Health Risks Assessment
A WHO perspective

Dr E. van Deventer
Outline

- Introduction
- Health risk assessment
- WHO HRA monographs
  - IARC monographs on the evaluation of carcinogenic risks to humans
  - Environmental Health Criteria monographs
- Conclusion
Somalia is again polio-free

25 March 2008 -- With no new cases reported in a year, Somalia is again polio-free, the Global Polio Eradication Initiative announced today. Some 10,000 volunteers and health workers vaccinated more than 1.8 million children under the age of five to wipe out the disease.

News release on polio in Somalia

Poor sanitation threatens public health

20 March 2008 -- Six out of every 10 Africans do not have access to a proper toilet, according to preliminary data on sanitation in Africa released today. About 2.6 billion people around the world have no access to a toilet at home and thus are vulnerable to a range of health risks.

News release on sanitation

World TB Day

Sanitation

10 facts on its role in health

Iraqi health workers

First-hand accounts

World Health Report

Annual report on global public health and key statistics

Governance of WHO

WHO Constitution, Executive Board and World Health Assembly

Media centre

News, events, fact sheets, multimedia and contacts

International travel and health

Publication on travel risks, precautions and vaccination requirements

Key WHO information

Director-General

Director-General and senior management
Non-ionizing radiation

- Power lines
- Trains
- Radar
- Personal computer
- Cell phone
- Visible light
- X-ray

Frequency (Hz or cycles per second):

- 0 Hz
- $10^2$
- $10^4$
- $10^6$
- $10^8$
- $10^{10}$
- $10^{12}$

Ionizing radiation
Radiation

Public Health

Public Concern

UV
Radon
X-rays
EMF

EMF
X-rays
Radon
UV
WHO and Radiation

Health Security and Environment (HSE)

Public Health and Environment (PHE)

Radiation (RAD)

International EMF Project

International RADON Project
WHO Partners in Radiation

International Organizations

Collaborating Centres

National Authorities

IAEA.org
International Atomic Energy Agency

6th International ICNIRP Workshop, Rio de Janeiro | 16 October 2008
Participating countries & entities in EMF Project

Click on your location in the map below to find information on contact details and activities relating to EMF in your area.
WHO Regional Office for the Americas (AMRO)

:: Brazil
:: Canada
:: Cuba
:: Ecuador
:: Peru
:: United States of America
WHO International EMF Project

- Established in 1996
- Coordinated by WHO HQ
- A multinational, multidisciplinary effort to create and disseminate information appropriate to human health risk assessment for EMF
Through the EMF Project, WHO provides scientific information and practical advice on the health impact and environmental effects of exposure to electromagnetic fields.

Objectives

- Review the scientific literature on health effects of EMF exposure and formally assess health risks;
- Promote a focused agenda of high quality EMF research;
- Encourage internationally acceptable harmonized standards;
- Provide information on risk perception, risk communication, risk management.
EMF: An environmental risk?

- Science
  - Risk Assessment
- Public Concern
  - Risk Perception
- Policies
  - Risk Management
Established in 1995

Original partners

- United Nations Environmental Programme (UNEP)
- World Meteorological Organization (WMO)
- International Commission on Non-Ionizing Radiation Protection (ICNIRP)
- International Agency for Research on Cancer (IARC)

To reduce the global burden of disease resulting from exposure to UV radiation
INTERSUN Programme

Through INTERSUN, WHO provides scientific information and practical advice on the health impact and environmental effects of exposure to UV radiation.

Objectives

- Promotes research
- Quantifies health risks of UV radiation
- Facilitates public and occupational programmes to reduce UV-related health risks
- Develops practical resources for sun protection in schools
- Promotes the UV Index
UV: An environmental risk!!

Science
Risk Assessment

Public Awareness
Risk Perception and communication

Policies
Risk Management
Outline

- Introduction
- Health risk assessment
Definitions

Risk analysis
- Risk assessment
- Risk management
- Risk communication

Risk Assessment in the Federal Government: Managing the Process
National Academies Press, 1983
USA

"The Red Book"
Definitions

Risk analysis

Risk assessment
Risk management
Risk communication

Risk assessment
Risk communication
Risk management
Problem Formulation

Exposure Assessment
Determine the amount, duration and pattern of exposure to the agent

Hazard Identification
Review key research to identify any potential health problems that an agent can cause

Exposure-Response Assessment
Estimate how much of the agent it would take to cause varying degrees of health effects that could lead to illnesses

Risk Characterization
Assess the risk for the agent to cause cancer or other illnesses in the general population
Some definitions (cont'd)

- **Hazard Identification**: identifying the type and nature of adverse effects that an agent has as inherent capacity to cause (no magnitude)

- **Exposure-Response Assessment**: quantification of the magnitude, duration, frequency and timing of exposure and the severity and frequency of adverse effects

- **Exposure Assessment**: quantification of the range and frequency of the exposure

