

ICNIRP: STRUCTURE, ACTIVITIES, PROTECTION STANDARDS

Dr Paolo Vecchia

National Institute of Health, Rome, Italy

Former Chairman of ICNIRP



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



THE INTERNATIONAL COMMISSION ON NON-IONIZING RADIATION PROTECTION

ICNIRP is an independent scientific organization that:

- 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



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



STRUCTURE OF ICNIRP

ICNIRP operates through:

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



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



MAIN COMMISSION 2012 - 2016

<http://www.icnirp.org/commission.htm>

R. Matthes Germany Chairperson
M. Feychting Sweden Vice Chairperson

- R. Croft Australia
- A. Green Australia
- K. Jokela Finland
- J..Lin USA
- C. Marino Italy
- A. Peralta Philippines

- Z. Sienkiewicz UK
- P. Soederberg Sweden
- B. Stuck USA
- E. van Rongen Netherlands
- S. Watanabe Japan

G. Ziegelberger Germany Scientific Secretary
M.H. Repacholi Switzerland Chairman Emeritus
P. Vecchia Italy Chairman 2004-2012



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



A MULTI-DISCIPLINARY APPROACH

Individual competences

- Medicine
- Biology
- Toxicology
- Epidemiology
- Physics
- Engineering

Collective evaluation



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



STANDING COMMITTEES

- SC I – Epidemiology
Chair: Antony Swerdlow (UK)
- SC II – Biology
Chair: Eric van Rongen (Netherlands)
- SC III – Physics
Chair: James Lin (USA)
- SC IV – Optics
Chair: Per Söderberg (Sweden)



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



ICNIRP Statement

GENERAL APPROACH TO PROTECTION AGAINST NON-IONIZING RADIATION

Health Physics 82:540-548 (2002)

www.icnirp.org



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



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



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



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



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



REVIEW OF THE LITERATURE

Any single observation or study may indicate the possibility of a health risk related to a specific exposure.

However, risk assessment requires information:

- From studies that meet **quality criteria**
- From the **totality** of science



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



REVIEW OF THE LITERATURE

The review performed by ICNIRP 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



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



OVERALL EVALUATION

A decision must be made whether the available evidence allows the identification of an exposure hazard, i.e. an adverse health effect that is caused by an NIR exposure.

By this identification, the effect becomes “established”.

Science-based exposure limits are set with regard to established effects



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



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



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



ESTABLISHED EFFECTS

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

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



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



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**



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



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)

