Health Risks Assessment
A WHO perspective

Dr E. van Deventer

World Health Organization

Outline

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

HIGHLIGHTS

WHO/Ahmed Tajudin

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

Iraqi health workers
First-hand accounts

Sanitation
10 facts on its role in health

WHO 60th anniversary

KEY WHO INFORMATION

Director-General
Director-General and senior management

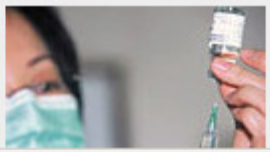
Governance of WHO
WHO Constitution, Executive Board and World Health Assembly

Media centre
News, events, fact sheets, multimedia and contacts

International travel and health
Publication on travel risks, precautions and vaccination requirements

World Health Report
Annual report on global public health and key statistics

World TB Day

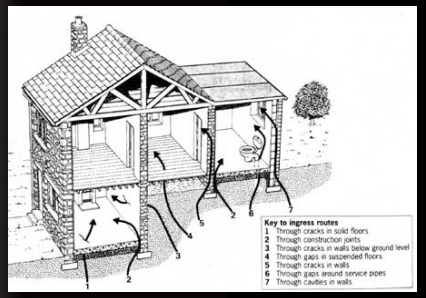


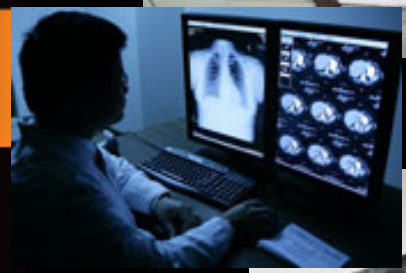
Non-ionizing radiation

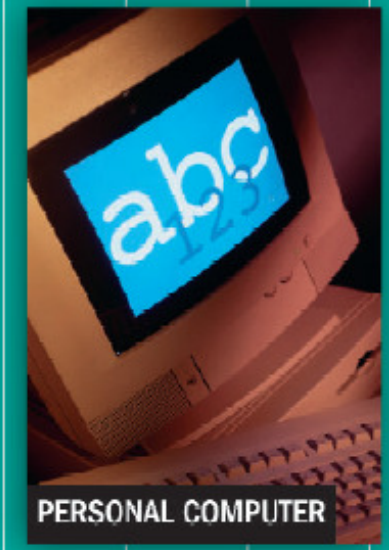
Ionizing radiation

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

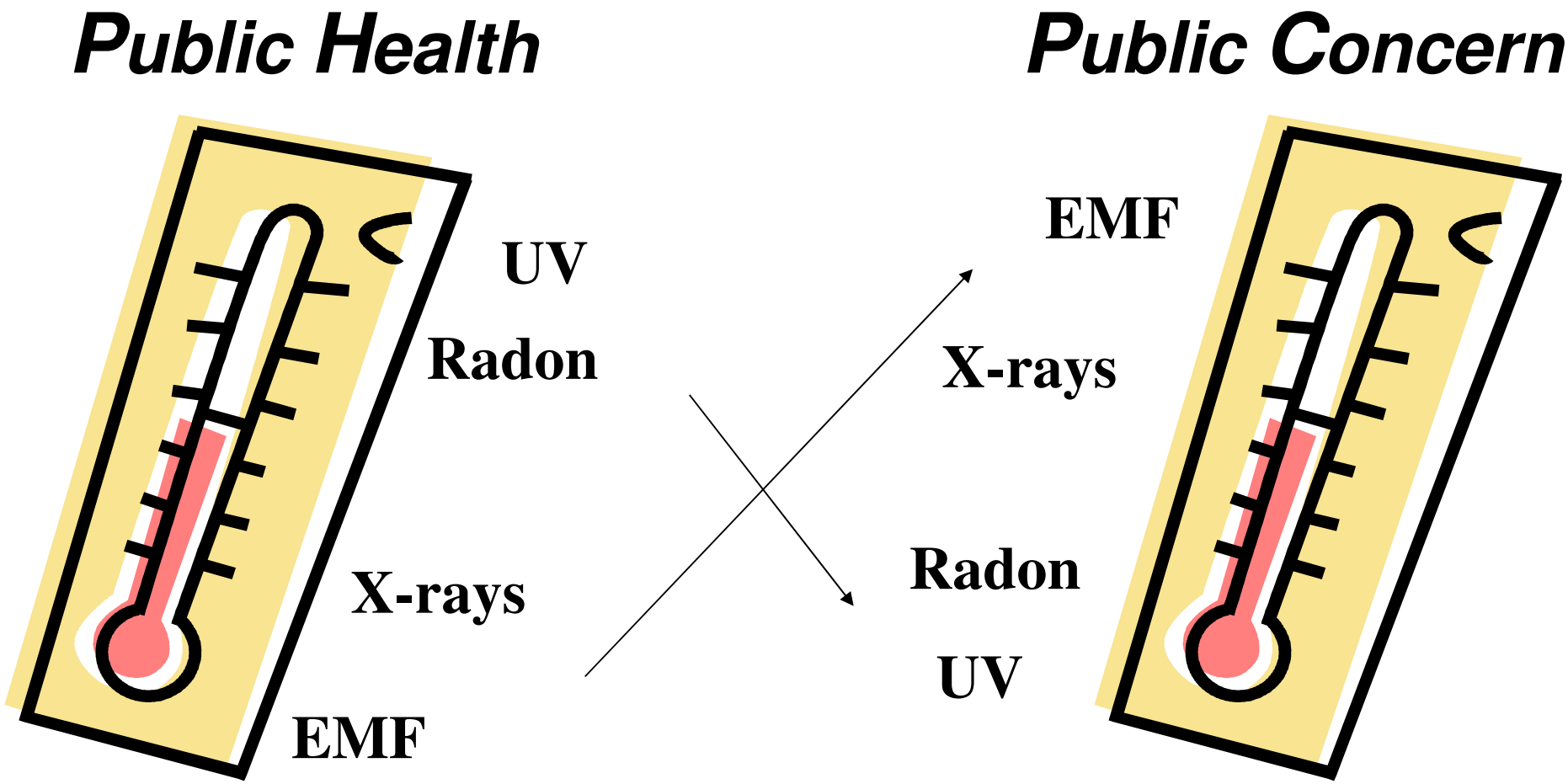
FREQUENCY (Hz OR CYCLES PER SECOND)







Radiation


Public Health
Public Concern
UV
Radon
X-rays
EMF
EMF
X-rays
Radon
UV

WHO and Radiation

CLUSTER

Health Security and Environment (HSE)

DEPARTMENT

Public Health and Environment (PHE)

PROGRAM

Radiation (RAD)