- **Risk Characterization**: The qualitative and, if possible, quantitative determination of the probability of occurrence of known and potential adverse effects under defined exposure conditions, including assumptions, scientific judgments, and estimate of uncertainties
Health Risk Assessments...
Outline

- Introduction
- Health risk assessment
- WHO HRA monographs
  - IARC monographs on the evaluation of carcinogenic risks to humans
  - Environmental Health Criteria monographs
WHO Health Risk Assessment

Risk assessment of all health outcomes (Environmental Health Criteria)

Hazard identification and classification of possible carcinogens (Monographs)

International Agency for Research on Cancer (IARC)
Centre International de Recherche sur le Cancer (CIRC)

World Health Organization
The *IARC Monographs* are a series of scientific reviews that identify environmental factors that can increase the risk of human cancer.

Each *Monograph* includes:
- Critical review of the pertinent scientific literature
- Evaluation of the weight of the evidence that the agent can alter the risk of cancer in humans

National and international health agencies use the *Monographs*:
- As a source of information on potential carcinogens
- As scientific support to guide their actions to prevent exposure to potential carcinogens
• Initiated in 1969

• Criteria established in 1971, last update January 2006
  http://monographs.iarc.fr/ENG/Preamble/index.php

• “Carcinogen”: exposure that is capable of increasing the incidence of malignant neoplasms (at any stage of the carcinogenesis)

• 900+ agents have been evaluated

• Volume 80: Non-Ionizing Radiation, Part 1: Static and Extremely Low-Frequency (ELF) Electric and Magnetic Fields, 2002

• Volume 100: review of the human carcinogens that have been identified to date
For each type of cancer, classify human and animal data separately as:

- Sufficient
- Limited
- Inadequate
- Lack of effect

**Group 1**: Is carcinogenic to humans
**Group 2A**: Probably is carcinogenic
**Group 2B**: Possibly is carcinogenic
**Group 3**: Not classifiable
**Group 4**: Is probably not carcinogenic
A matter of scientific judgement

- The Preamble (2006) provide guidance on criteria to use
- Identification of carcinogenicity, but not potency
Health Risk Assessment

Problem Formulation

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Cancer
Background

WHO Environmental Health Criteria

- Original impetus for the Programme came from World Health Assembly resolutions and the recommendations of the 1972 UN Conference on the Human Environment

- Subsequently the work became an integral part of the International Programme on Chemical Safety (IPCS), including UNEP, ILO and WHO

- The EHC monographs have become widely established, used and recognized throughout the world
Environmental Health Criteria (EHC) documents provide international, critical reviews on the effects of chemicals or combinations of chemicals and physical and biological agents on human health and the environment.

Each EHC follows a standard outline or format, and you can expect to find a summary of the whole document followed by information on identity, sources of exposure, environmental transport, distribution and transformation, environmental levels and human exposure, kinetics and metabolism in laboratory animals and humans, effects on laboratory animals and in vitro test systems. Effects on humans; effects on other organisms in the laboratory and field. An overall evaluation and conclusions for the protection of human health and the environment is found at the end of each document together with needs for further research and details of previous evaluations by international bodies e.g. IARC, IEP/FA.

Two different series of Environmental Health Criteria (EHC) documents are available: (1) on specific chemicals or groups of related chemicals; and (2) on risk assessment methodologies. Both are accessible from the numerical listing below. In addition the EHCs on risk assessment methodologies are accessible from the listing of all IPCS methodology publications and projects.
Environmental Health Criteria

**Target audience**
- National and international authorities
- To assist them in making risk assessment and subsequent risk management decisions

**Reason for development**
- Mandate
- Update
  - EHC 16 Radiofrequency and microwaves (1981)
  - EHC 35 Extremely low frequency (ELF) fields (1984)
  - EHC 69 Magnetic fields (1987)
  - EHC 137 Electromagnetic fields (300 Hz-300 GHz) (1993)
Environmental Health Criteria
Contributors

- Chapter authors, expert working group members
- Task Group members
  - Individual scientists, not representatives of their organizations
  - Composition dictated by range of expertise and views, gender and geographical distribution
  - Membership approved by Assistant Director General
  - Role: assess risks to health, reach agreements by consensus, make final conclusions and recommendations that cannot be altered after the Task Group meeting
- Observers
- Secretariat
Environmental Health Criteria

- Development of an extensive database
  - Peer-reviewed scientific publications (Medline, PubMed)
  - Geographical inclusion
  - Use of unpublished reports
  - Use of reviews by other national and international expert review bodies
Inputs to the ELF EHC

New data and analysis

4 focused Expert Working Groups
RESEARCH
Balance of studies needed

Does EMF Exposure Cause Disease?