THRESHOLDS FOR EFFECTS

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

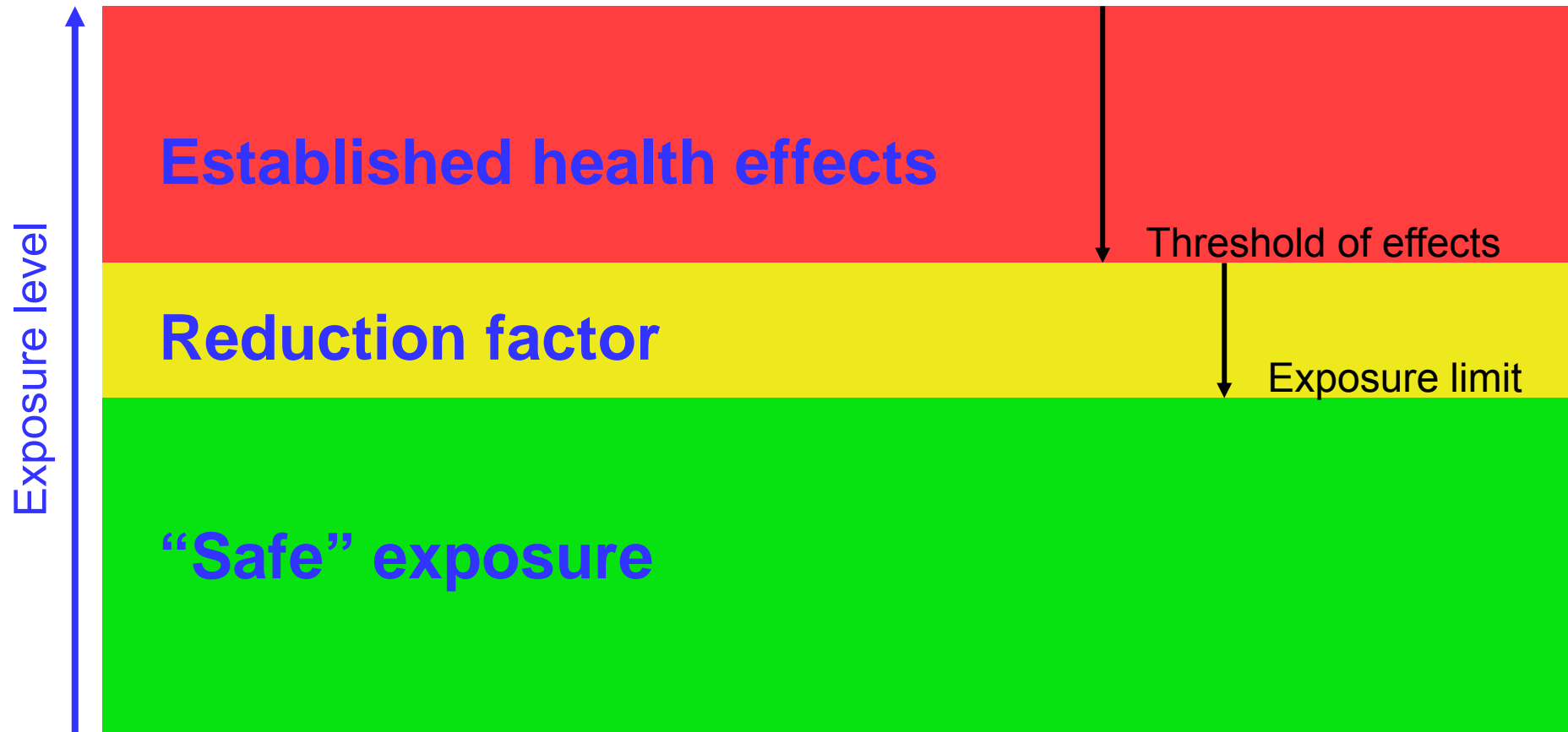
If the relationship takes the form of a **threshold**, it may be possible to state a level of exposure below which **the adverse effect may be avoided**



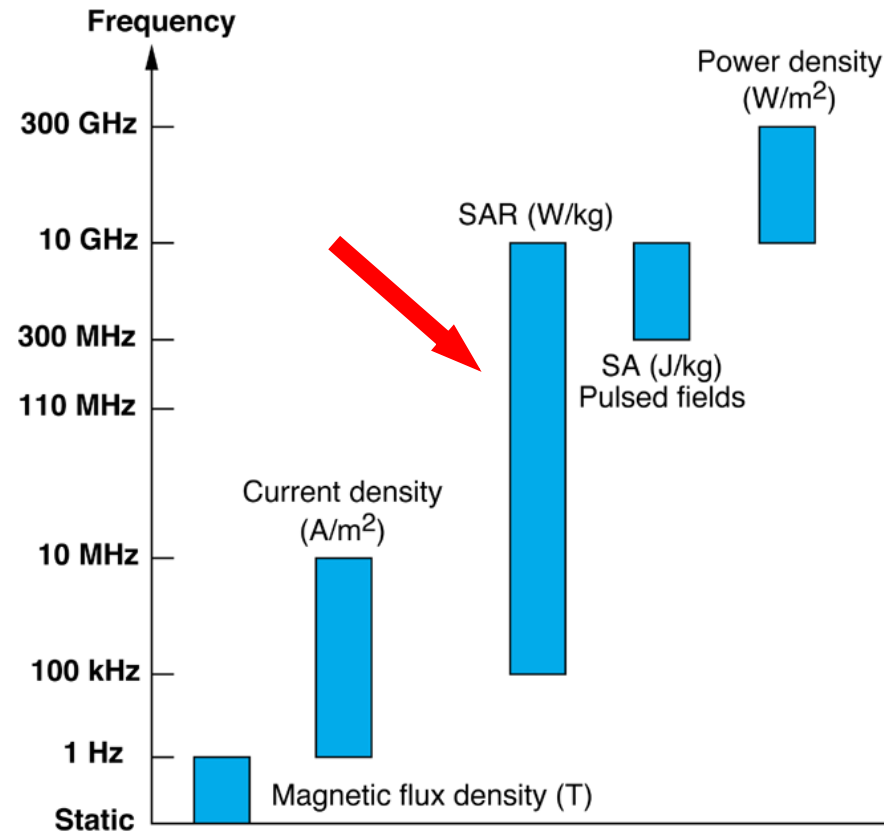
First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