International EMF Project

INTERSUN

World Health Organization
INTERNATIONAL RADON PROJECT

WHO Partners in Radiation

International Organizations

National Authorities

Collaborating Centres

Bundesamt für Strahlenschutz

Health Protection Agency

uOttawa

World Health Organization

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All WHO | This site only

- Home
- About WHO
- Countries
- Health topics
- Publications
- Research tools
- WHO sites
- EMF Home
- About electromagnetic fields
- EMF Project
- Research
- Standards
- EMF publications & information resources
- Meetings

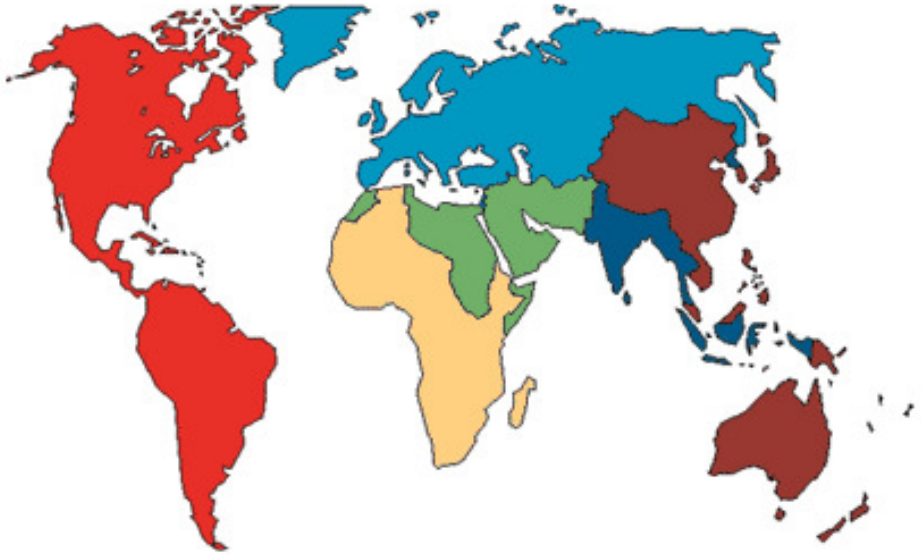
Electromagnetic fields (EMF)

About us | Publications | Contact us

WHO > WHO sites > Electromagnetic fields (EMF) > The International EMF Project

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 African Region
WHO European Region
WHO Region of the Americas
WHO Eastern Mediterranean Region
WHO South-East Asia Region
WHO Western Pacific Region

Participating countries & entities in EMF Project

WHAT'S NEW!

Model Legislation
More information

Standards Framework
More information

Fact Sheet N°304
Base stations and wireless technologies

QUICK LINKS IN THE EMF SITE

Fact Sheets and Information Sheets
Full text

The EMF Standards World Wide Database
Click here

WHO Regional Office for the Americas (AMRO)

:: Brazil

:: Canada

:: Cuba

:: Ecuador

:: Peru

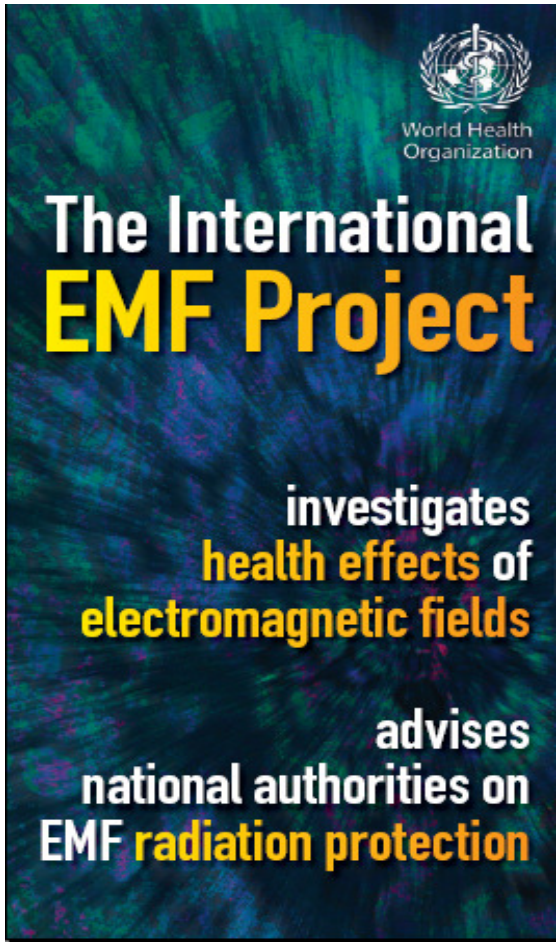
:: United States of America

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

WHO International EMF Project

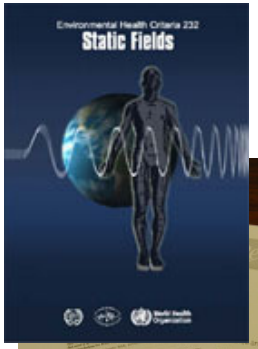
Through the EMF Project, WHO provides scientific information and practical advice on the health impact and environmental effects of exposure to electromagnetic fields.



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

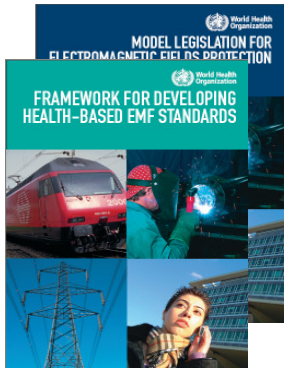
EMF: An environmental risk?



Science
Risk Assessment

Public Concern
Risk Perception

Policies
Risk Management

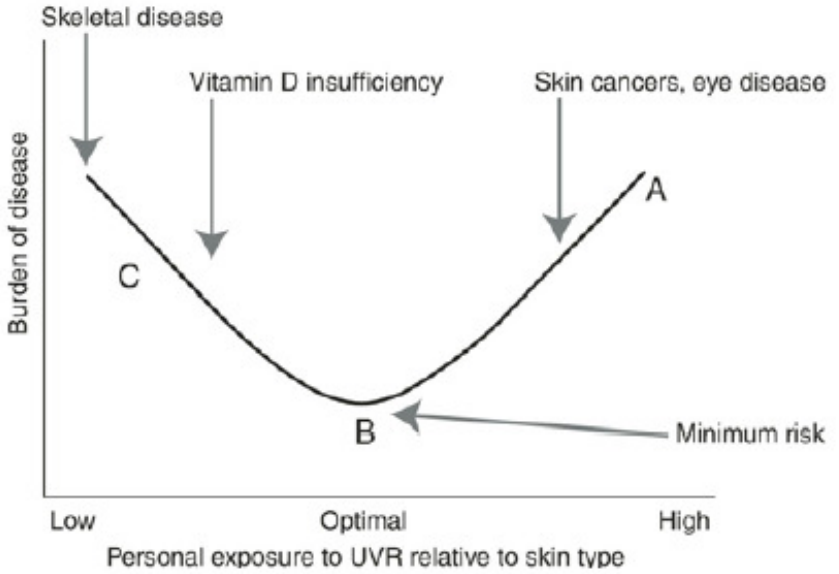


World Health Organization

WHO Global UV Project
INTERSUN

- **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



World Health Organization

INTERSUN Programme

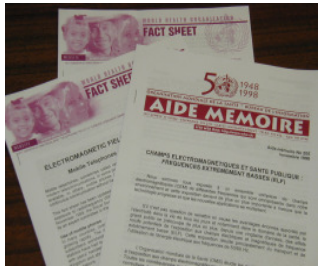
Through INTERSUN, WHO provides scientific information and practical advice on the health impact and environmental effects of exposure to UV radiation.

