

Evaluation and Communication of Scientific Evidence and Uncertainty  
Towards a Consistent Terminology in Non-ionizing Radiation  
*Salzburg (Austria), 23-24 November 2009*

# **THE ICNIRP PERSPECTIVE OF NIR HEALTH RISKS: FACTS, UNCERTAINTIES, PUBLIC PERCEPTION AND NEED FOR ACTION**

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# WHAT IS ICNIRP

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The International Commission on Non Ionizing Radiation Protection is an independent scientific organization that:

- Provides **advice** on the health hazards of non-ionizing radiation
- Develops **international guidelines** on limiting exposure to non-ionizing radiation
- Provides **science-based guidance** and recommendations on protection from non-ionizing radiation exposure



# THE “PHILOSOPHY,, OF ICNIRP

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*ICNIRP Statement*

## **GENERAL APPROACH TO PROTECTION AGAINST NON-IONIZING RADIATION**

Health Physics 82:540-548 (2002)  
[www.icnirp.org](http://www.icnirp.org)

**Paolo Vecchia, National Institute of Health, Rome, Italy**



# ICNIRP VIEWPOINTS

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- Acute health effects exist that have been clearly established
- Acute effects occur above given exposure thresholds
- The evidence for health effects below the standards is very low
- The relevance for health of biological effects identified below the standards is unclear
- Long-term effects cannot form the basis for exposure standards

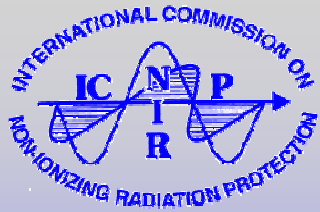


# SCOPE OF ICNIRP GUIDELINES

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ICNIRP's advice, and in particular guidelines, is intended to provide protection:

- In all frequency ranges
- For all categories of the population
- Against all established health effects



# FREQUENCY RANGES

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0 Hz	Static fields
>0 Hz – 100 kHz	Extremely Low Frequency (ELF) fields
100 kHz – 300 GHz	Radiofrequency (RF) fields
1 mm (300 GHz) – 760 nm	Infrared radiation
780 nm – 380 nm	Visible light
380 nm – 100 nm	Ultraviolet radiation



# “EXTREMELY“ LOW FREQUENCIES

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WHO 2007 (EHC 238)	up to 100 kHz
ICNIRP 2009 (Draft)	up to 100 kHz
IEEE/ICES 2002	up to 3 kHz (not explicitly defined)
IARC 2002	up to 3 kHz (reference to IEEE/ICES)
OPECST (France) 2009	up to 300 Hz



# INTERMEDIATE FREQUENCIES

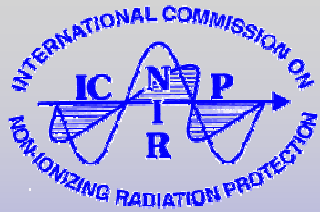
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- COST 244bis 1998 (Workshop Paris)      1 kHz – 3 MHz
- ICNIRP 1999 (Workshop Maastricht)      300 Hz – 10 MHz

Should the term *intermediate frequencies* formally (and univocally) adopted, or definitely abandoned?

Frequency range cutoffs multiple of 3 or multiples of 10?





# CATEGORIES TO BE PROTECTED

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Different groups in a population may have differences in their ability to tolerate a particular NIR exposure. Children, the elderly, and some chronically ill people might have a lower tolerance for one or more forms of NIR exposure than the rest of the population.

*(ICNIRP 2002)*

The meaning of *children* may be different across studies and disciplines, and between scientists and the public



# EFFECTS FROM WHICH TO PROTECT

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Guidelines are mainly based on established adverse health effects

A **biological effect** occurs when exposure to electromagnetic waves causes some *noticeable or detectable physiological change in a biological system*.

An **adverse health effect** occurs when the biological effect is outside the normal range for the body to compensate, and thus leads to some detrimental health condition.  
(WHO 1998)

Annoyance and discomfort, if prolonged and/or repeated, can affect the well-being, and therefore health, as defined by the WHO Constitution.

