

HEALTH PROTECTION AGAINST EMFs: PRINCIPLES AND PRACTICES

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Technical and Regulatory Aspects Related to the
Effects of Non-Ionizing Electromagnetic Radiation

Lima, Peru, 19 June 2006



ICNIRP

The International Commission on Non-Ionizing Radiation:

- Is an independent group of experts established in 1992
- Is formally recognised by WHO and ILO
- Maintains close relationships with other national and international organizations



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THE INTERNATIONAL COMMISSION ON NON-IONIZING RADIATION PROTECTION

ICNIRP:

- provides **guidance and advice** on the health hazards of non-ionizing radiation
- develops **international guidelines** on limiting exposure to non-ionizing radiation that are independent and science based
- provides **science based guidance** and recommendations on protection from non-ionizing radiation exposure

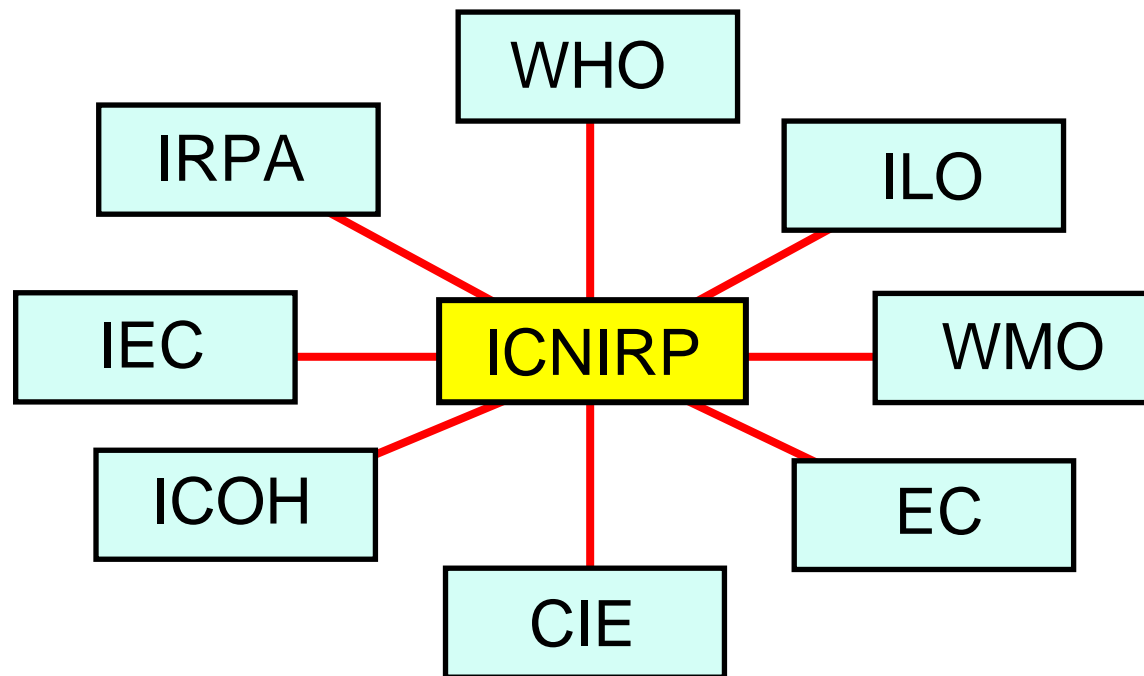


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ICNIRP'S PARTNERS



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STRUCTURE OF ICNIRP

ICNIRP operates through:

- A Main Commission (14 Members, including a Chairperson and a Vice-chairperson)
- Four standing committees
- Consulting experts



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MAIN COMMISSION

P. Vecchia Italy **Chairperson**
M. Hietanen Finland **Vice Chairperson**

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- **F. De Gruijl** The Netherlands
- **J. Lin** USA
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STANDING COMMITTEES

- **SC I – Epidemiology**
Chair: Anders Ahlbom (Sweden)
- **SC II – Biology and Medicine**
Chair (interim): Bernard Veyret (France)
- **SC III – Physics and Engineering**
Chair: Rüdiger Matthes (Germany)
- **SC IV – Optical radiation**
Chair: Bruce Stuck (USA)