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**

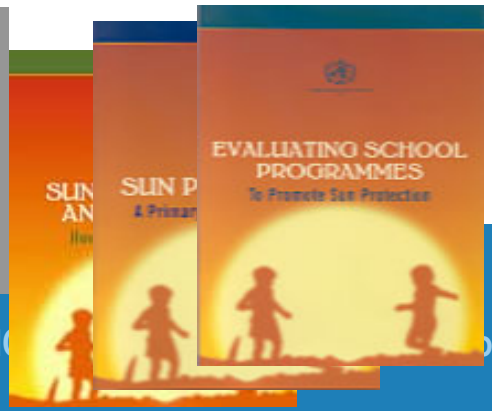
UV: An environmental risk !!

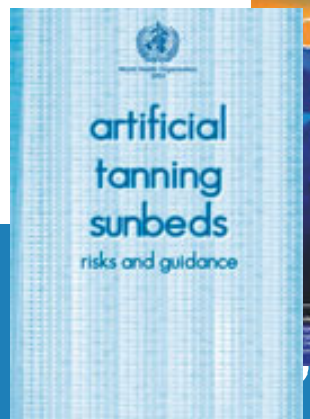
Science
Risk Assessment

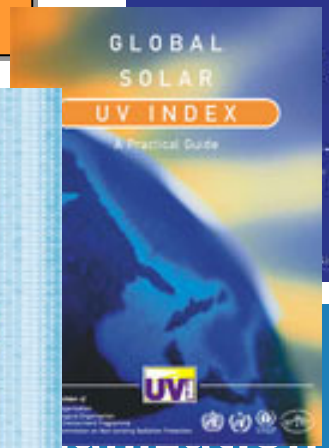


Public Awareness
Risk Perception and communication

Policies
Risk Management



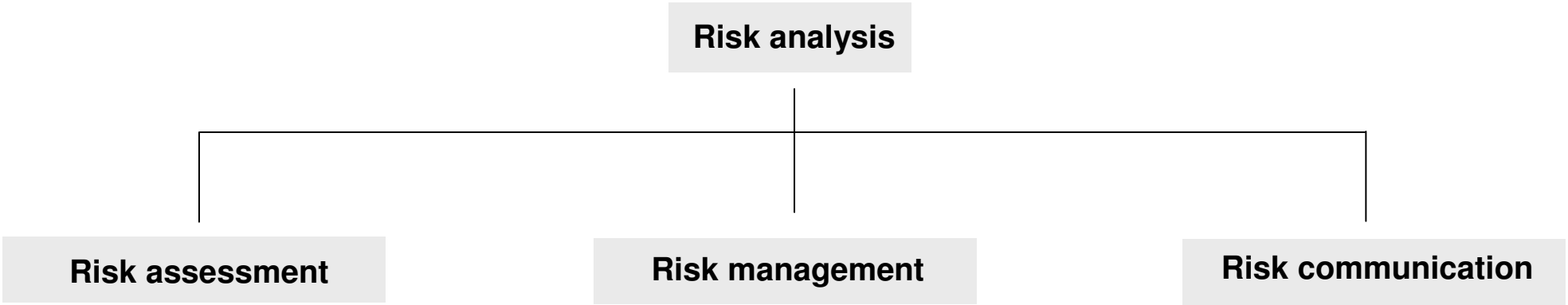


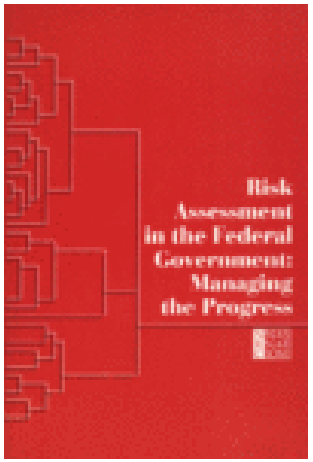


Outline

- Introduction
- Health risk assessment

Definitions



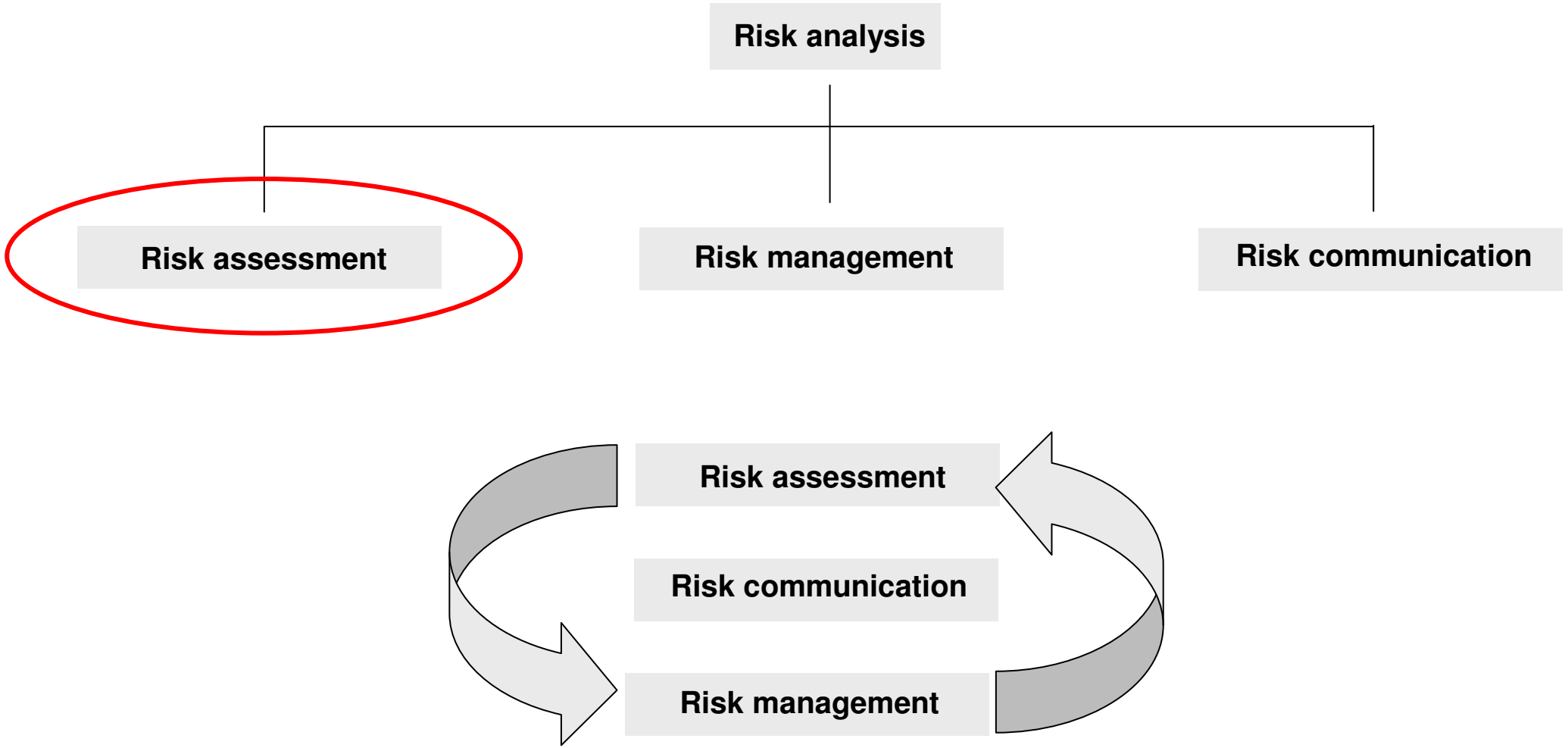


Risk Assessment in the Federal Government: Managing the Process
National Academies Press, 1983
USA

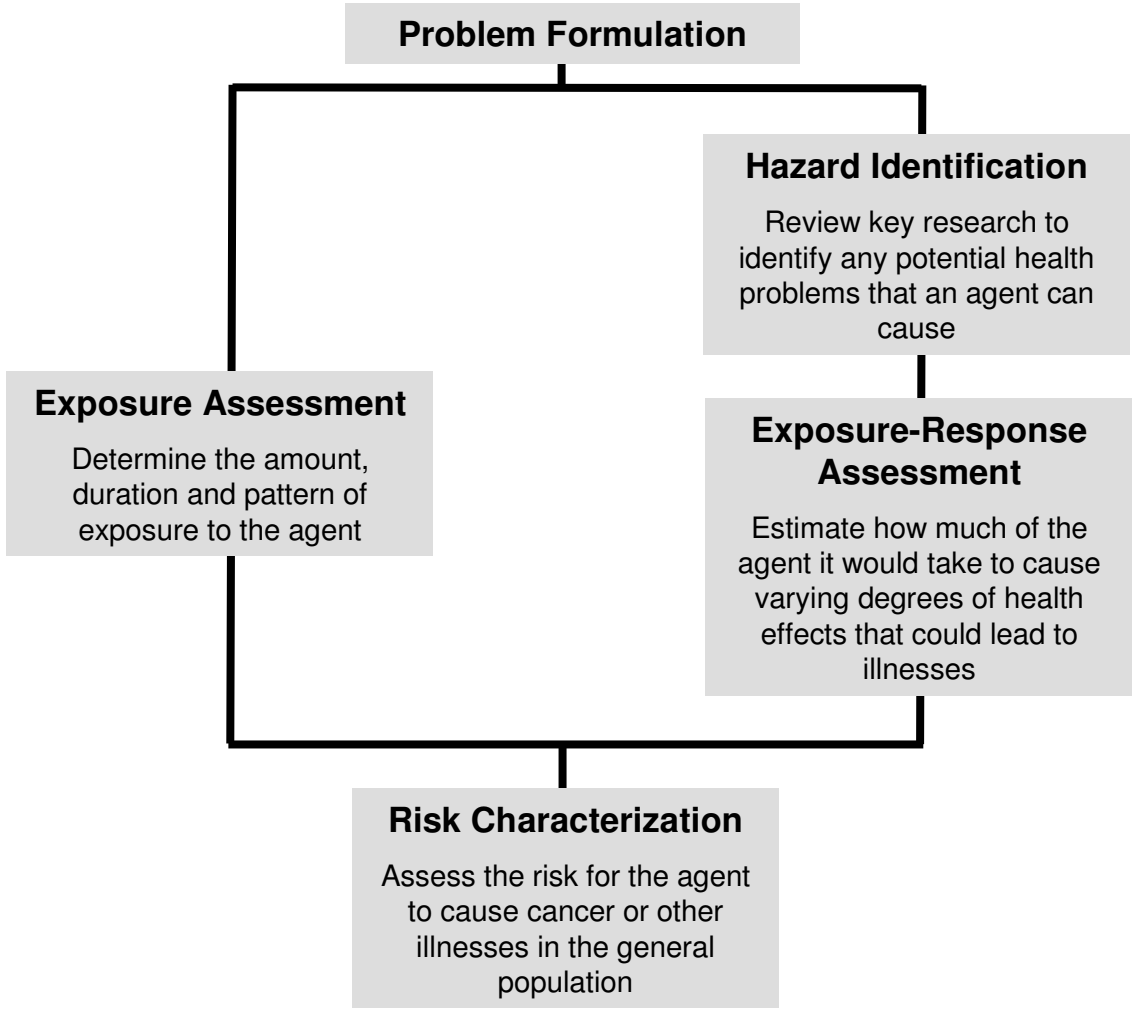
"The Red Book"

World Health Organization

Definitions



Health Risk Assessment



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

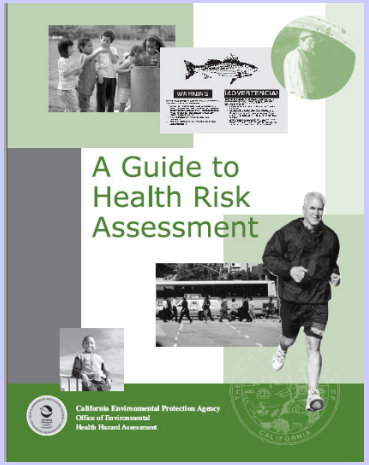
Health Risk Assessments…

nrpb

Health Protection Agency

Health & Consumer Protection Directorate-General

EUROPEAN COMMISSION



International Agency for Research on Cancer (IARC)

Centre International de Recherche sur le Cancer (CIRC)

▪ ▪ ▪ ▪

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)

International EMF Project

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

Background
IARC Monographs

International Agency for Research on Cancer (IARC)

Centre International de Recherche sur le Cancer (CIRC)

- **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

Background
IARC Monographs

International Agency for Research on Cancer (IARC)

Centre International de Recherche sur le Cancer (CIRC)