**Shall annoyance and discomfort be a basis for exposure limits?**



# HEALTH EFFECTS AND HEALTH RISKS

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In common language, the term risk may indicate either:

- The very **possibility** that an adverse health effect exists, or
- A combination of the **credibility** of the effect and its possible **health impact**

Within the public and the media, confusion is frequently made, especially when the risk is labeled as **“high”** or **“low”** (high/low likelihood or high/low impact)?

Within the scientific community, criteria and terminologies have been developed for the **credibility** of risks, and for the assessment of scientific evidence



# THE IARC CLASSIFICATION

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## Group 1

The agent is carcinogenic to humans

## Group 2A

The agent is probably carcinogenic to humans

## Group 2B

The agent is possibly carcinogenic to humans

## Group 3

The agent is not classifiable as to its carcinogenicity to humans

## Group 4

The agent is probably not carcinogenic to humans



# THE ASSESSMENT OF EVIDENCE

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## Sufficient evidence:

A causal relationship has been established between exposure and effect

## Limited evidence:

A causal interpretation is considered to be credible, but chance, bias or confounding could not be ruled out with reasonable confidence.

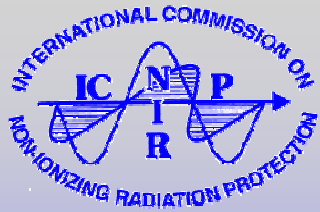
## Inadequate evidence:

The available studies are of insufficient quality, consistency or statistical power to permit a conclusion regarding the presence or absence of a causal association

## Evidence suggesting lack of effects:

There are several adequate studies covering the full range of levels of exposure, which are mutually consistent in not showing a positive association

What in the case of strong prevalence, but not total consistency, of negative studies?



# ASSESSING THE EVIDENCE - TERMINOLOGY

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## EHC 238 - Chapter 6 Neuroendocrine system

### Draft report

Overall, these data do not indicate that ELF electric and/or magnetic fields affect the neuroendocrine system in a way that would have an adverse impact on human health and the evidence is thus considered *very weak*.

### Final text

Overall, these data do not indicate that ELF electric and/or magnetic fields affect the neuroendocrine system in a way that would have an adverse impact on human health and the evidence is thus considered *inadequate*.

The draft chapter included 100 references



# SOURCES OF UNCERTAINTY

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Uncertainties unavoidably affect any scientific evaluation.

In risk assessment, uncertainties may exist about:

- The very existence of a biological effect
- The relevance of a biological effect for human health
- The exposure/effect relationship (including thresholds, if any)
- The global health impact



# REDUCTION FACTORS

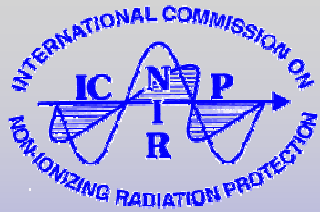
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Uncertainties on the quantitative features of the exposure/response relationships are accounted for by the introduction of reduction factors

The choice of reduction factors is to a large extent a **matter of judgment**

A balance is needed **between conservative approach and practicality of standards**