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ICNIRP Statement

GENERAL APPROACH TO PROTECTION AGAINST NON-IONIZING RADIATION

Health Physics 82:540-548 (2002)
www.icnirp.org



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SYSTEMS OF PROTECTION

- **Health threshold based systems**
Adequate for well established, threshold effects
- **Optimization systems**
Adequate for no-threshold known hazards
- **Precautionary measures**
Adequate for suspected, not established hazards



FUNDAMENTALS OF ICNIRP GUIDELINES

- Procedures and criteria are defined *a priori*
- Restrictions are based on science.
No consideration for economic or social issues
- Only established effects are considered



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ICNIRP Guideline

GUIDELINES FOR LIMITING EXPOSURE TO TIME-VARYING ELECTRIC, MAGNETIC, AND ELECTROMAGNETIC FIELDS (UP TO 300 GHZ)

Health Physics 74:494-522 (1998)

www.icnirp.org



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STEPS IN THE DEVELOPMENT OF GUIDELINES

- Review of the literature
- Establishment of health effects
- Identification of the critical effect
- Setting basic restrictions
- Derivation of reference levels



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REVIEW OF THE LITERATURE

The review of the literature is at the same time:

- **Comprehensive**

No one single study can prove a health effect

- **Selective**

Studies are critically evaluated based on

- ❖ **Quality**

- ❖ **Replicability**

- ❖ **Consistency**



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RANKING OF EVIDENCE

EVIDENCE

≠

PROOF

humans

animals

cells

ASSOCIATION

≠

CAUSALITY

BIOLOGICAL EFFECT

≠

HEALTH EFFECT

biological models

Dosimetry



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IDENTIFICATION OF EFFECTS

Effects that are:

- **Evident** from peer-reviewed studies
- **Replicated** and/or
- **Consistent** across different studies

Are considered as **established**



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ESTABLISHED EFFECTS OF EMF

All effects of EMF that have been established so far are acute in nature

ELF

Stimulation of electrically excitable tissues

RF

Increase of body temperature (general or local)

Such acute effects occur above given exposure thresholds



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BIOLOGICALLY EFFECTIVE QUANTITIES

The biological and health effects are related to several parameters of exposure that include the intensity of the fields, but are not limited to it.

Therefore, external fields are not the most appropriate quantities to be related to the effects.

Biologically effective quantities, also called **dosimetric quantities**, are used instead.



INTERACTION MECHANISMS AND BIOLOGICALLY EFFECTIVE QUANTITIES

ELF

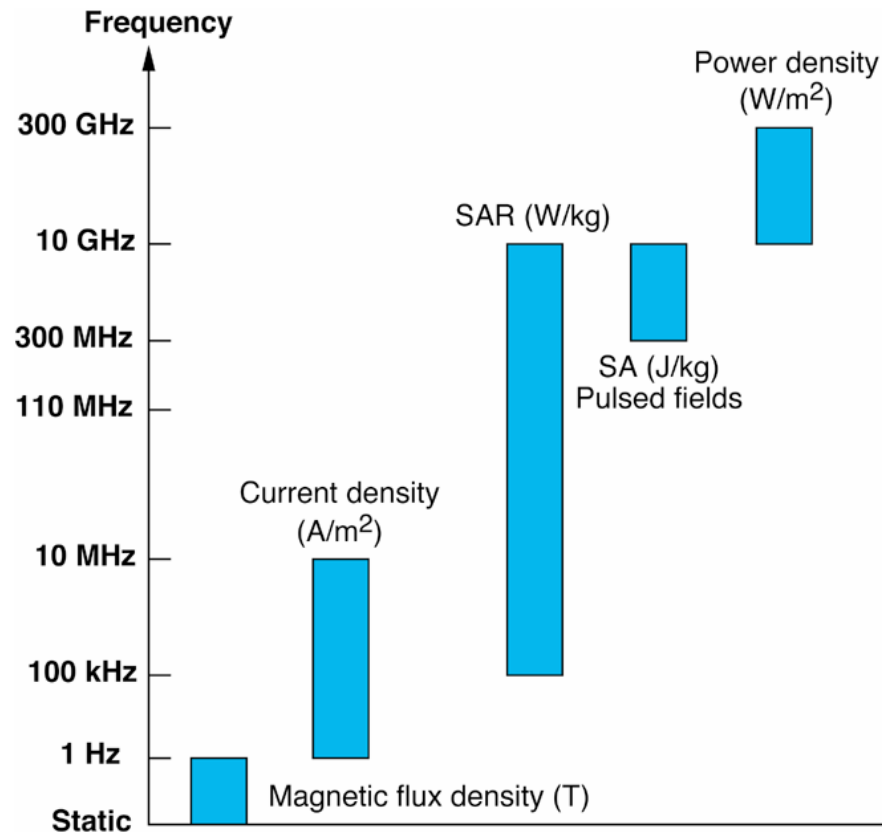
Interaction mechanism:	Stimulation of tissues
Biological effective quantity:	Induced current density
Unit:	mA/m^2

