed at meetings in Munich, Germany (1996) and RF pulse-modulated fields in Erice, Sicily (1999); low frequencies (0 to 300 Hz) were reviewed in Bologna, Italy (1997); psychosocial impacts of EMF exposure in Graz, Austria (1998); intermediate frequencies (300 Hz to 10 MHz) were reviewed in Maastricht, The Netherlands (1999); and environmental impacts of EMF were reviewed in Ismaning, Germany (1999). Updates of the science are now given on a regional basis at meetings for the Standards Harmonisation activity.

A workshop 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 will be published as a special volume of the International Journal of Hyperthermia within the next few months.

RESEARCH CO-ORDINATION

Research Co-ordination Committee Meeting

A research coordination committee meeting was held in Cape Town on December 2001. This meeting indicated that areas requiring further research were possible effects of EMF exposure (particularly RF) on children. There was also much discussion on the implication of the IARC classification of ELF magnetic fields as a 2B carcinogen. A report updating the EMF research agenda is being prepared.

HEALTH RISK ASSESSMENTS

Schedule of assessments

The schedule for formal reviews of the EMF literature have been scheduled as shown below:

2001 IARC carcinogen identification and evaluation of static and ELF fields

- 2003 WHO/ICNIRP health risk assessment of static and ELF fields
- 2005 IARC carcinogen identification and evaluation of RF fields
- 2006-7 WHO/ICNIRP health risk assessment of RF fields

IARC publishes the results of their meetings in the IARC monographs and WHO will incorporate the IARC conclusions into the results of the WHO task group meetings and publish them as WHO monographs. It is anticipated that all reports will be published by 2007.

EMF RISK PERCEPTION, COMMUNICATION AND MANAGEMENT

A large amount of useful information on EMF risk perception, communication and management has now been gathered following the international reviews in Vienna in 1997 and Ottawa in 1998. A summary report of the Ottawa meeting, entitled "EMF Risk Perception and Communication" by LM Brodsky, W Leiss, D Krewski and MH Repacholi has been completed and has been submitted for publication.

A user-friendly handbook for governmental and non-governmental organizations, and individuals interested in this topic has been completed and is being published. It is entitled "Establishing a dialogue on risks from electromagnetic fields". All IAC members have had the opportunity to review this book that has taken some time to complete. However, it has been through extensive review and revision and is now in excellent shape for publication. This handbook will be published in an attractive format, as well as being formatted for use and downloading on the EMF web site.

A draft of a WHO monograph on risk perception, communication and management has been prepared. This contains summaries of information on this topic as well as recommendations for further research. Such a monograph will be useful to managers and specialists in the field as a basis for establishing programmes on risk and furthering research in this area. The monograph will include examples from physical, biological and chemical agents, but will use EMF as a case study. This document is being reviewed with the purpose of determining if it contains more useful information than the handbook. A decision on whether to continue with this book will be made at the 2002 International Advisory Committee meeting.

EMF ENVIRONMENTAL IMPACTS

This review examines potential environmental impacts of electromagnetic fields (EMF) of major electrical technologies including high voltage power lines and undersea cables, an extremely low frequency submarine communications system, a proposed solar power satellite, radar, and high powered broadcast transmitters. Brief summaries are provided of environmental field levels produced by the technologies, considerations related to exposure assessments and mechanisms responsible for biological responses to the fields, and reported effects of fields on biota. While environmental effects from fields emitted by major technologies appear to be generally minor and localized, assessments of environmental impacts of such fields have been very scattered and open to criticism on a number of grounds. This review concludes with recommendations for improved approaches to assessments of environmental impacts of EMF. The scientific paper has been submitted to Environmental Health Perspectives in January 2002.

HARMONIZATION OF EMF STANDARDS

This 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.

1. 2nd International EMF Seminar in China: Electromagnetic Fields and Biological Effects: Xi'an, China 23-26 October 2000.
2. WHO EMF Standards Harmonization Meeting: Brooks Airforce Base, San Antonio, Texas 13-14 November 2000
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 20-23 April 2003 (Incorporates a working group meeting to finalize the framework prior to submitting to the international congress)
9. WHO EMF Standards Harmonization International Congress, Geneva, Switzerland in 2003

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.

A final International Conference on Harmonization of EMF Standards is envisaged for 2003 in Geneva to reach agreement on the framework. This framework would then be used as a basis for national standards and for international standards by ICNIRP. This would complete this activity.

