



# **What is known for low level chronic exposure? What is dose for EMF?**

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# Why is there no low-level EMF limits?

**Today there is no established interaction mechanism(s) for bioeffects from low level EMF exposure.**

**But there are a number of low level effects reported, but these are not considered to be a health hazard**



## **Unknown characteristics**

**What is exposure? E field, B field, dB/dt, SAR.....**

**What is dose? How to take exposure time into account?**

**Is there a threshold value for an effect to occur?**

**What is the biological reset time after exposure?  
Is intermittent exp more effective than  
continuous?**

**How to add different exposures? Frequencies,**

**Interaction mechanism(s) !!!!**



## Basic problems

**Need to distinguish between acute effects and late effects, different exposure parameters of interest:**

**Late effects: Need to sum up exposure over last ten years or so**

**Acute effects: Today's exposure of interest.**



## What has been done so far?

### **Chronic ELF magnetic field exposure - late effects**

- **wiring configuration (W&L, 1979,.....)**
- **annual** average values from power lines
- **spot measurements, logging 24 h,  
bedroom,...**
- **Occupational exposure and job exposure  
matrix**
  - $\mu\text{T}$**
  - $\mu\text{T}$  /working day**
  - $\mu\text{T}$ -years**



# What has been done so far? cont.

## **Video Display Terminals**

- **Hours per day at VDT**
- **E and B field in ELF range**
- **E and B field in VLF range**
- **E and B field in the room**



# What has been done so far? cont.

## Chronic RF exposure - late effects

- **RF exposed/not exp., years with exposure**
- **different type of RF welding machines**
- **E field**
- **H field**
- **combined time - field, E x time, V/m x h**
- **power density**
- **contact current**
- **etc**



# What has been done so far? cont.

## Naval ships and reproduction

- Working within 10 m of shortwave antennas
- Working with radar



# What has been done so far? cont.

## **Mobile phone base stations**

- **Distance to base stations estimated by cases**
- **Measurement of broadband field strength in room**
- **Measurement of broadband field strength outside house**



# What has been done so far? cont.

## Mobile phone exposure

- **NMT, GSM, cordless phone use, years of use**
- **time per day on the phone**
- **number of calls per day**
- **life time hours of use**
- **SAR values for different phones**
- **SAR and time combined to**
  - SAD - spec abs per day**
  - SAC - spec abs per call**



# How to combine different exposures?

**A person has been using:**

**NMT analogue phone**

**GSM 900 phone**

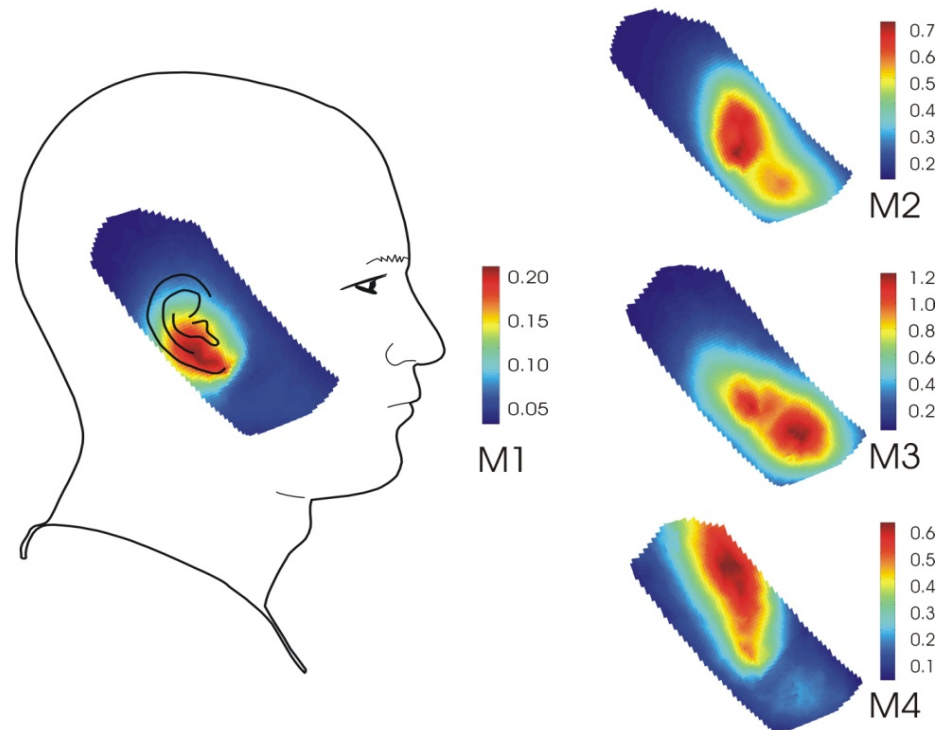
**cordless phone**

**How should we add the use of these different phones?**

**Weight factors according to power output: NMT= 1 W, GSM= 0.25 W, cordless= 0.01 W**

# How to combine different exposures?

**A person has been using different GSM phones with different SAR distributions. How to add the total exposure?**





# CONCLUSIONS

**Today it is not possible to limit chronic exposure, ELF or RF.**

**Need to know more about interaction mechanisms, more cellular experiments.**

**Better exposure assessment in epi-studies.**

**While waiting for better knowledge, we may apply a precautionary approach.**