- 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

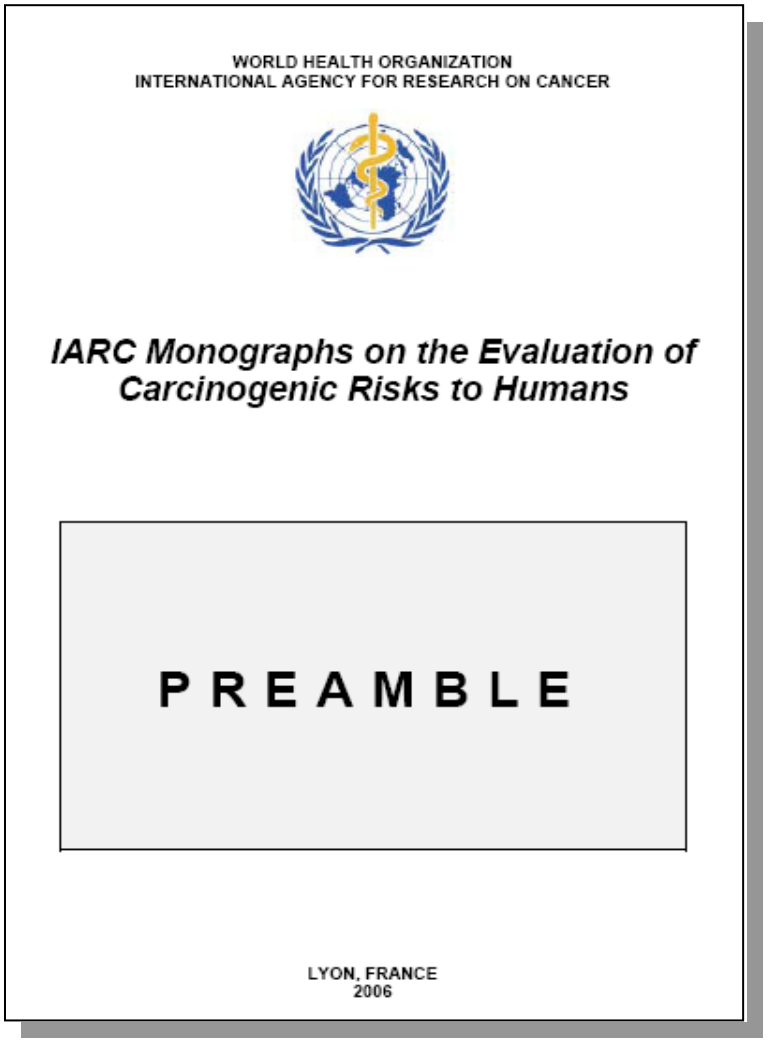
Background
IARC Classification

- 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
- http://monographs.iarc.fr



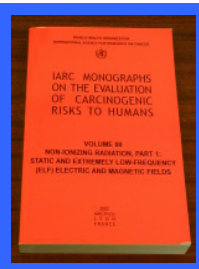
Health Risk Assessment

Problem Formulation

Hazard Identification

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

Cancer



Exposure Assessment

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

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

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

IPCS Home

Chemicals assessment

Methods for chemicals assessment

Chemicals in food

Poisons information, prevention and management

Chemical incidents and emergencies

Capacity building

Publications | About IPCS | Events

International Programme on Chemical Safety > Publications

Environmental Health Criteria

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, JEFCA.

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.

ACCESS TO ENVIRONMENTAL HEALTH CRITERIA DOCUMENTS

List of EHCs in numerical order

List of EHCs (on chemicals or groups of chemicals) in alphabetical order

List of EHCs and other IPCS publications and projects on risk assessment methodologies

NEW PUBLICATIONS

CICADS

CICAD 68
Tetrachloroethene
Download [pdf 1.20Mb]

CICAD 67
2-Butoxyethanol
Download [pdf 784kb]

PESTICIDES

The WHO Recommended Classification of Pesticides by Hazard

PREVENTION

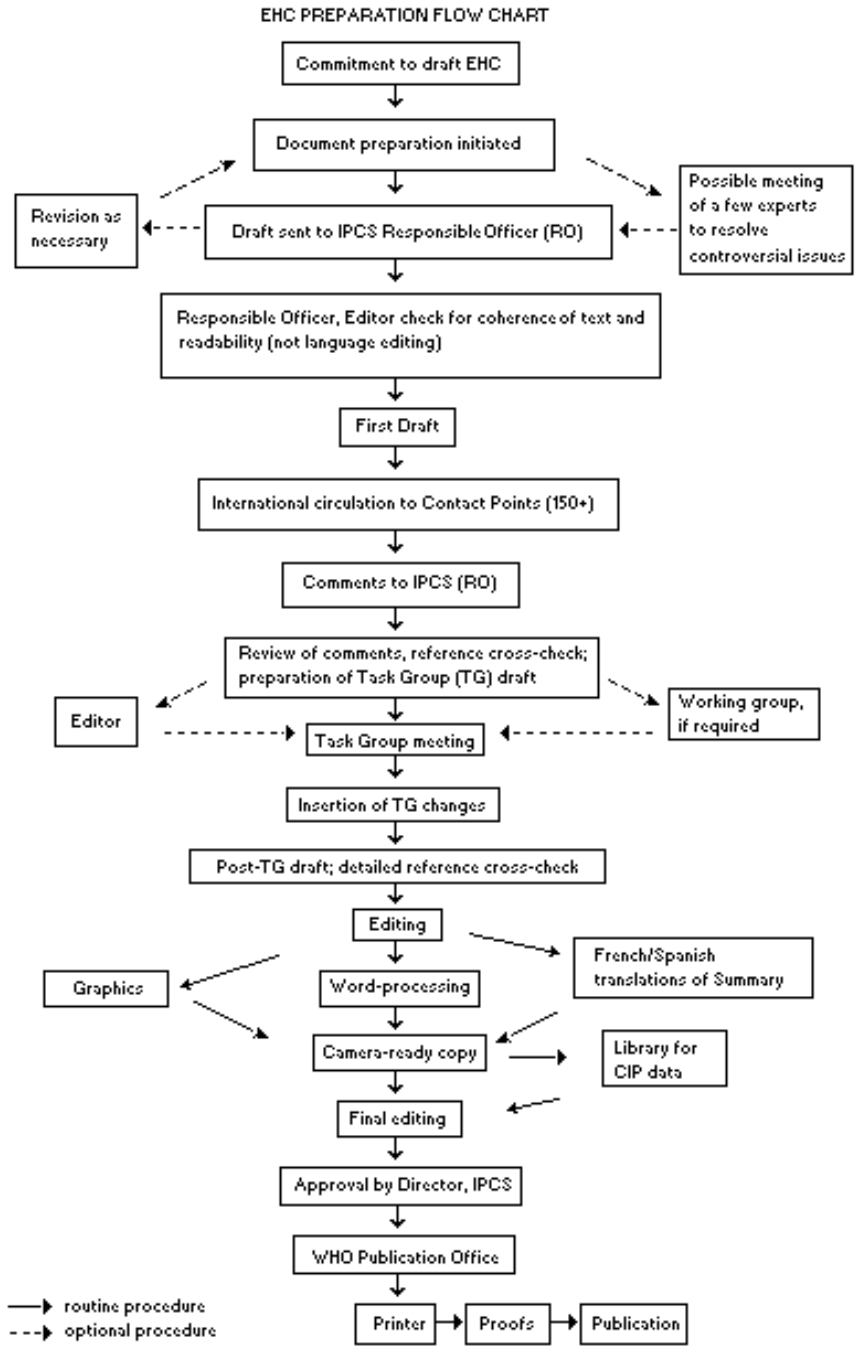
Guidelines on the prevention of toxic exposures

Contact us
Click here to sign up for updates to the site about selected topics of interest.