THRESHOLD-BASED APPROACH (ELF and RF fields)



BIOLOGICALLY EFFECTIVE QUANTITIES



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.



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



BASIC RESTRICTIONS AND REFERENCE LEVELS

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



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



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



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



BASIC RESTRICTIONS ON SAR

Workers

Whole body	0.4 W/kg
Local - head and trunk (average on 10 g)	10.0 W/kg
Local - limbs (average on 10 g)	20.0 W/kg

General public

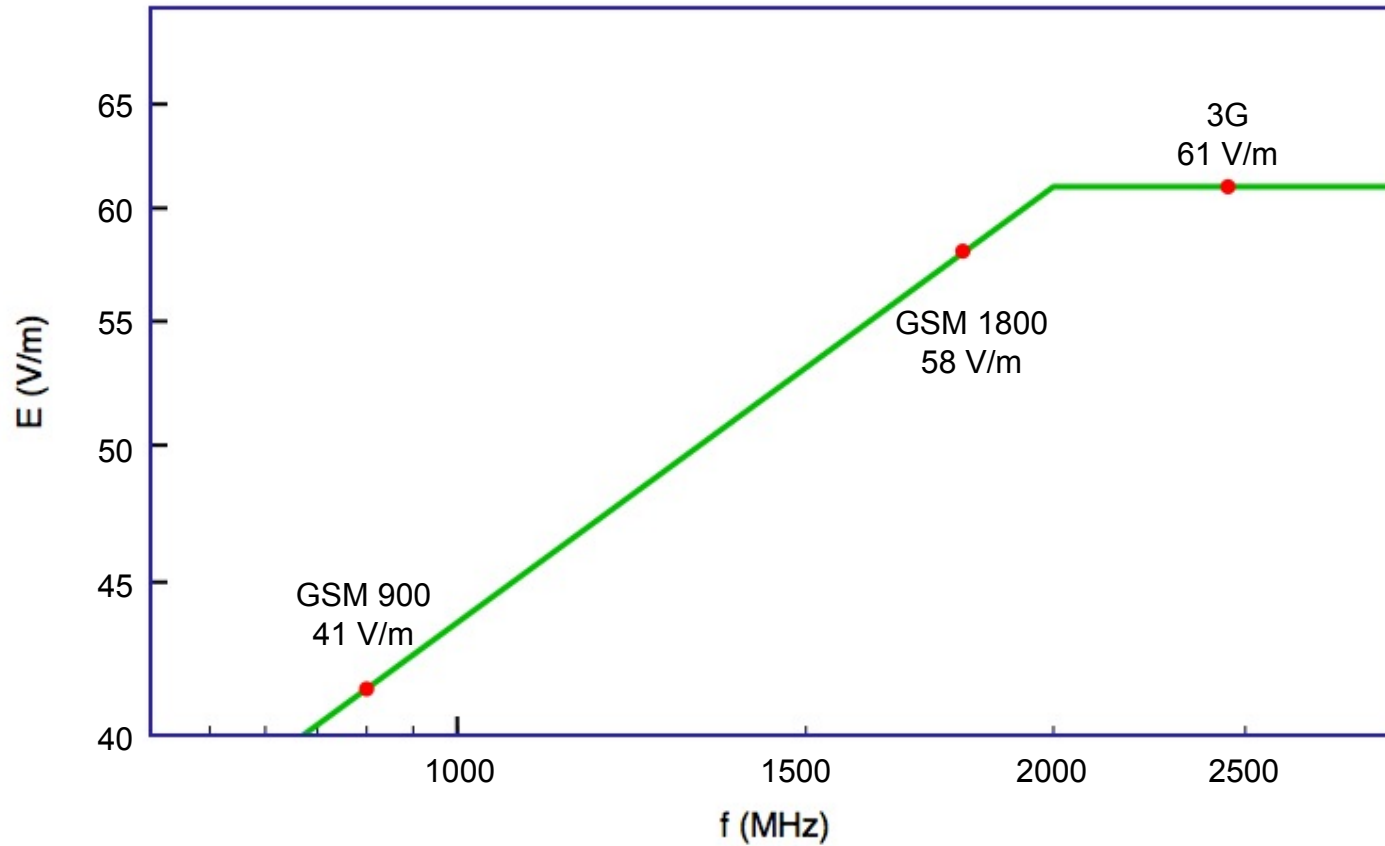
Whole body	0.08 W/kg
Local - head and trunk (average on 10 g)	2.0 W/kg
Local - limbs (average on 10 g)	4.0 W/kg



