

Norwegian University of Science and Technology

### The protection philosophy – non-ionizing radiation

Gunnhild Oftedal,

Dept. of Electronic Systems, NTNU

Member of ICNIRP Commission

## ICNIRP

"The Commission is established for the purpose of advancing Non-Ionizing Radiation Protection for the benefit of people and the environment and in particular to provide guidance and recommendations on protection from NIR exposure."

- Non-ionizing radiation
- Infrasound and ultrasound

### **Basis for the presentation**

 Principles practised in existing guidelines (some comparisons with ICRP)

(ICNIRP Philosophy draft document – not for publication yet)

## What is electromagnetic fields/radiation?



### **Biological interactions - examples**



# Some differences Ionizing radiation – non-ionizing radiation ICRP – ICNIRP



### Ionizing radiation (IR): stochastic Non-ionizing radiation (NIR): deterministic



IR: Effect do not depend on dose
 NIR: Effect increases with exposure intensity/dose except for in the higher UV part

NTNU Norwegian University of Science and Technology

In the following: Deterministic effects for NIR

### **Stochastic**

#### IR:

Risk depends on total equivalent dose (intensity \* time):



#### Accumulation of effects!

## Deterministic

### NIR:

High frequency radiation:
Risk depends on absorbed energy
over 6 min (related to tissue
temperature):
6 min-averaged Specific
Absorption Rate (SAR)

Low frequency electric and magnetic fields: Risk depends on instantaneous field level (stimulation of nerves)



## ALARA principle or not?

"As Low As Reasonably Achievable"

### **IRPC:**

- ALARA applied
- Reasonable for stochastic effects

### Reduced risk with reduced Risk dose Dose No reduced risk Risk with reduced dose below threshold Exposure level/Dose

Threshold

### ICNIRP

- ALARA NOT applied
- Not reasonable for deterministic effects

 ${
m NTNU}$  Norwegian University of Science and Technology

### **Exposure limits**



### ICNIRP - EXPOSURE GUIDELINES

 $\hfill O NTNU$  Norwegian University of Science and Technology

# "Only effects for which there was reliable scientific evidence were used as the basis for the exposure restrictions." (ICNIRP 2000)



### **Biological effect – health effect**



Not regarded: Biological effects not known to cause health effects

#### **Regarded:**

Biological or physiological effects, like perceptions, which may cause annoyance and stress reactions

## ICNIRP: method to define exposure levels

- 1. Threshold levels for effects are identified
- 2. Reduction factors are applied to account for:
  - Dosimetry uncertainties
  - Biological variations between individuals



### **General public - Workers**





- More homogenous group
- Informed about exposure and potential risks

#### Higher reduction factors for general public than for workers

## **Basic restrictions – Reference levels**

### **Related to health effects**



Internal electric fields Nerve

stimulation

- Specific absorption rate (SAR)
  - Temperature increase

### **Derived from basic restrictions**:

When not exceeded, basic restrictions not exceeded

Can be measured directly



- External electric and magnetic fields
- Power density

# Thank you!