



THE INTERNATIONAL EMF PROJECT

PROGRESS REPORT 2002-2003

SUMMARY

This eighth progress report for the International EMF Project covers activities and outputs for the period May 2002 to May 2003. 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. Current details of the EMF Project, its activities and outputs can be found on our newly re-vamped home page at: <http://www.who.int/emf/>

A workshop on the effects of heating on the human body was held at WHO/HQ in March 2002. The results have been published as a special volume of the International Journal of Hyperthermia, Vol. 19, No. 3, pp. 215-384 / May-June 2003.

We have embarked on the health risk assessments for exposure to static and ELF fields. Based on the large literature on static fields which has never been thoroughly reviewed we have decided to develop to separate monographs, one for static fields and another one for ELF fields.

The Handbook on "Establishing a dialogue on risks from electromagnetic fields" has been published. It has been very well received and has been translated into Spanish, German and Italian, electronic versions of which are available on the Project WebSite. Additionally, it is currently being translated into: French (in house at WHO). Dutch and Japanese translations are being discussed. If you are interested in translating it into other languages please let us know. 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 framework has been re-drafted based on numerous inputs and has been mailed to IAC for final review. Depending on comments received we will further refine it and submit to an international meeting for approval in 2004.

SCIENTIFIC REVIEWS

Since the main effect of exposure of humans to RF radiation is heating, it is of particular importance to critically evaluate information relating elevated temperature effects on the human body, from the cellular and tissue level to the whole body level. This would include heating of the embryo and fetus as well as thermally sensitive organs in the body. In order to provide this information, WHO's EMF Project convened a Workshop on Adverse Temperature Levels in the Human Body from 21-22 March 2002 at WHO headquarters in Geneva.

The purpose of the Workshop was to:

- present state-of-the-science information on the effects of elevated temperature and times of exposure on mammalian cells and tissues, the fetus, sensitive organs (e.g. eye, skin, brain, and testes) and the whole body.

- define the combined elevated temperature and exposure times causing adverse effects in biological systems.
- prepare a written report on the persuasiveness of the data for recommendations for maximal permissible temperature elevations in tissues and organs in human beings and make such recommendations if appropriate.
- provide information useful for development of RF exposure standards.

The results have been published as a special volume of the International Journal of Hyperthermia, Vol. 19, No. 3, pp. 215-384 / May-June 2003. (**Publisher:** Taylor & Francis Health Sciences, part of the Taylor & Francis Group):

Thermal stress and radiation protection principles

L. Kheifets, M. Repacholi, R. Saunders

Cardiovascular responses to heat stress and their adverse consequences in healthy and vulnerable human populations

G. C. Donaldson, W. R. Keatinge, R. D. Saunders

Carcinogenic effects of hyperthermia

M. W. Dewhirst, M. Lora-Michiels, B. L. Viglianti, *et al.*

Cellular effects of hyperthermia: relevance to the minimum dose for thermal damage

James R. Lepock

Basic principles of thermal dosimetry and thermal thresholds for tissue damage from hyperthermia

M. W. Dewhirst, B. L. Viglianti, M. Lora-Michiels, *et al.*

Effects of heat on embryos and foetuses

M. J. Edwards, R. D. Saunders, K. Shiota

Hyperthermia induced pathophysiology of the central nervous system

H. S. Sharma, P. J. Hoopes

Effects of heat stress on cognitive performance: the current state of knowledge

P. A. Hancock, I. Vasmatzidis

Summary, conclusions and recommendations: adverse temperature levels in the human body

L. S. Goldstein, M. W. Dewhirst, M. Repacholi, *et al.*

Glossary

As you can see several papers in this volume are by leading hyperthermia scientists and WHO

staff representing state-of the art knowledge and will provide key input to the development of standards world-wide.

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.

Of particular importance this year was the meeting on Electromagnetic Fields and Human Health. Fundamental and Applied Research. Moscow / St. Petersburg, Russia - 17-25 September 2002. This workshop reviewed Russian publications that have provided the basis for standards in Russia and other parts of the world. Additionally, important discussion focused on the differences in the scientific evidence and review standards in the different parts of the world. While providing important insight most of these differences remain unresolved. Previous attempts to replicate Russian studies have not been successful. Further progress will require organization and funding of parallel studies addressing key hypothesis.