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



REFERENCE LEVELS FOR MOBILE NETWORKS



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



ICNIRP ON LONG-TERM EFFECTS

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



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



EVOLUTION OF ICNIRP GUIDELINES

- RF (interim) 1984
- RF 1988
- 50/60 Hz electric and magnetic fields (interim) 1990
- Static magnetic fields 1994
- Time-varying electromagnetic fields > 0 Hz - 300 GHz 1998

Basic features of guidelines have not changed over the time



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



STATUS OF ICNIRP GUIDELINES

January 1, 2012

Guidelines for:

- Static magnetic fields 16 years old
- Campi elettrici e magnetici ELF (e IF) 12 years old
- Radiofrequency fields 14 years old

Guidelines were old

Were they outdated?



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



WHY TO REVISE A STANDARD?

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

Social pressure, on any side, must not be a reason to revise science-based standards



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



NOT REASONS TO REVISE SCIENCE-BASED STANDARDS

- Social pressure
- Different regulations issued by national or local authorities
- Time passed from last revision



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



UPDATE OF GUIDELINES

Depending on the evaluation of the literature, the guidelines may be subject to:

- Global revision
- Refinement / Clarification
- Confirmation



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



STATUS OF ICNIRP GUIDELINES

October 6, 2009

Guidelines for:

- Static magnetic fields Published 2009
- ELF (and IF) electric and magnetic fields Published 2010
- RF fields Confirmed 2009



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012

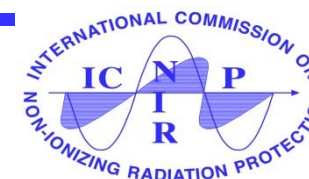


TYPICAL SEQUENCE OF ACTIONS

- Update of science (Blue Book) ICNIRP
- Evaluation of carcinogenicity (Monograph) IARC
- Overall evaluation of health hazard (EHC) WHO-ICNIRP
- Revision of standards ICNIRP



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



APPROACH TO HEALTH RISK ASSESSMENT

ICNIRP Guidelines are based upon:

- Rigorous methodology
- Science only
- Weight of evidence
- Consensus



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



THE WAY TO CONSENSUS

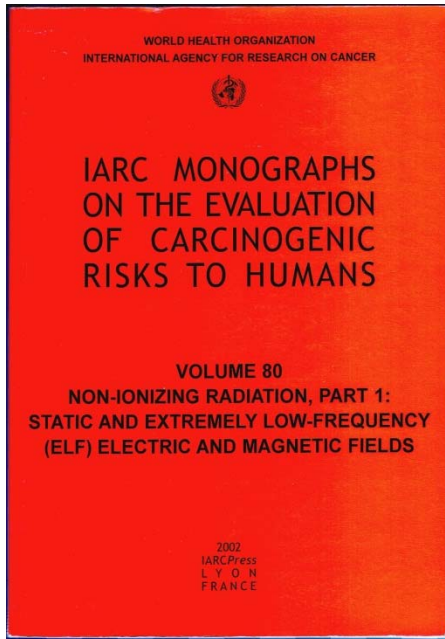
- Draft prepared by an ad hoc working group
- Discussion and approval by the Main Commission
- Expert consultation
- Incorporation of comments
- Final approval and publication