Mailing address:
IPCS

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)



2002

October 2005

June 2007

World Health Organization

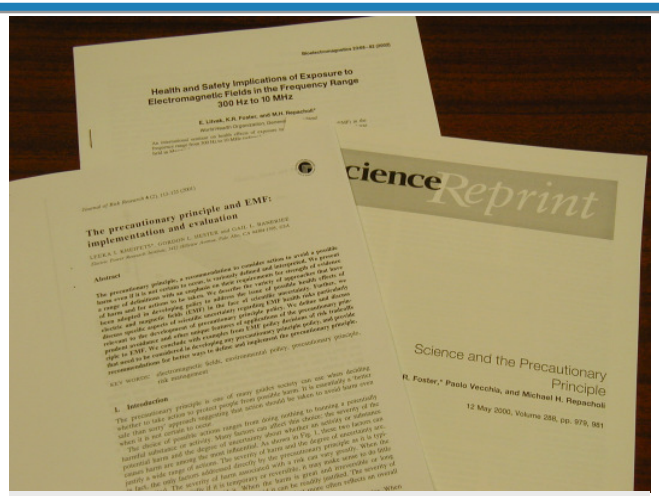
Environmental Health Criteria
Contributors

- 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

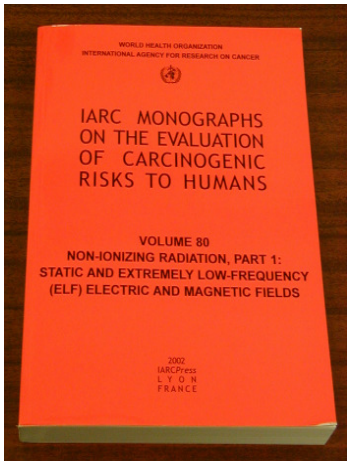
Environmental Health Criteria

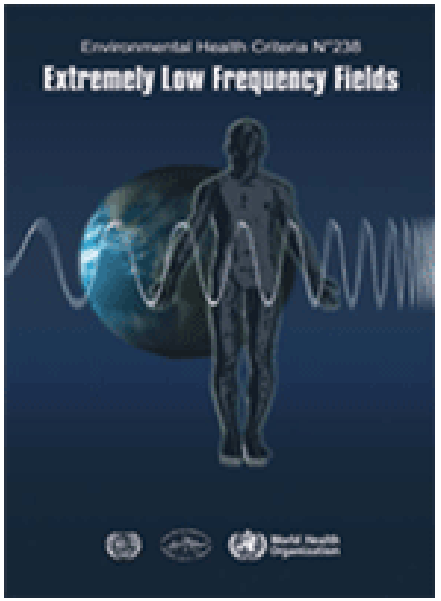
- Development of an extensive database
  - Peer-reviewed scientific publications (Medline, PubMed)
  - Geographical inclusion
  - Use of unpublished reports
  - Use of reviews by other national and international expert review bodies