ADMINISTRATION

Role of WHO

In 1996 WHO established the International EMF Project and defined its activities and workplans. WHO acts as the Secretariat to coordinate, facilitate and implement the Project. EMF Project Working Groups are comprised of internationally-recognized experts representing a wide range of diverse opinions on the subject under deliberation. WHO staff cannot be members of any EMF Project Working Group but are present at meetings to facilitate reaching consensus agreement on conclusions or recommendations

The international EMF Project scientific reviews meetings are generally conducted in conjunction with ICNIRP (WHO's formally recognized NGO for NIR protection). Review meetings are open to any scientist, but working group membership is restricted to independent (non-industry) scientists. WG conclusions and recommendations are published in scientific peer-review journals to ensure that the information is made available to as wide an audience as possible. WHO staff members are listed authors to meet Journal requirements for identifying a contact person but are identified as editors for the WGs. All WG members are identified in the manuscript.

All publications of the EMF Project are reviewed by the International Advisory Committee. This oversight Committee is composed of representatives of the 45 national authorities, 8 international agencies and WHO collaborating centres. Final approval by senior WHO management is required of all publications.

Once a scientific review is completed WHO uses the conclusions and recommendations in its information for national authorities and the public. This information is usually published as WHO Fact Sheets prepared by WHO's Information Services and approved by the Director General's Office.

Funding

Over the past year there have been questions raised as to the funding sources of the EMF Project. A summary of funding sources and conditions are given below. There are very strict requirements for WHO to receive funds for extrabudgetary projects, such as the EMF Project.

WHO can receive funds from industry (preferably from industry associations) only after review and approval by WHO's Legal office. A special WHO committee provides further review of funding from industry.

In 1995 WHO reached agreement consistent with these policies with Royal Adelaide Hospital (RAH), Australia to collect funds on behalf of the EMF Project. A memorandum of understanding allowed RAH to collect funds from government, professional associations and industry. All funds would be collected, combined into one account, and sent to WHO on a regular basis for funding Project activities. All industry contributors to the Project are required to sign an agreement prepared by Legal that requires the following:

- The industry cannot advertise the fact of their contribution for commercial purposes
- Industry representatives cannot participate in any WGs or task groups that assess health risks
- Industry can note their support for the Project in their internal reports, such as their annual report.

All contributions and accounting are strictly audited by WHO and RAH. The EMF Project has adhered to all the requirements placed on it by WHO and will continue to do so until the Project concludes.

Personnel and Structure

Personnel: Dr Colin Roy from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) joined WHO for 11 months beginning in February 2001. His term finished at the end of January 2002. Dr Leeka Kheifets accepted the position of Head, Radiation Studies Program within RAD and commenced at WHO in June 2001. Leeka manages the EMF Project. Additional scientific staff are being recruited to assist with the ever increasing demands on the EMF Project. Dr Larry Goldstein, a biologist, has also joined WHO, from February 2002 on an 11 month contract to assist with the health risk assessment process. In addition, Dr Emilie Van Deventer works 60% for the EMF Project. Emilie is a professor electrical engineer and, as part of her duties, she responds to the large number of enquiries that the Project receives each week.

Structure: In view of the new importance in radiation within WHO a new Unit created called Radiation and Environmental Health was created effective January 2002. This Unit has the responsibility for all WHO responsibilities and activities related to ionizing and non-ionizing radiations (including the International EMF Project).

Home page

- WHO's home page and e-mail addresses have changed to a newly created domain from ".ch" for Switzerland to ".int" for international. Although both addresses will be valid for some extended period, the EMF Project home page is now at <http://www.who.int/emf/>.

EMF PROJECT PUBLICATIONS

Brochure

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:

- Electromagnetic Fields and Public Health: The International EMF Project. WHO Fact Sheet #181 Oct. 1997, revised May 1998.
- Electromagnetic Fields and Public Health: Physical Properties and Effects on Biological Systems. WHO Fact Sheet #182 Oct. 1997, revised May 1998.
- Electromagnetic Fields and Public Health: Health Effects of Radiofrequency Fields. WHO Fact Sheet #183 Oct. 1997, revised May 1998.
- Electromagnetic Fields and Public Health: Public Perception of EMF Risks. WHO Fact Sheet #184 Oct. 1997, revised May 1998.
- Electromagnetic Fields and Public Health: Mobile Telephones and their Base Stations. WHO Fact Sheet #193, revised June 2000.
- Video Display Units (VDUs) and Human Health. WHO Fact Sheet #201 July 1998
- Electromagnetic Fields and Public Health: Extremely Low Frequency (ELF). WHO Fact Sheet #205 November 1998.