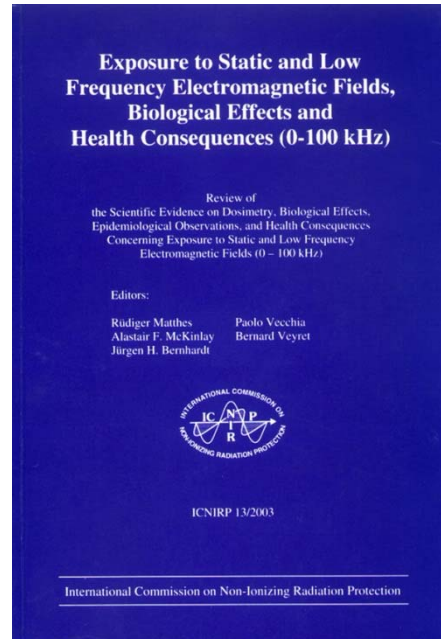
First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



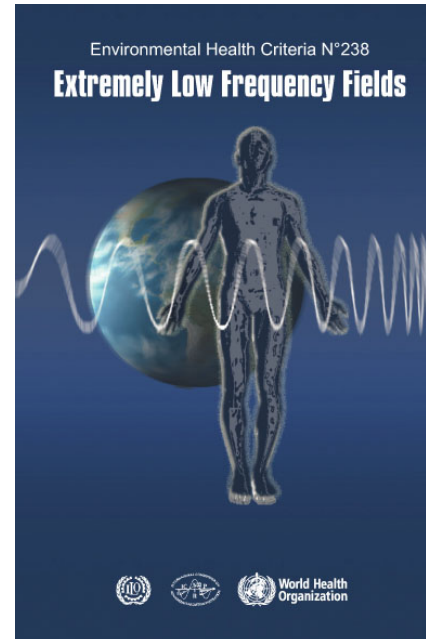
ELF FIELDS



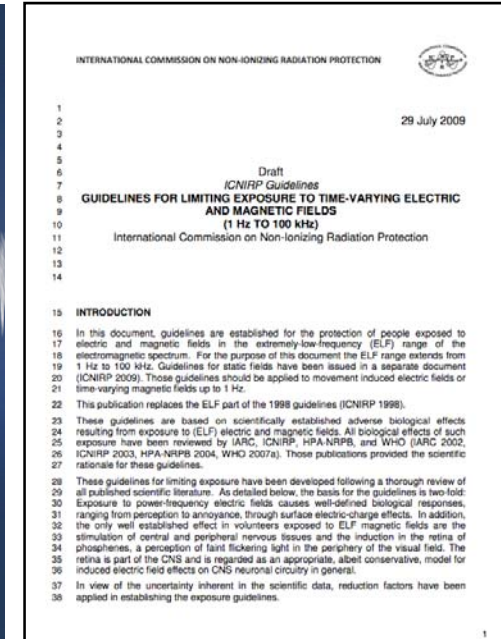
IARC 2002



ICNIRP 2003



WHO 2007



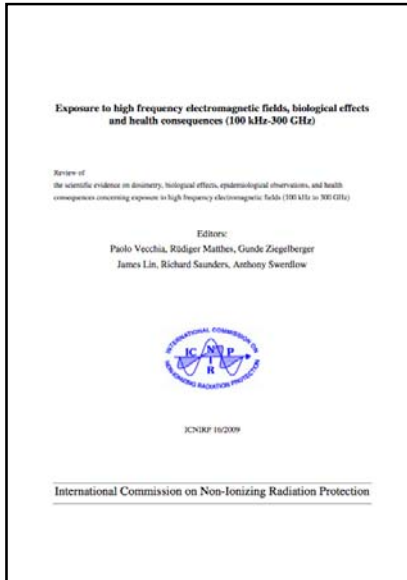
ICNIRP 2009



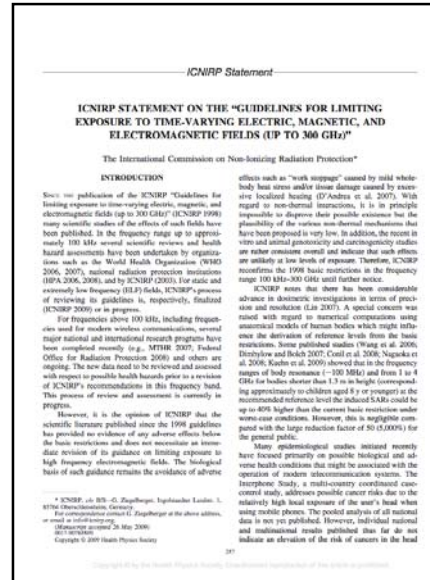
First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



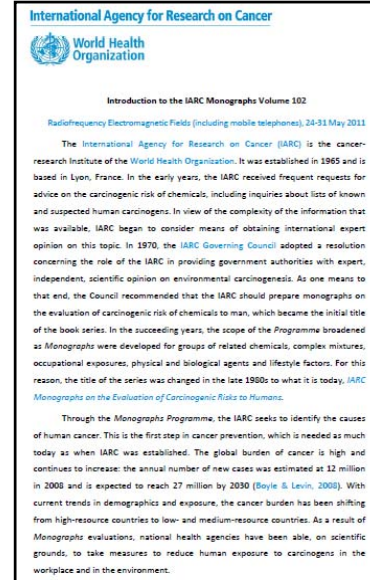
RF FIELDS



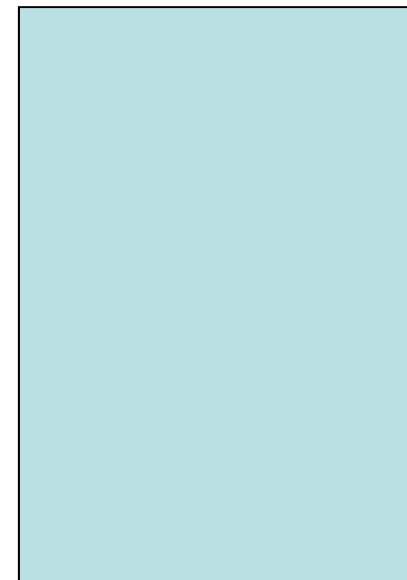
ICNIRP 2009
(review)



ICNIRP 2009
(confirmation statement)



IARC 2011



WHO 2013(?)



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



RF STATEMENT 2009

ICNIRP STATEMENT ON THE “GUIDELINES FOR LIMITING EXPOSURE TO TIME-VARYING ELECTRIC, MAGNETIC, AND ELECTROMAGNETIC FIELDS (UP TO 300 GHz)”

The International Commission on Non-Ionizing Radiation Protection*

INTRODUCTION

SINCE THE publication of the ICNIRP “Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz)” (ICNIRP 1998) many scientific studies of the effects of such fields have been published. In the frequency range up to approximately 100 kHz several scientific reviews and health hazard assessments have been undertaken by organizations such as the World Health Organization (WHO

effects such as “work stoppage” caused by mild whole-body heat stress and/or tissue damage caused by excessive localized heating (D’Andrea et al. 2007). With regard to non-thermal interactions, it is in principle impossible to disprove their possible existence but the plausibility of the various non-thermal mechanisms that have been proposed is very low. In addition, the recent in vitro and animal genotoxicity and carcinogenicity studies are rather consistent overall and indicate that such effects are unlikely at low levels of exposure. Therefore, ICNIRP