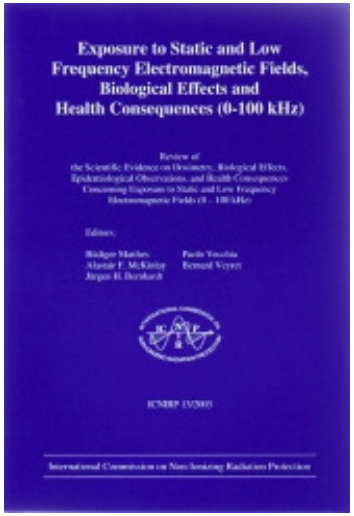
Inputs to the ELF EHC

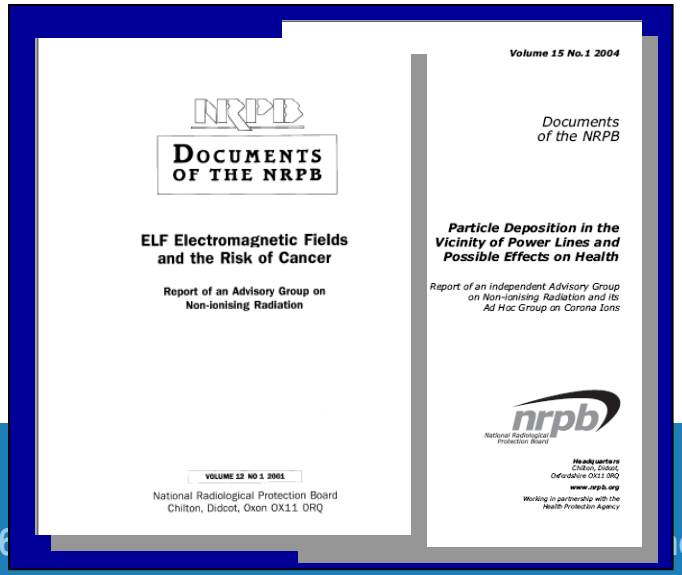


New data and analysis







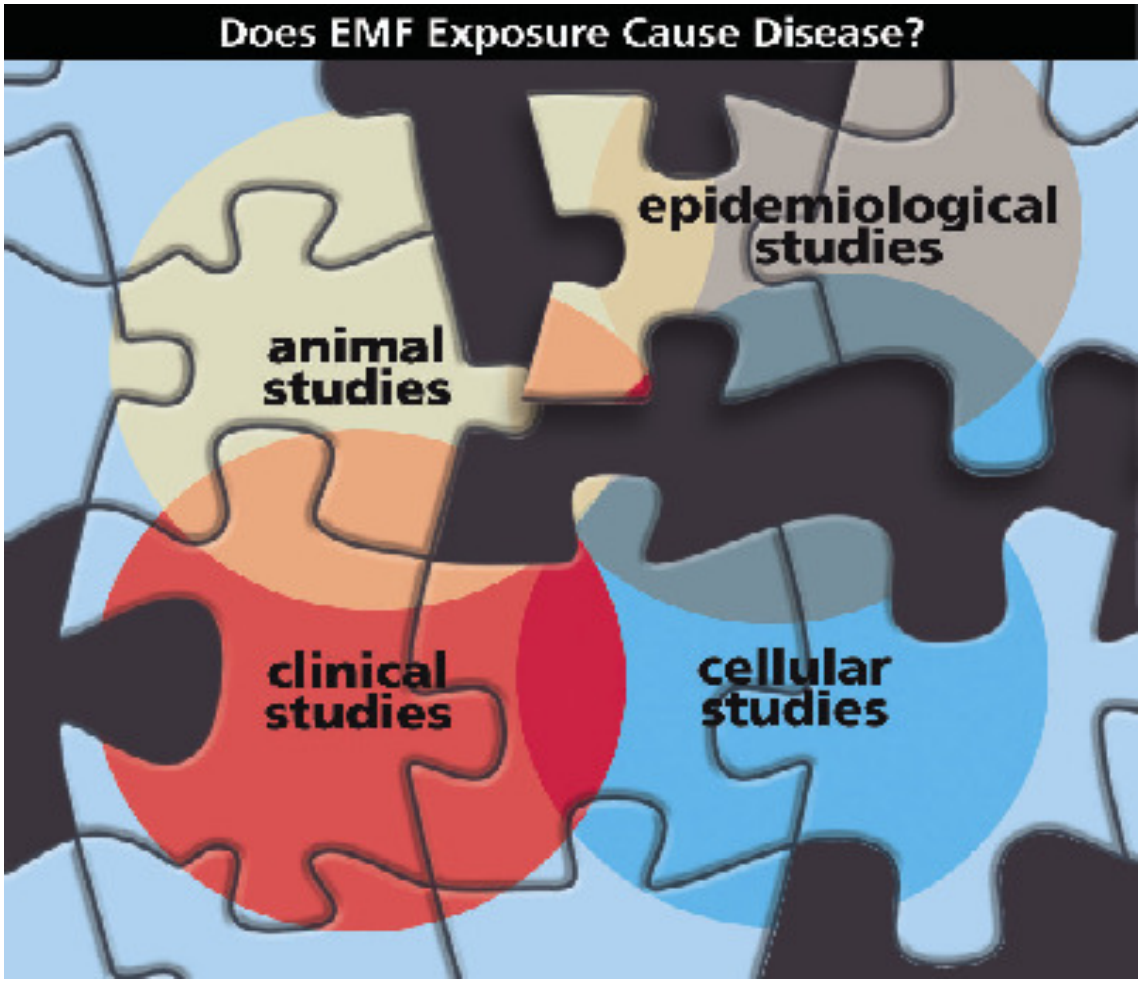


4 focused Expert Working Groups

World Health Organization

RESEARCH

Balance of studies needed

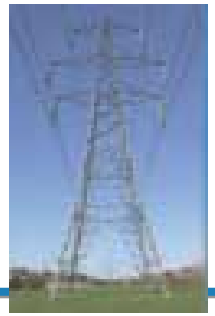


http://www.niehs.nih.gov/emfrapid/booklet/emf2002.pdf

By type of studies

EHC on ELF Fields

Table of Contents



By disease category

Health Risk Assessment

Problem Formulation

Hazard Identification

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

Exposure Assessment

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

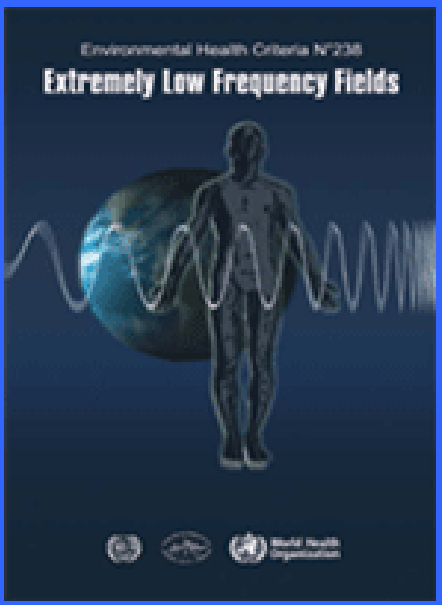
Exposure-Response Assessment

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

Risk Characterization

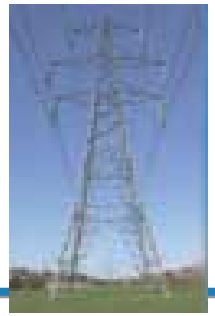
Assess the risk for the agent to cause cancer or other illnesses in the general population

All studied outcomes



EHC on ELF Fields

Table of Contents



Other outputs

Fact sheets

World Health Organization

Fact sheet N°322
June 2007

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 have been raised whether exposure to these extremely low frequency (ELF) electric and magnetic fields (EMF) produces adverse health consequences. Since then, much research has be resolving important issues and narrowing the focus of future research.

In 1996, the World Health Organization (WHO) established the International Electromagnetic Fields Project to investigate potential health risks associated with technologies emitting EMF. A WHO ' concluded a review of the health implications of ELF fields (WHO, 2007).

This Fact Sheet is based on the findings of that Task Group and updates recent reviews on the health effects of ELF EMF published in 2002 by the International Agency for Research on Cancer (I the auspices of WHO, and by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) in 2003.

ELF field sources and residential exposures

Electric and magnetic fields exist wherever electric current flows - in power lines and cables, residential wiring and electrical appliances. **Electric** fields arise from electric charges, are measured in and are shielded by common materials, such as wood and metal. **Magnetic** fields arise from the motion of electric charges (i.e. a current), are expressed in tesla (T), or more commonly in millitesl (μT). In some countries another unit called the gauss, (G), is commonly used (10,000 G = 1 T). These fields are not shielded by most common materials, and pass easily through them. Both types close to the source and diminish with distance.

Most electric power operates at a frequency of 50 or 60 cycles per second, or hertz (Hz). Close to certain appliances, the magnetic field values can be of the order of a few hundred microtesla. Ur magnetic fields can be about 20 μT and electric fields can be several thousand volts per metre. However, average residential power-frequency magnetic fields in homes are much lower - about 0.0' μT in North America. Mean values of the electric field in the home are up to several tens of volts per metre.

Task group evaluation

In October 2005, WHO convened a Task Group of scientific experts to assess any risks to health that might exist from exposure to ELF electric and magnetic fields in the frequency range >0 to 1 While IARC examined the evidence regarding cancer in 2002, this Task Group reviewed evidence for a number of health effects, and updated the evidence regarding cancer. The conclusions and r Task Group are presented in a WHO Environmental Health Criteria (EHC) monograph (WHO, 2007).

Following a standard health risk assessment process, the Task Group concluded that there are no substantive health issues related to ELF electric fields at levels generally encountered by members remainder of this fact sheet addresses predominantly the effects of exposure to ELF magnetic fields.

Short-term effects

There are established biological effects from acute exposure at high levels (well above 100 μT) that are explained by recognized biophysical mechanisms. External ELF magnetic fields induce electi the body which, at very high field strengths, cause nerve and muscle stimulation and changes in nerve cell excitability in the central nervous system.