- Electromagnetic Fields and Public Health: Radars and Human Health. WHO Fact Sheet #226 June 1999.
- Electromagnetic Fields and Public Health: WHO Backgrounder on Cautionary Policies. March 2000
- 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 Launches New International Project to Assess Health Effects of Electric and Magnetic Fields. Press release WHO/42, 4 June 1996.
- Electromagnetic fields: Experts Met in Vienna to Assess Public Perceptions of Risks. Press release WHO/75, 23 October, 1997.
- Health Effects of Electromagnetic Fields: WHO Recommends Research Priorities. Press release WHO/95, 19 December 1997.
- Scientists Meet in Moscow to Discuss Adverse Effects of Electromagnetic Fields. Press release WHO/38, 20 May, 1998.
- WHO Launches an Initiative to Harmonize Electromagnetic Field Standards Worldwide. Press release WHO/88, 17 November 1998
- More information necessary to establish health effects of mobile phones. Press release WHO/45, 28 June 2000.
- WHO clarifies its position on health effects of mobile phone use. Note for the press No 14 10 October 2001
- Clarification of mooted relationship between mobile telephone base stations and cancer. Statement WHO/1 23 January 2002.

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
- Electromagnetic fields: Biological effects and hygienic standardisation. MH Repacholi, NB Rubtsova and AM Muc (eds) Proceedings of International Meeting. Moscow 18-22 May 1998. WHO publication WHO/SDE/OEH/99.5, WHO Geneva 1999.

- EMF Risk Perception and Communication. MH Repacholi and AM Muc (eds) Proceedings of International Seminar on EMF Risk Perception and Communication. Ottawa, Canada 31 August-1 September 1998. WHO publication # WHO/SDE/OEH/99.01, WHO Geneva 1999.
- 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

EMF Project Scientific Journal Publications

- Repacholi MH, Cardis E (1997): Criteria for EMF Health Risk Assessment. *Radiat Prot Dosim* 72: 305-312
- MH Repacholi (ed) (1998) Low-Level Exposure to Radiofrequency Electromagnetic Fields: Health Effects and Research Needs. *Bioelectromagnetics* 19: 1-19 (1998)
- MH Repacholi and B Greenebaum (eds) (1999) Interaction of Static and Extremely Low Frequency Electric and Magnetic Fields with Living Systems: Health Effects and Research Needs. *Bioelectromagnetics* 20: 133-160
- AF McKinlay and MH Repacholi (eds) (1999) Exposure metrics and dosimetry for EMF epidemiology. *Radiation Protection Dosimetry* 83(1-2), 194.
- KH Foster, P Vecchia, MH Repacholi (2000) Science and the Precautionary Policy. *Science* 288: 979-981.
- E Litvak, KR Foster and MH Repacholi (2002) Health and safety implications of exposure to electromagnetic fields in the frequency range 300 Hz to 10 MHz., *Bioelectromagnetics* 23(1) 68-82.
- LS Goldstein, MW Dewhirst, MH Repacholi, and L Kheifets (2002) Summary, conclusions and recommendations: adverse temperature levels in the human body, *International J. Hyperthermia*, In Press
- MW Dewhirst, ML Michiels, BL Viglianti, and MH Repacholi (2002) Carcinogenic effects of hyperthermia, *International J. Hyperthermia*, In Press
- L. Kheifets, MH Repacholi, and R_Saunders (2002) Thermal stress and radiation protection principles, *International J. Hyperthermia*, In Press
KR Foster, JM Osepchuk, and MH Repacholi, Environmental impacts of electromagnetic fields from major electrical technologies, Submitted to *Environmental Health Perspectives* 2002

WHO/IARC publications

Non-ionizing radiation, Part 1: Static and extremely low-frequency (ELF) electric and magnetic fields, IARC Monographs 80, IARC Press: Lyon, (2002), pp 429.

All press materials, WHO's Agenda for EMF Research, project progress reports, Minutes of Research Co-ordination meetings, Standards Harmonization meetings and International Advisory Committee meetings can be obtained on WHO EMF Project web site at: www.who.int/emf

FOR FURTHER INFORMATION:

Visit the International EMF Project Web site at: <http://www.who.int/emf/>

or contact:

Dr Leeka Kheifets
World Health Organization
Radiation and Environmental Health
1211 Geneva 27, Switzerland
Tel: +41 22 791 4976/4076 - Fax: +41 22 791 41 23
E-mail: kheifets@who.int