

SCIENTIFIC RATIONALE OF ICNIRP GUIDELINES

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**CURRENT TRENDS IN HEALTH AND SAFETY
RISK ASSESSMENT OF WORK-RELATED EXPOSURE TO EMFs**

Milan, Italy, 14-16 February 2007



ICNIRP Statement

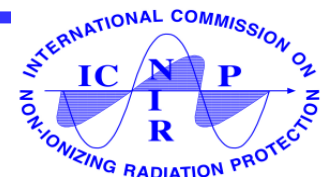
GENERAL APPROACH TO PROTECTION AGAINST NON-IONIZING RADIATION

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



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STEPS IN THE DEVELOPMENT OF GUIDELINES

- **Critical review of the literature**
- **Identification of health effects and biological effects relevant for health**
- **Identification of the critical effect**
- **Establishment of basic restrictions**
- **Derivation of reference levels**



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ESTABLISHED EFFECTS

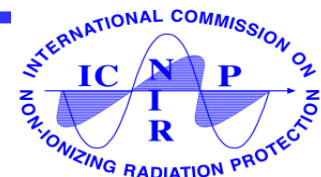
Effects are considered as **established** based on:

- Quality of the studies (peer review)
- Consistency
- Replicability
- Cause-effect relationship (for epidemiology)



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THE CRITICAL EFFECT

If several effects occur, it may be possible to rank them according to the exposure level at which each effect becomes relevant.

The **critical effect** is the established adverse health effect that is relevant at the **lowest level of exposure**



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THE TWO-LEVEL SYSTEM

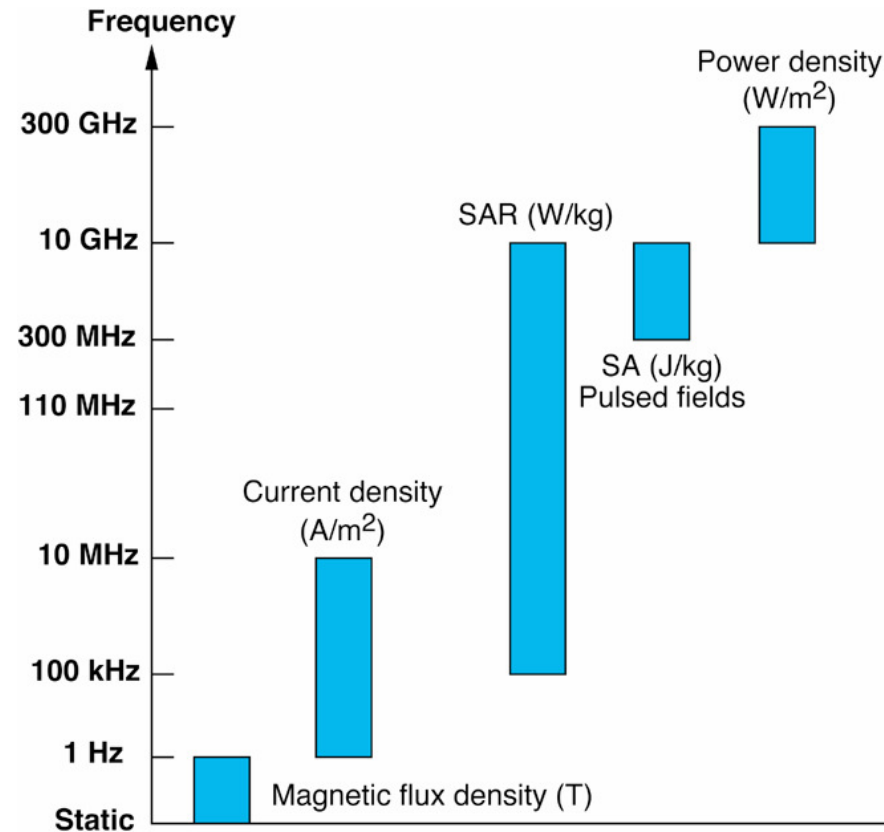
- **Basic restrictions**
in terms of biologically effective quantities
- **Reference levels**
in terms of an external exposure metric

Exposure below reference levels ensures compliance with basic restrictions, since the relations between them have been developed under worst-case conditions.

If the reference level is exceeded, the basic restriction is not necessarily exceeded.