Previously held scientific review meetings include:

- 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.

RESEARCH CO-ORDINATION

A research update meeting will take place in Geneva June 11-13, 2003. At this meeting we will focus on RF research only. Research needs for static fields and ELF are being developed as part of the review for EHC. At this meeting on RF we will assess ongoing studies, planned research and research priorities by government and industry funding agencies.

Assessment of outstanding EMF research needs will be determined by independent research scientists invited by WHO on 11 June 2003. Assessment of ongoing studies and research priorities by government and industry funding agencies will take place on June 12-13. At this meeting we will review ongoing and planned national and collaborative research programs as well as identify of research needs. We will discuss both short term priorities for research which can be completed to in time to contribute to EHC, as well as the long term research agenda. Finally, we will discuss the WHO Research Database and the best way to update and maintain it.

HEALTH RISK ASSESSMENTS

The primary goal of the International EMF Project is to review the scientific literature on health effects of electromagnetic fields with frequencies 0 to 300 GHz, to assess the health risks of exposures based on this review, and to develop policy options in light of this understanding. The results will be published as Environmental Health Criteria (EHC) monograph or another similar document. We have embarked on the health risk assessments for exposure to static and ELF fields. Based on the large literature on static fields which has never been thoroughly reviewed we have decided to develop to separate monographs one for static fields and another one for ELF fields.

The EHCs are the result of in-depth weight-of-evidence critical reviews conducted through independent, scientific peer-review groups on various topics related to exposure of people to static and time varying electric and magnetic fields. The reviews will build on excellent reviews already completed and update them with the more recent literature. Reviews will be primarily focus on the peer review literature, however reports and other publications of well-conducted research not in the peer review literature will also be considered.

Once the first drafts of the chapters are complete they will be peer-reviewed. Comments will be incorporated and a combined report will be subjected to a formally constituted WHO Task Group meeting. Membership of WHO Task Groups are approved by the Executive Director (Sustainable Development and Healthy Environments) of WHO and will comprise representatives of the drafting committees and experts appointed by speciality, range of views, gender and geographical distribution. Following WHO technical reviewing and editing, the final document will be published by WHO.

Schedule of assessments and progress

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
- 2003-4 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

Several working group meetings which are developing chapters for EHC have been held, including Static Fields held in Vlaardingen, The Netherlands (18-19 November 2002); Neurodegenerative workshop held at WHO HQ, Geneva (12-13 December 2002); Cardiovascular disease held at Karolinska Institut, Sweden (27 May 2003). And the important policy workshop held in Luxembourg (Feb 2003) which is described in the next section.

The next workshop, to be held in Japan and scheduled for September 2003 and will:

1. Review a chapter on World-wide exposure distribution and other aspect of human exposure
2. Update epidemiological studies on cancer (especially childhood leukaemia) which came out after IARC evaluation (Germany, Japan and possibly Italy)

3. Critically review Epidemiological studies (what do they tell us, exposure misclassification, uncertainties)
4. Decide how to move beyond hazard identification to the estimate of the disease burden.

EMF RISK MANAGEMENT

Possible health effects arising from exposure to extremely low frequency (ELF) electromagnetic fields (EMF) have been the subject of research for many years, but without definitive scientific resolution. At radio frequencies (RF), the rapid growth of new technologies such as mobile wireless telecommunications has raised concerns that exposure to fields from mobile phones and base stations could have long-term health consequences.

Conducting Human Health and Environmental Risk Assessment and Risk Management under the precepts of Precautionary Principle represents challenges and opportunities for scientists, policy makers and the public. Responding to the need to provide a framework and test it in a case study, 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.