animal studies

epidemiological studies

clinical studies

cellular studies

By type of studies
Preamble
1. Summary and recommendations for further studies
2. Sources, measurements and exposures
3. Electric and magnetic fields inside the body
4. Biophysical mechanisms
5. Neurobehaviour
6. Neuroendocrine system
7. Neurodegenerative disorders
8. Cardiovascular disorders
9. Immune system and haematology
10. Reproduction and development
11. Cancer
12. **Health risk assessment**
13. Protective measures

Appendix
Problem Formulation

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All studied outcomes

Environmental Health Criteria N°236
Extremely Low Frequency Fields

World Health Organization

6th International ICNIRP Workshop, Rio de Janeiro | 16 October 2008
EHC on ELF Fields

Table of Contents

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1. Summary and recommendations for further studies
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Appendix
Other outputs

Fact sheets

Electromagnetic fields and public health
Exposure to extremely low frequency fields

The use of electricity has become an integral part of everyday life. Whenever electricity flows, both electric and magnetic fields exist close to the lines that carry electricity, and close to appliances. Questions about whether or not exposure to these extremely low frequency (ELF) electric and magnetic fields (EMFs) produces adverse health consequences have been asked for many years. Research has been focused on this issue for the past several decades. It is now widely acknowledged that ELF EMFs are safe for the general public.

In 1986, the World Health Organization (WHO) established the International Electromagnetic Fields Project to investigate potential health risks associated with technologies emitting EMF. A WHO study concluded in 2007 that there is no evidence that ELF EMF exposure poses a health risk.

This Fact Sheet is based on the findings of the Task Group and update recent reviews on the health effects of ELF EMF published in 2012 by the International Agency for Research on Cancer (IARC) and the National Research Council (NRC) in 2013.

ELF field sources and residential exposures

Electric and magnetic fields exist whenever electric current flows - in power lines and cables, residential wiring and electrical appliances. Electric fields arise from electric charges, are measured in volts per meter (V/m), and are shielded by common materials, such as wood and metal. Magnetic fields arise from the motion of electric charges (i.e., currents), are measured in teslas (T), and are commonly measured in milliteslas (mT). In some countries other units are used, such as the gauss (G), which is commonly used (1,000 G = 1 T). These fields are not shielded by most common materials, and pass easily through them. Both types of field are also produced by transformers and power lines at a frequency of 50 or 60 cycles per second. Cables in power lines and power cables can be sources of ELF fields.

Task group evaluation

In October 2005, WHO established a Task Group of experts to assess any risks to health that might exist from exposure to ELF electric and magnetic fields in the frequency range 0 to 300 Hz. The Task Group reviewed the evidence regarding cancer and concluded in 2007 that there is no evidence of a relationship between ELF magnetic fields and cancer.

2007 WHO Research Agenda for Extremely Low Frequency Fields

Introduction

In 2007, the WHO International EMF Project developed a Research Agenda in order to facilitate and coordinate research worldwide on the possible adverse health effects of electromagnetic fields (EMF). In subsequent years, this agenda has undergone periodic review and refinement.

In October 2005, WHO carried out a health risk assessment of extremely low frequency (ELF) electromagnetic fields up to 100 kHz, which is published as a WHO Environmental Health Criteria monograph. Gaps in knowledge about possible health effects of ELF field exposure are identified in this monograph, and form the basis for research recommendations given in this Research Agenda.

Following a standard health risk assessment process, it was concluded that there were no substantive health issues related to ELF electric fields at levels generally encountered by members of the public. Thus this Research Agenda addresses further research concerning the possible acute and long-term effects of exposure to ELF magnetic fields.

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In general, acute effects are known to result from exposure to ELF magnetic fields which induce electric fields and currents in the body. These fields, if high enough, can cause nerve and muscle stimulation and changes in nerve cell excitability in the central nervous system. Various research recommendations are made which address uncertainty in the threshold levels of these acute effects. With regard to long-term effects, epidemiological studies have presented data indicating an association between ELF exposure above approximately 0.004 μT and an increased risk of childhood leukemia. Despite several decades of work, however, compelling evidence from experimental studies to support a causal relationship is lacking. In addition, there is no readily accepted mechanism by which ELF fields at normal environmental and occupational exposure levels might affect the incidence of cancer or any other disease in the human population. Therefore, there is a need to support the epidemiological evidence by establishing an animal model response to ELF fields that is widely transferable between laboratories, if indeed such responses occur.

Most studies carried out have concerned the possible effects of exposure to power frequency fields. Further research on intermediate frequencies, usually taken as frequencies between 300 Hz and 100 kHz, is required given the present lack of data in this area. For these frequencies, very little of the required knowledge base for a health risk assessment has been gathered and most existing studies have contributed inconsistent results, which need to be further substantiated. General requirements for constructing a sufficient intermediate frequencies
RF EHC ....

INTERPHONE multinational epidemiologic study

IARC evaluation of carcinogenic risks to humans from RF

WHO assessment of all health risks to humans from RF