RF

Interaction mechanism:	Energy absorption
Biological effective quantity:	SAR (Specific Absorption Rate)
Unit:	W/kg



BIOLOGICALLY EFFECTIVE QUANTITIES



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THE CRITICAL EFFECT

When several health effects – or biological effects that might be relevant for health – occur, the one that occurs at the lowest level of exposure is assumed as the reference

Such effect is called the **critical effect**

Exposure limits aim at preventing the critical effect



BASIC RESTRICTIONS AND REFERENCE LEVELS

- Basic restrictions (limits of exposure) are set in terms of the biologically effective quantity, **below the threshold for the critical effect**
- Reference levels in terms of measurable quantities are derived by the basic restrictions **assuming conditions of maximum coupling**




CONSERVATIVE APPROACH

- Compliance with basic restrictions ensures prevention of established, acute effects
- Compliance with reference levels ensures compliance with basic restrictions

On the contrary, exceeding reference levels does not necessarily imply that basic restrictions are exceeded



ESTABLISHED EFFECTS FOR ELF FIELDS

- 
- Induction of internal electric fields and currents
 - Stimulation of electrically excitable tissues

The effects are related to the internal electric field (V/m) or the internal current density (A/m²)



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BASIC LIMITS AND REFERENCE LEVELS ELF

Basic limits

workers	10 mA/m²
general public	2 mA/m²

Reference levels – electric field




workers	10 kV/m
general public	5 kV/m

Reference levels – magnetic flux density

workers	500 μT
general public	100 μT



ESTABLISHED EFFECTS FOR RF FIELDS

-  **Absorption of electromagnetic energy**
-  **Increase of body temperature (general or local)**
-  **Thermal effects**

Thermal effects are related to SAR, i.e. to the energy absorbed per unit time and per unit body mass (W/kg)

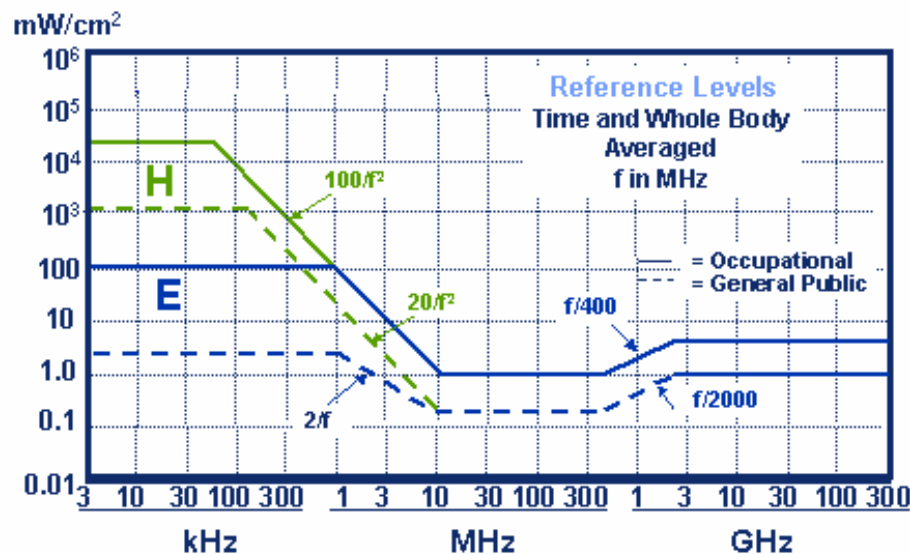
BASIC LIMITS AND REFERENCE LEVELS RF

Basic limits: **workers**

0.4 W/kg

general public

0.08 W/kg



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ICNIRP ON LONG-TERM EFFECTS

ELF

In the absence of support from laboratory studies, the epidemiological studies are **insufficient** to allow an exposure guideline to be established.