Research Agendas

World Health Organization

2007 WHO Research Agenda for Extremely Low Frequency Fields

Introduction

In 1997, 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[1]. 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.

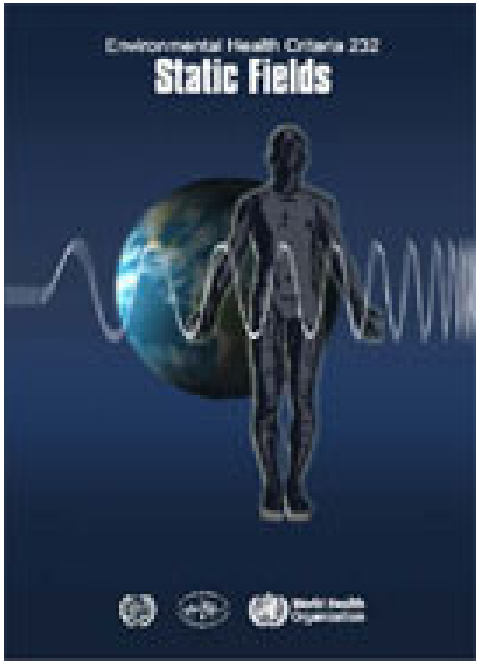
In general, acute effects are known to result from exposure to ELF magnetic field which induces electric fields and currents in the body. These can, at high experimentally induced field strengths (well above 100 μT), cause nerve and muscle stimulation and changes in nerve cell excitability in the central 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 0.3-0.4 μT and an increased risk of childhood leukaemia. Despite several decades of work, however, compelling evidence from experimental studies to support a causal relationship is lacking. In addition, there is no widely 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 in vitro cell response or 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 constituting a sufficient intermediate frequencies

[1] World Health Organization (2007). Extremely Low Frequency Fields. Environmental Health Criteria 238. Geneva, World Health Organization (see: www.who.int/emf).

Environmental Health Criteria

Electromagnetic Fields



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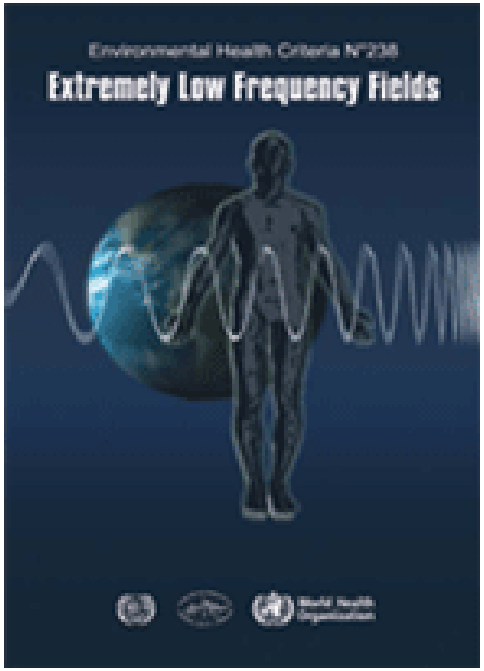

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RF Fields

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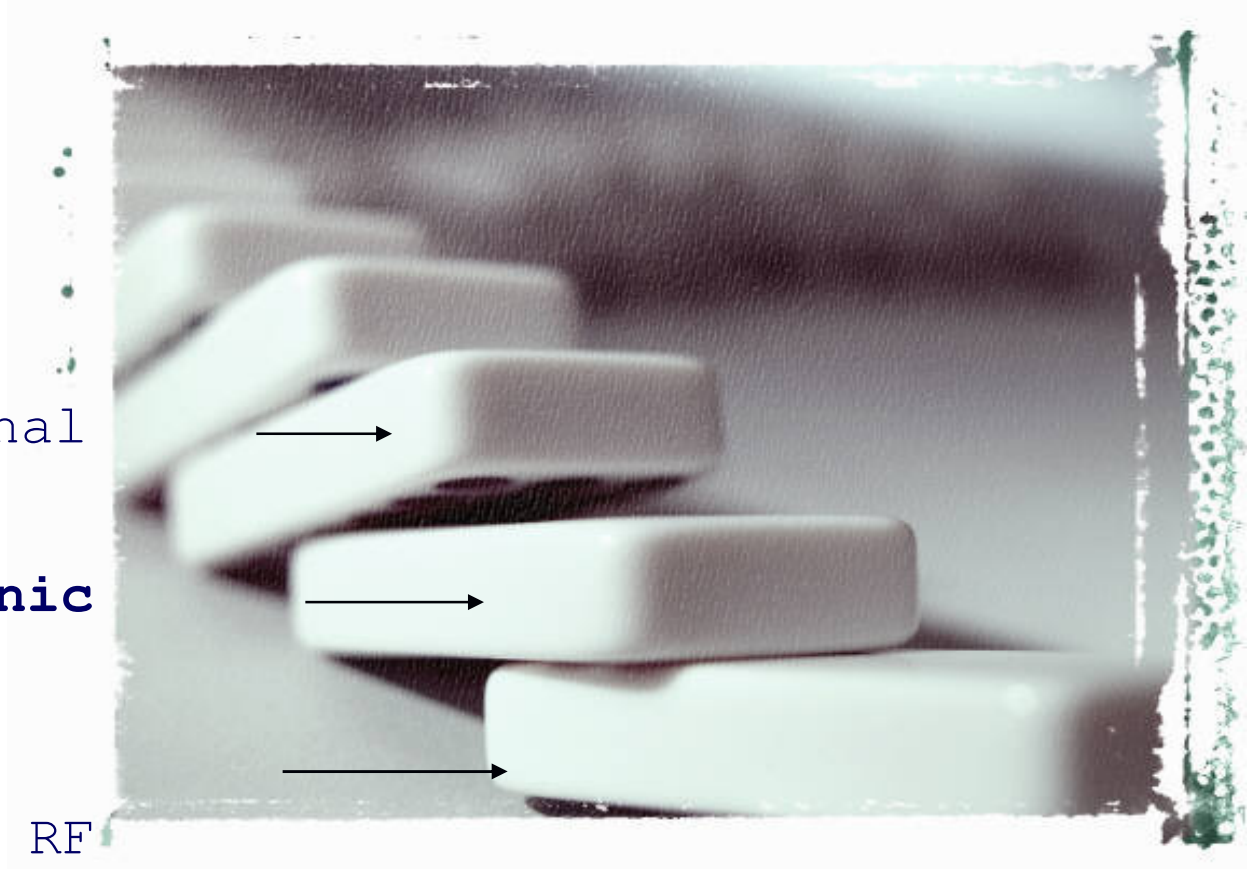
RF EHC ....

INTERPHONE multinational epidemiologic study

IARC evaluation of **carcinogenic** risks to humans from RF

WHO assessment of all health risks to humans from RF



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