# REFERENCE LEVELS

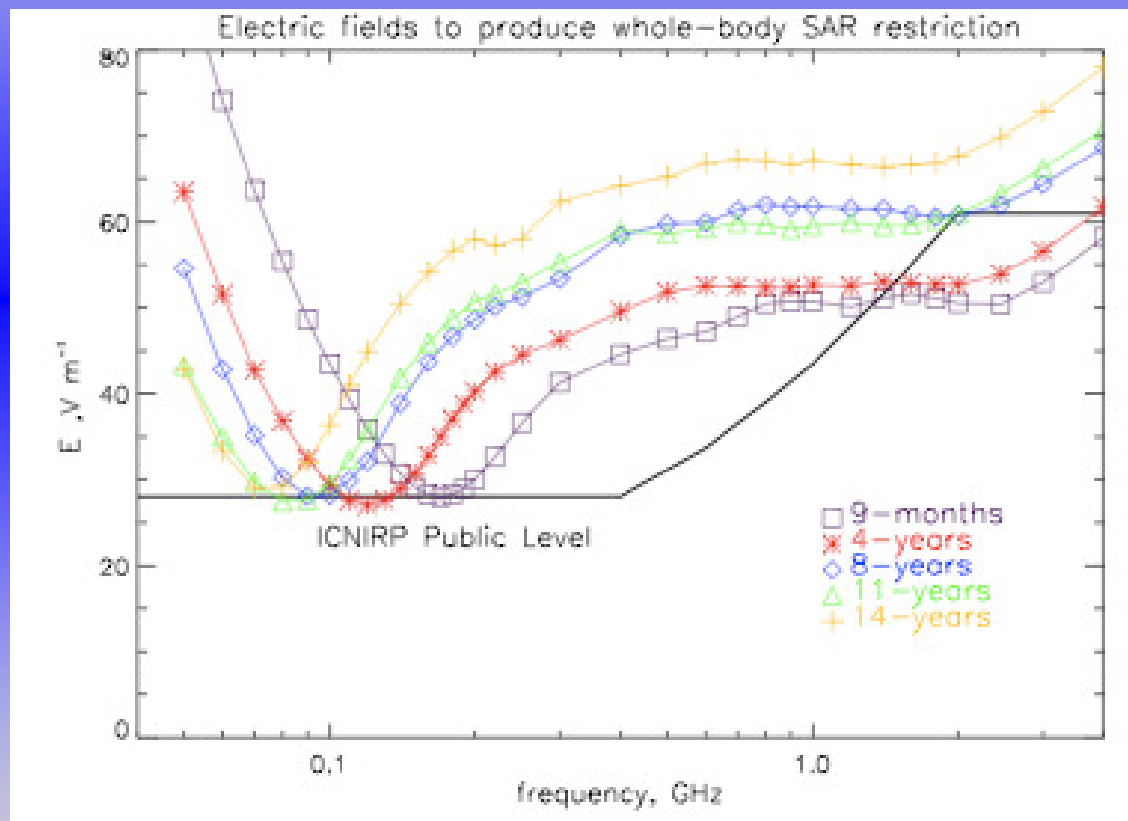
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Reference levels are derived by basic restrictions making use of the best available dosimetry, and conservative assumptions on the exposure conditions.

The choice of reference levels also depends on practicality (e.g. with regard to the analytical relations chosen to account for the frequency dependence of the thresholds for effects).

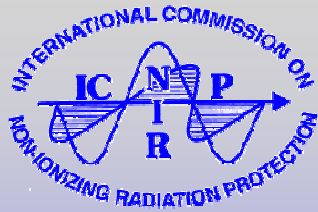
# CONSISTENCY OF REFERENCE LEVELS?

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RMS E-values required to produce  
a whole-body-averaged SAR of  
0.08 W/kg in child models

*Dimbylow & Bolch 2007*



# IMPLICATIONS FOR HEALTH

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[...] calculations are for optimal coupling conditions of a vertically polarized electric field applied to a standing subject. The SAR values can be averaged over a 6 min period and it is **unlikely that you could get small children to stand straight for this length of time.**

*(Dimbylow and Bolch 2007)*

at the recommended reference level the induced SARs could be up to 40% higher than the current basic restriction under worst-case conditions. However, this is **negligible compared with the large reduction factor** of 50 (5,000%) for the general public.

*(ICNIRP 2009)*



# THE ICNIRP GUIDELINES: PRESENT SITUATION

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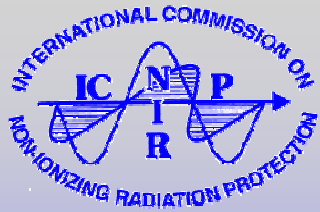
Static magnetic fields	<b>Revised</b> 2009
ELF electric and magnetic fields	<b>Draft</b> (Publication expected 2010)
RF electromagnetic fields	<b>Confirmed</b> (Revision expected 2012)
Broadband optical radiation	<b>In preparation</b> (Expected 2010)



# WHY TO REVISE A STANDARD?

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- New scientific data (new effects, change of thresholds, refinement of dosimetry)
- New technologies (revision of reduction factors, possibility of relaxation)
- Outdated rationale



# FINAL CONSIDERATIONS

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- ICNIRP guidelines have been recently revised, or are being revised
- A balance is needed between **stability** of standards over the time and **update** to most recent research
- Refinements and clarifications may be provided as needed, **also with regard to terminology**
- ICNIRP welcomes any suggestion and comment to its documents and scientific position