RF

Although there are deficiencies in the epidemiological work, [...] the studies have yielded **no convincing evidence** that typical exposure levels lead to adverse reproductive outcomes or an increased cancer risk in exposed individuals.

ICNIRP Guidelines, 1988



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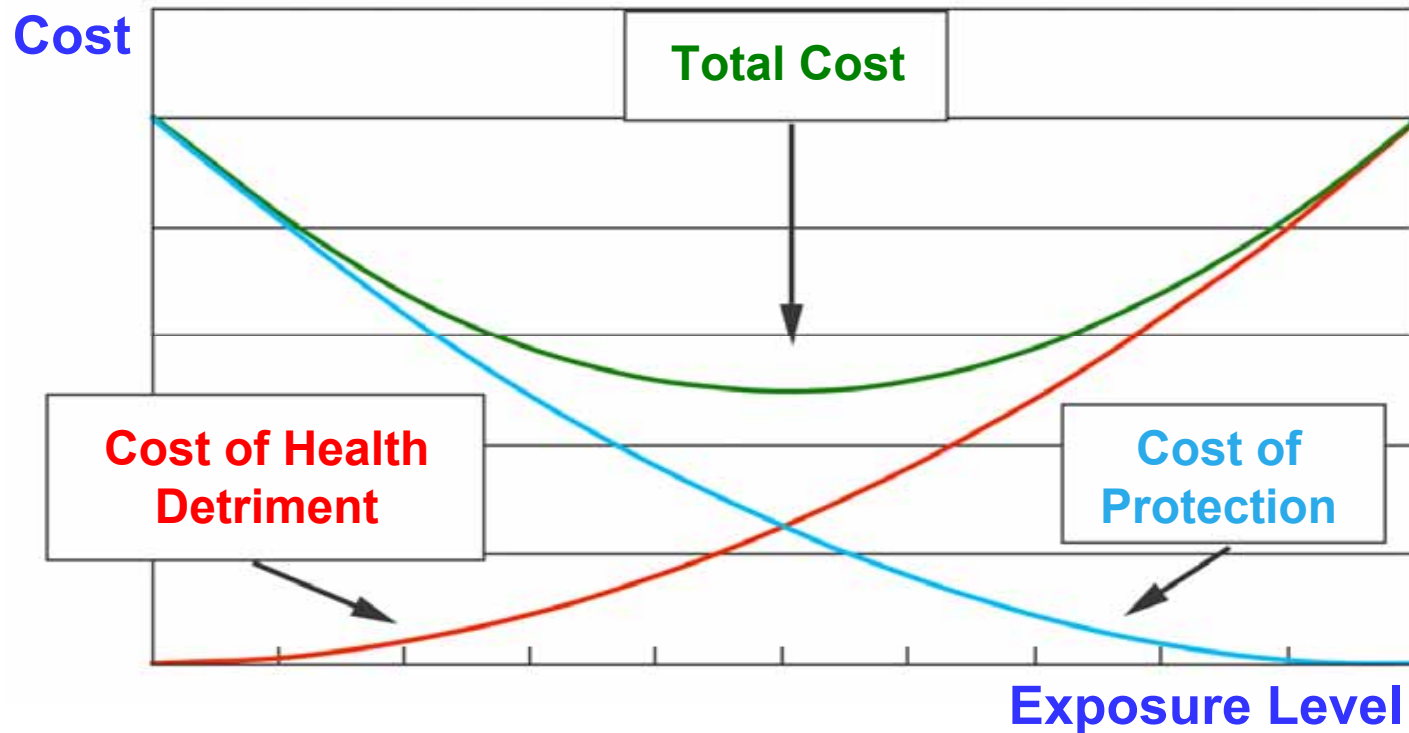
NON-THRESHOLD EFFECTS

If available data permit the **identification of an adverse effect** but not of a threshold, other risk reducing strategies may be employed. The role of ICNIRP is to analyse the risk in terms of levels of consequences that could be quantified.