The first day was an open meeting featuring point-counterpoint presentations to highlight strengths and weaknesses of the Precautionary Principle, and arguments for and against its use for policy decisions regarding possible health implications from exposure to electromagnetic fields (EMF). Attendees had the opportunity to provide input and perspective and participate in an open discussion with a panel of experts. The workshop was well attend and 16 individuals and organizations had an opportunity to provide a diverse input. For a masterful summary by Tom McManus go to:

http://www.who.int/peh-emf/meetings/en/Lux_final_rapp_report.pdf

During the second and third days, invited experts worked on a draft document. The workshop brought together scientists, engineers, lawyers, health professionals and concerned citizens with knowledge of the Precautionary Principle to contribute perspectives from health, government, academia, environmental advocacy groups and industry. As a starting point the group used the criteria for the application of Precautionary Principle developed in the European Commission communication published in February 2002: decisions must be proportional to the chosen level of protection, non-discriminatory in their application, consistent with measures already taken, based on potential costs and benefits, subject to review and capable of assigning responsibility for producing the scientific evidence necessary for more comprehensive risk assessment. EMF was a test case for an environmental agent already classified as possibly carcinogenic for the low frequency magnetic fields, and for mobile phone technologies where key studies for the conventional risk assessment will not be completed for several years.

As the result of the input received at the workshop, WHO re-drafted it's 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.

Based on this framework, and once it has been finalized, we will develop several case studies which will include ELF and RF. 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 Precautionary Framework on health issues.

EMF RISK PERCEPTION AND COMMUNICATION

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 published. It is entitled "Establishing a dialogue on risks from electromagnetic fields" (ISBN 92 4 154571 2). All IAC members have had the opportunity to review this book that has taken some time to complete. This handbook was published in an attractive format in October 2002, and formatted for use and downloading on the EMF web site:

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

Due to the extreme popularity and large demand of this publication, and at the advice of WHO's Marketing and Dissemination Unit, we decided to sell it. The Handbook has been very well received and has been kindly translated into Spanish by Victor Cruz's institute, Peruvian National Institute for Research and Training in Telecommunications (INICTEL), German, Axel Böttger's institute (Federal Ministry of Environment, Nature Conservation and Nuclear Safety) and also into Italian by Paolo Vecchia, Istituto Superiore di Sanità. It is expected that about 50,000 copies of the Italian version will be printed. Electronic versions of the Spanish, Italian and German are now available to downloadable from the EMF web site at:

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

Additionally, it is currently being translated into French (in house at WHO), and Dutch and Japanese translations are also being discussed. If you are interested in translating it into other languages please let us know.

HARMONIZATION OF EMF STANDARDS

In response to the many countries that are considering new EMF standards WHO launched an initiative to harmonize 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 28April - 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 18-22 April 2003 (Incorporates a working group meeting to finalize the framework prior to submitting to the international congress) Meeting to be rescheduled because of SARS outbreak.
9. WHO EMF Standards Harmonization International Congress, Geneva, Switzerland in 2004

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. 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. However, the last working group meeting scheduled to take place in China had to be postponed due to SARS.

A framework has been re-drafted based on numerous inputs and has been mailed to IAC for final review. Depending on the comments received we will further refine it and submit to a final International Conference on Harmonization of EMF Standards which is envisaged for 2004 in Geneva to reach agreement on the framework. Alternatively, we might have to postpone this activity until the China meeting takes place. Final framework would be used as a basis for

national standards and for international standards by ICNIRP. In addition we are proceeding with the development of model legislation for NIR protection. This could be used as a basis for national legislation in those countries not having a process for setting mandatory health standards or health protection measures for NIR. This activity should be completed over the next year.

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). These 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 may be listed authors as appropriate.

All publications of the EMF Project are reviewed by the International Advisory Committee. This oversight Committee is composed of representatives of many national authorities, 8 international agencies and WHO collaborating centres. Formal approval by 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 year has been a very busy for us with requests for presentations on the state of science and the EMF project well in excess of what we can handle. We attempt to fulfill requests as much as possible, especially when it comes from national authorities. For the list of the meetings with presentations by WHO staff see below.

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.