Health Physics

www.icnirp.org



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



CONFIRMATION OF ESTABLISHED EFFECTS

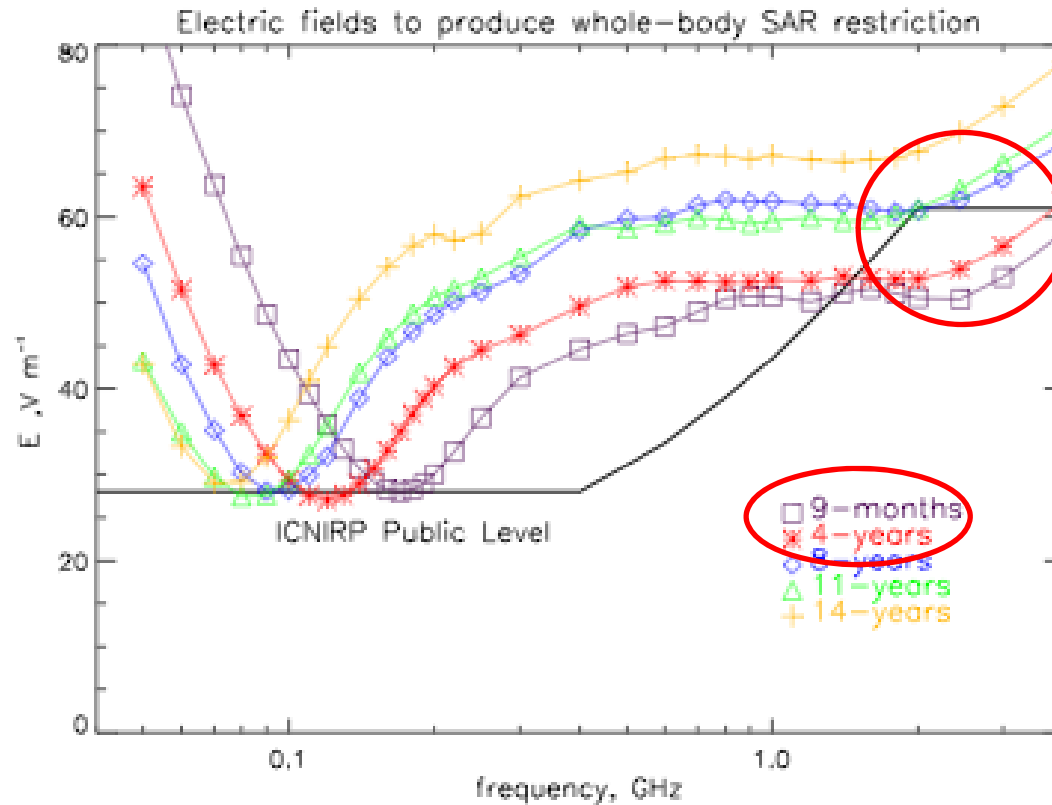
It is the opinion of ICNIRP, that the scientific literature published since the 1998 guidelines has provided **no evidence of any adverse effects below the basic restrictions** and does not necessitate an immediate revision of its guidance on limiting exposure to high frequency electromagnetic fields.



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



CONSISTENCY OF REFERENCE LEVELS



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

Dimbylow & Bolch 2007



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



CONSISTENCY OF REFERENCE LEVELS

A special concern was raised with regard to numerical computations using anatomical models of human bodies which might influence the derivation of reference levels from the basic restrictions.

[...] from 1 to 4 GHz for bodies shorter than 1.3 m in height (corresponding approximately to children aged 8 years or younger) 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 (5000%) for the general public.



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



NON-THERMAL EFFECTS

With regard to non-thermal interactions, it is in principle impossible to disprove their possible existence but **the plausibility of the various non-thermal mechanisms that have been proposed is very low.**

In addition, the recent *in vitro* and animal genotoxicity and carcinogenicity studies are rather consistent overall and indicate that **such effects are unlikely** at low levels of exposure.



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012



CONCLUSIONS

(Personal views)

- A balance is needed between updating and stability of standards
- Most probably, the next revision of RF guidelines will not compromise the adequateness of present standards
- Relevant modifications of basic restrictions and reference levels are unlikely to occur in the future



First West African Conference on EMF and Health
Lagos, Nigeria, 27/28 June 2012