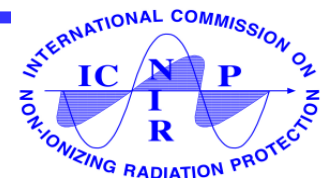


BIOLOGICALLY EFFECTIVE QUANTITIES



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THRESHOLDS FOR EFFECTS

Guidelines are developed based upon a **quantitative** relationship between exposure and adverse effect

If the relationship takes the form of a **threshold**, it may be possible to state a level of exposure below which **the adverse effect may be avoided**

This is the case of all **established** effects



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ESTABLISHED EFFECTS OF ELF FIELDS

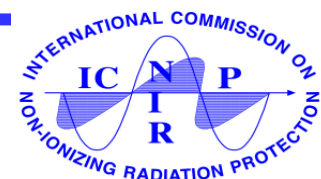
- ↪ Induction of internal electric fields and currents
- ↪ Stimulation of electrically excitable tissues

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



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BASIC LIMIT AND REFERENCE LEVELS ELF

Basic restriction – Induced current density

10 mA/m²

Reference level – Electric field

10 kV/m

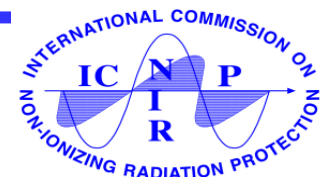
Reference level – Magnetic flux density

500 μ T






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ESTABLISHED EFFECTS OF RF FIELDS

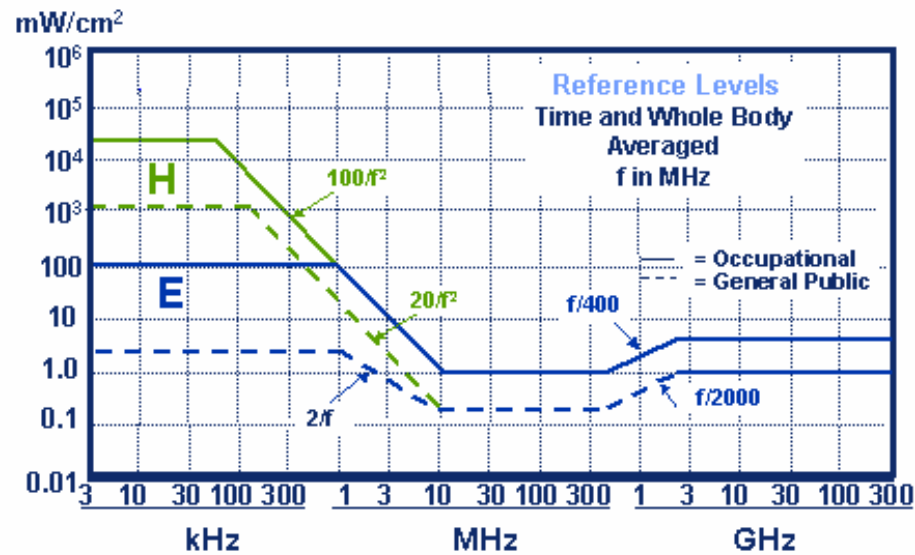
-  **Absorption of electromagnetic energy**
-  **Increase of body temperature (general or local)**
-  **Thermal effects**

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 restriction: **0.4 W/kg**

Reference levels



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ESTABLISHED EFFECTS OF STATIC FIELDS

Electric fields

None

Magnetic fields

Annoyance (vertigo, nausea, phosphenes) due to movement in the field



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EXPOSURE LIMITS FOR MAGNETIC STATIC FIELDS

- No reference levels
- No critical effect
- Approach different from ELF and RF fields

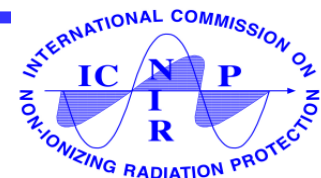
Exposure limits:

Ceiling value	2 T
Average level (working day)	200 mT



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REDUCTION FACTORS

- Introduced to take into account scientific **uncertainty**, not **incertitude**
- **Conservative**, not **precautionary**
- **Dependent on the quantity and quality of available data**
- **Matter of judgement**



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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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EU ON LONG-TERM EFFECTS

- **EU Recommendation**

“Only established effects have been used as the basis for the recommended limitation of exposure”

- **EU Directive**

“The long-term effects, including possible carcinogenic effects [...] for which there is no conclusive scientific evidence establishing a causal relationship, are not addressed in this Directive”



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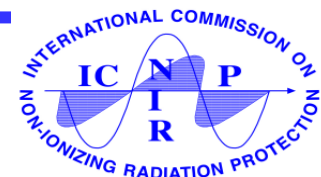
OTHER ASPECTS OF ICNIRP GUIDELINES

- Relaxation for local exposure
- Time average for RF fields (6 min)
- Indirect effects (contact currents)



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OPEN QUESTIONS

- **Are safety factors justified?**
- **Shall the critical effect be based on annoyance and discomfort?**
- **Shall compatibility with implanted devices be considered?**
- **Others...**



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