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

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

Dr Leeka Kheifets joined WHO in June 2001 to head the radiation studies program. After fulfilment of her commitment of two years Leeka has resigned and will be moving back to the US. We have greatly benefited from Leeka's scientific and management expertise and will continue working with her on the project. We are currently recruiting for her replacement. Dr Larry Goldstein, a biologist, joined WHO in February 2002 and is continuing the health risk assessment process. In addition, Dr Emilie van Deventer works 80% for the EMF Project. Emilie is a professor in electrical engineering and, as part of her duties, she responds to the large number of enquiries that the Project receives each week.

EMF PROJECT RESOURCES

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: <http://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.

EMF Project Scientific Journal Publications

- M H Repacholi, E Cardis (1997): Criteria for EMF Health Risk Assessment. *Radiation Protection Dosimetry* 72: 305-312.
- M H Repacholi (ed) (1998): Low-Level Exposure to Radiofrequency Electromagnetic Fields: Health Effects and Research Needs. *Bioelectromagnetics* 19: 1-19 (1998)
- M H 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.
- A F McKinlay and M H Repacholi (eds) (1999): Exposure metrics and dosimetry for EMF epidemiology. *Radiation Protection Dosimetry* 83(1-2): 194.
- K H Foster, P Vecchia, M H Repacholi (2000): Science and the Precautionary Policy. *Science* 288: 979-981.
- G Mezei, L Kheifets (2001): "Is There any Evidence for Differential Misclassification or for Bias Away from the Null in the Swedish Childhood Cancer Study?" Letter to the Editor, *Epidemiology* 12(6):750.
- L Kheifets, R Greenberg, R Neutra, G Hester, C Poole, D Rall D, G Banerjee (2001): From epidemiology to policy: An EMF case study. *American Journal of Epidemiology*

- 154(12): S50-59.
- L Kheifets, G Hester, G Banerjee (2001): The Precautionary Principle and EMF: Implementation and Evaluation. *Journal of Risk Research* 4(2): 113-125.
 - L Kheifets (2001): Electric and Magnetic Fields and Occupational Health. *Patty's Industrial Hygiene and Toxicology*, Fifth Edition 100: 141-198.
 - L Kheifets (2001): Electric and magnetic field exposure and brain cancer. *Bioelectromagnetics* 5: S120-S131.
 - M H Repacholi (2001): Health risks from the use of mobile phones. *Toxicology Letters* 120: 323-331.
 - E Litvak, K R Foster and M H 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.
 - M H Repacholi (2002). Assessment of the Health Effects of EMF Exposure. *The Radio Science Bulletin* 301: 14-24.
 - L Goldstein, L Kheifets, E van Deventer, M H Repacholi (2002): Comments of the paper "Long-term exposure of Em -Pim1 transgenic mice to 898.4 MHz microwaves does not increase lymphoma incidence" Radiation Research. *Radiation Research* 158: 357-364.
 - LS Goldstein, L Kheifets, E van Deventer, M H Repacholi (2002): Further comments on "Long-term Exposure of E&mgr;-Pim1 Transgenic Mice to 898.4 MHz Microwaves Does Not Increase Lymphoma Incidence" by Utteridge et al., Radiat. Res. 158, 357-364 (2002).
 - J Sahl, G Mezei, R Kavet, A McMillan, A Silvers, A Sastre, L Kheifets (2002): Occupational magnetic field exposures and cardiovascular mortality in a cohort of electric utility workers. *American Journal of Epidemiology* 156:913-918.
 - G Mezei, L Kheifets (2002): Clues to the possible viral etiology of childhood leukemia. *Technology* 9: 3-14.
 - L Kheifets, N Thrall (2002): Electromagnetic Fields and Health. *Macmillians Guide to Pollution*, in press.
 - L Kheifets, M H Repacholi, and R_Saunders (2003): Thermal stress and radiation protection principles. *International Journal of Hyperthermia* 19(3) May-June 2003: 215-224.
 - M W Dewhirst, M Lora-Michiels, B L Viglianti and M H Repacholi (2003): Carcinogenic effects of hyperthermia. *International Journal of Hyperthermia* 19(3) May-June 2003: 236-251.
 - L S Goldstein, M W Dewhirst, M H Repacholi and L Kheifets (2003): Summary, conclusions and recommendations: adverse temperature levels in the human body. *International Journal of Hyperthermia* 19(3) May-June 2003: 373-384.