The acceptability of such risks would, however, be based also on **social and economic considerations**, and as such fall outside the remit of ICNIRP.



THE OPTIMIZATION PRINCIPLE (ALARA)



BALANCING RISKS AND BENEFITS

Actions on limiting the exposure of the general public to electromagnetic fields should be balanced with the other **health, safety and security benefits** that devices emitting electromagnetic fields bring to the quality of life, in such areas as telecommunications, energy and public security.

EU Recommendation, 1999

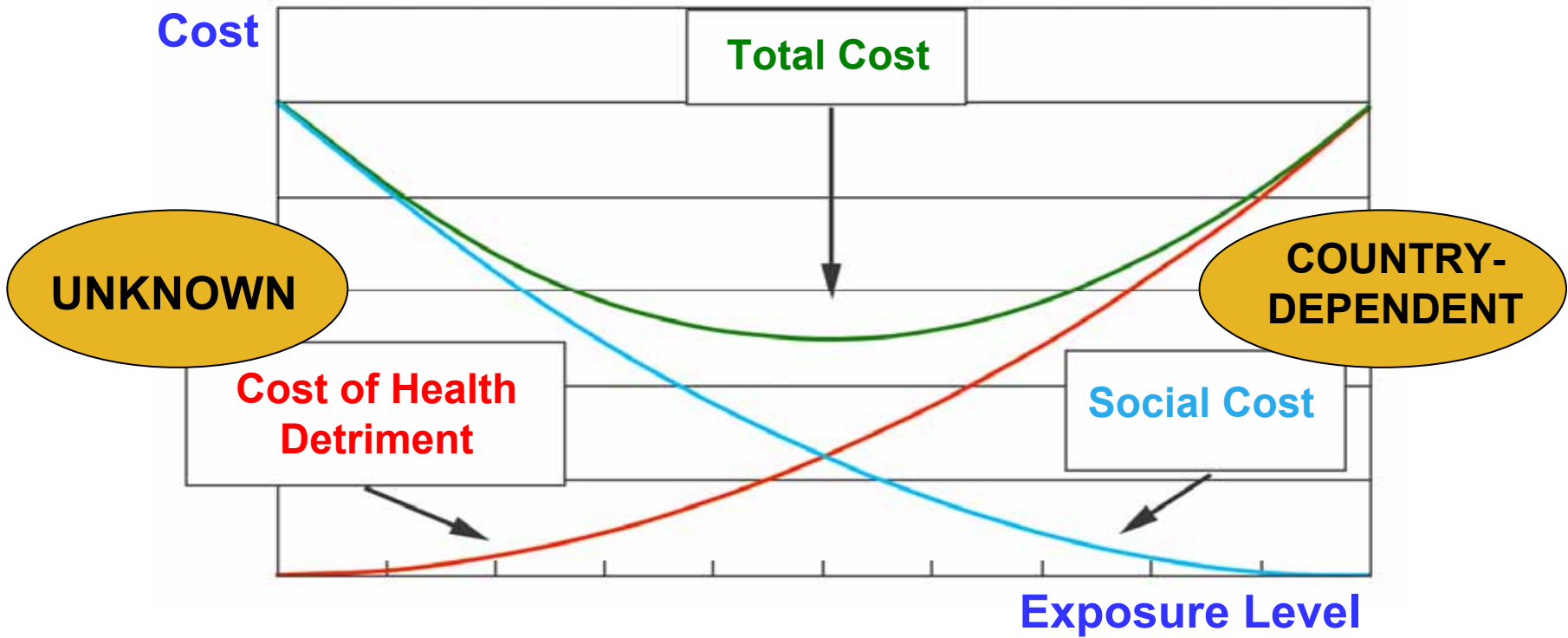


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ALARA FOR EMF?