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 <http://www.who.int/emf>

MEETINGS

The following 3 scientific conferences were organized for 2003, to include working group meetings in key regions, however, both meetings had to be postponed due to the SARS epidemic:

- 3rd International Conference, Electromagnetic Fields and Human Health. Fundamental and Applied Researches, Moscow and St Petersburg, Russia. 17-25 September 2002
- EMF Biological Effects and Standards Harmonization regional meeting, Guilin, Guangxi, (Incorporates a working group meeting to finalize the framework prior to submitting to the international congress). Postponed until end of March 2004.
- WHO / US Air Force Asian Pacific EMF Conference – Postponed until possibly April 2004.

EMF PROJECT Staff presented and participated in the following meetings from June 2002 –May 2003

Meeting details	Place	Date
<ul style="list-style-type: none"> • Royal Swedish International Union of Radio Science. Keynote Speech “Epidemiologic Studies of Electromagnetic Fields and their Contribution to Risk Assessment” 	Stockholm Sweden	June 2002
<ul style="list-style-type: none"> • 24th Annual Meeting of the Bioelectromagnetics Society Meeting. Keynote Address 	Quebec Canada	June 2002
<ul style="list-style-type: none"> • Malaga University Summer Course on Mobile Telephony and its Health Effects. Presentation on “NIR Protection against short-term thermal effect: The ICNIRP/WHO approach” 	Ronda – Malaga Spain	July 2002
<ul style="list-style-type: none"> • General Assembly of the International Union of Radio Science Commission K on Electromagnetics in Biology and Medicine • Keynote Address 	Maastricht The Netherlands	August 2002
<ul style="list-style-type: none"> • Talks with French Senators regarding EMF, mobile phones and health. 	Paris France	September 2002
<ul style="list-style-type: none"> • The National Board of Health and Welfare: Environmental Medicine Symposium. Presentation on the WHO EMF Project 	Lund Sweden	September 2002
<ul style="list-style-type: none"> • The Tunisian Society of Occupational Medicine 5th ICOH International Conference on Occupational Health of Health Workers. Presentation on Electromagnetic Capability 	Tunisia	September 2002
<ul style="list-style-type: none"> • 3rd International Conference: EMF and Human Health, Fundamental and Applied Researches. 	Moscow & St Petersburg Russia	September 2002

• EMC EUROPE 2002: Electromagnetic Fields and Sustainable Development. Presentation on WHO Risk Assessment Process	Sorrento Italy	September 2002
• 2nd International Workshop on Biological Effects of Electromagnetic Fields	Rhodes Greece	October 2002
• To participate in a workshop on “Genetic and Cytogenetic aspects of RF Field Interaction” and present on the WHO EMF Project.	Lowestein Germany	November 2002
• Mobile Telecommunications and Health Research Programme Meeting	London UK	November 2002
• COST 281 meeting	London UK	November 2002
• Representing the WHO EMF Project at a local public debate on Power lines and health	Gourdon France	November 2002
• Royal Society. 1- day Workshop	London UK	January 2003
• Precautionary Principle – WHO EHC meeting	Luxembourg	February 2003
• To speak at public debate on the subject of 400,000 volt power line between Lyon and Chambéry – organised by RTE (Gestionnaire du Réseau de Transport d’Electricité)	Chambéry France	February 2003
• ICNIRP / WHO International Workshop “Weak ELF Electric Field Effects in the Body”	Oxford UK	March 2003
• IBC Conference: Mobile Health and the Environment. Presentation on: “Meeting the ongoing challenge of Risk Communication”	London UK	March 2003
• To participate in “The Rise of the Precautionary Principle in EU Risk Regulation” organized by the University of Maastricht International and European Law.	Maastricht The Netherlands	May 2003
• European Parliament - Seminar on Mobile Communication Health and Environment in the Mobile Community	Brussels Belgium	May 2003
• Official presentation on Italian translation of “Establishing a dialogue on risks from Electromagnetic Fields”	Rome Italy	May 2003

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
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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 27-28 July 2001, Whistler, British Columbia.
- 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

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