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CONCLUSIONS

ICNIRP aims at developing guidelines that are **scientific, logical, and flexible**

ICNIRP continuously monitors the progress of research – and updates its guidelines when needed - in the light of:

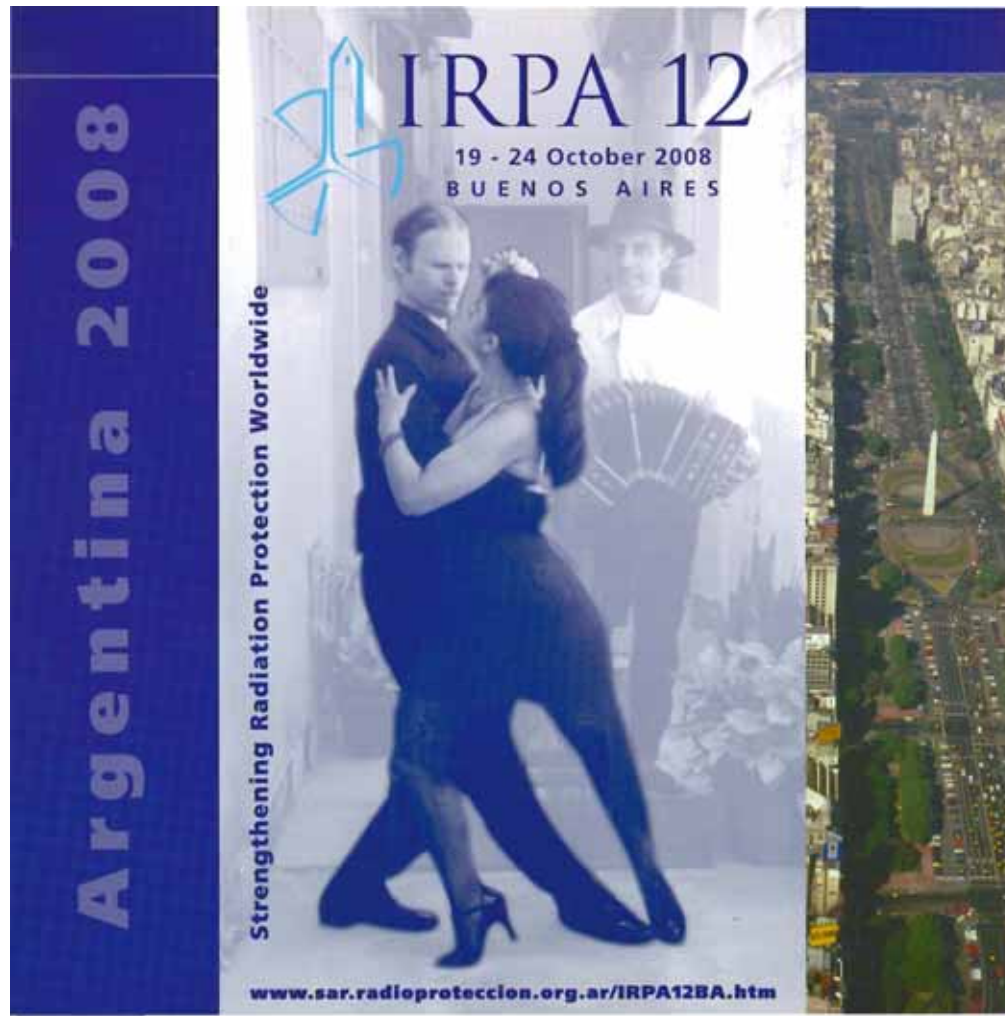
- **New scientific data**
- **Introduction of new sources and related exposure conditions**
- **Experience gained with practical implementation**



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~~International ICNIRP Workshop on Non-ionizing Radiation~~

Technical and Regulatory Aspects Related to the
Effects of Non-ionizing Electromagnetic Radiation

Provisional dates: 15-17 October 2008

Lima, Peru, 19 June 2006



THANK YOU FOR YOUR ATTENTION

The ICNIRP Guidelines are available in English, French, Spanish, German, Italian, and Japanese at

www.icnirp.org



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