

Expert Seminar on Working Environment Challenges for the Future
Copenhagen, 24 and 25 September 2009

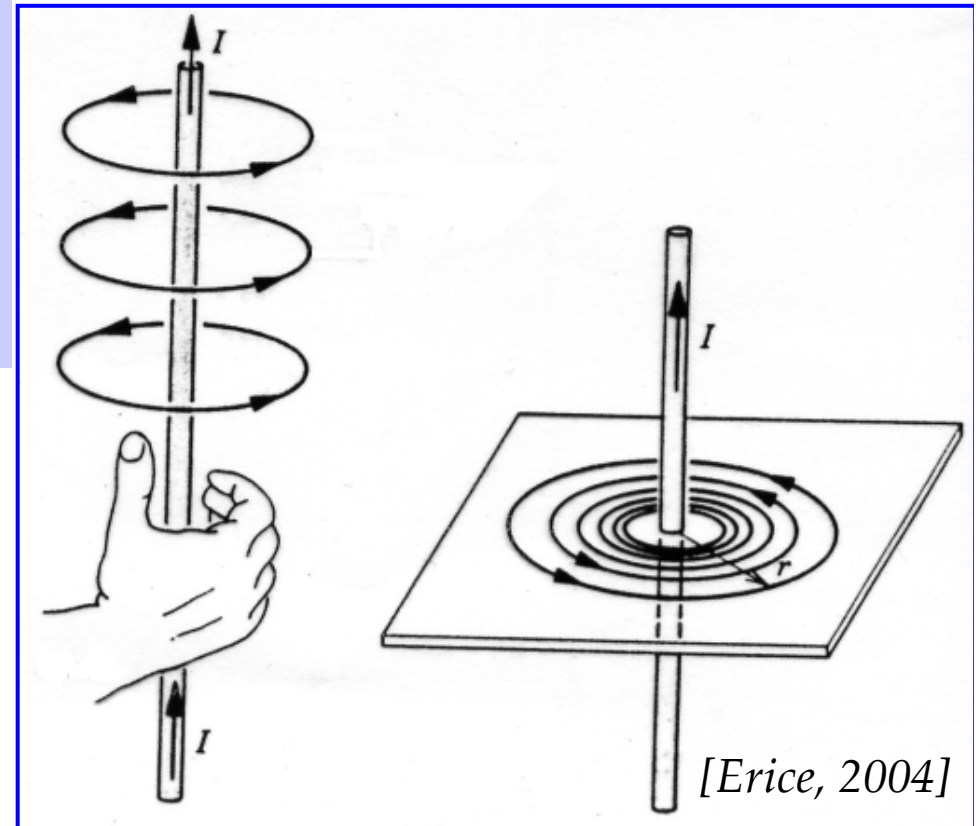
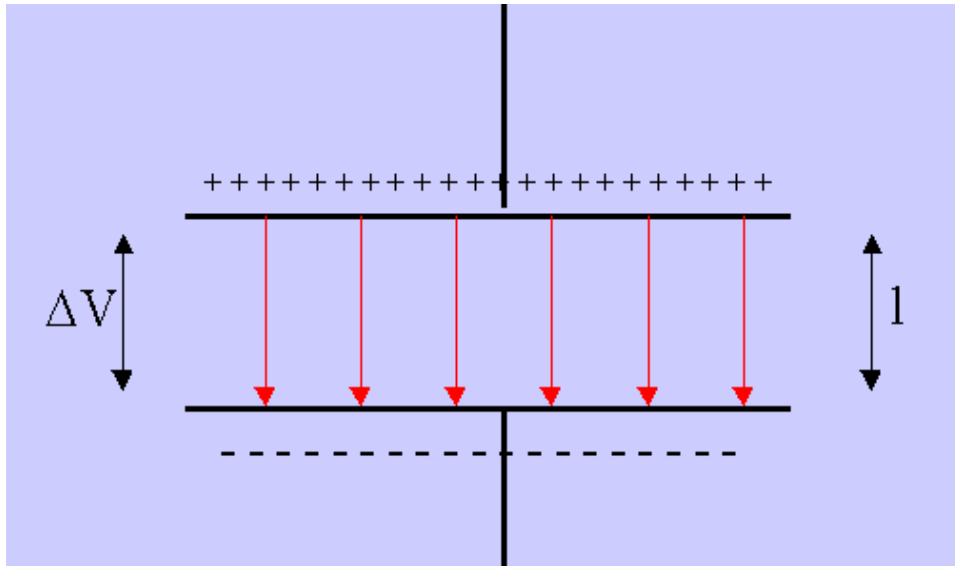
Future challenges with respect to electromagnetic component of working and living environment

Jolanta Karpowicz

Central Institute for Labour Protection
–National Research Institute (CIOP-PIB)
Warszawa, Poland
jokar@ciop.pl, <http://www.ciop.pl/> EMF



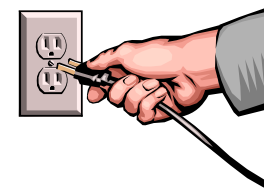
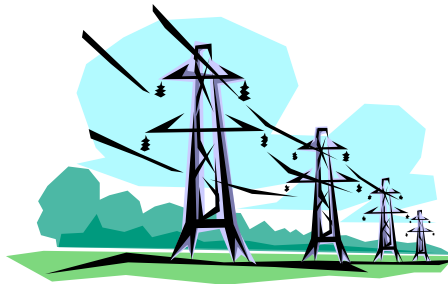
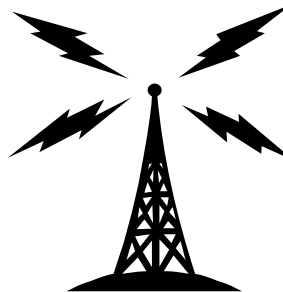
Electric and magnetic fields (EMF)



EMF exposure

The majority workers & public population is subject to simultaneous exposure to EMF from:

- ➔ broadcasting installations
- ➔ power distribution installations
- ➔ various electrical and wireless appliances



Significant occupational exposure to EMF

might be caused by

(but not necessary, depend on work practice):

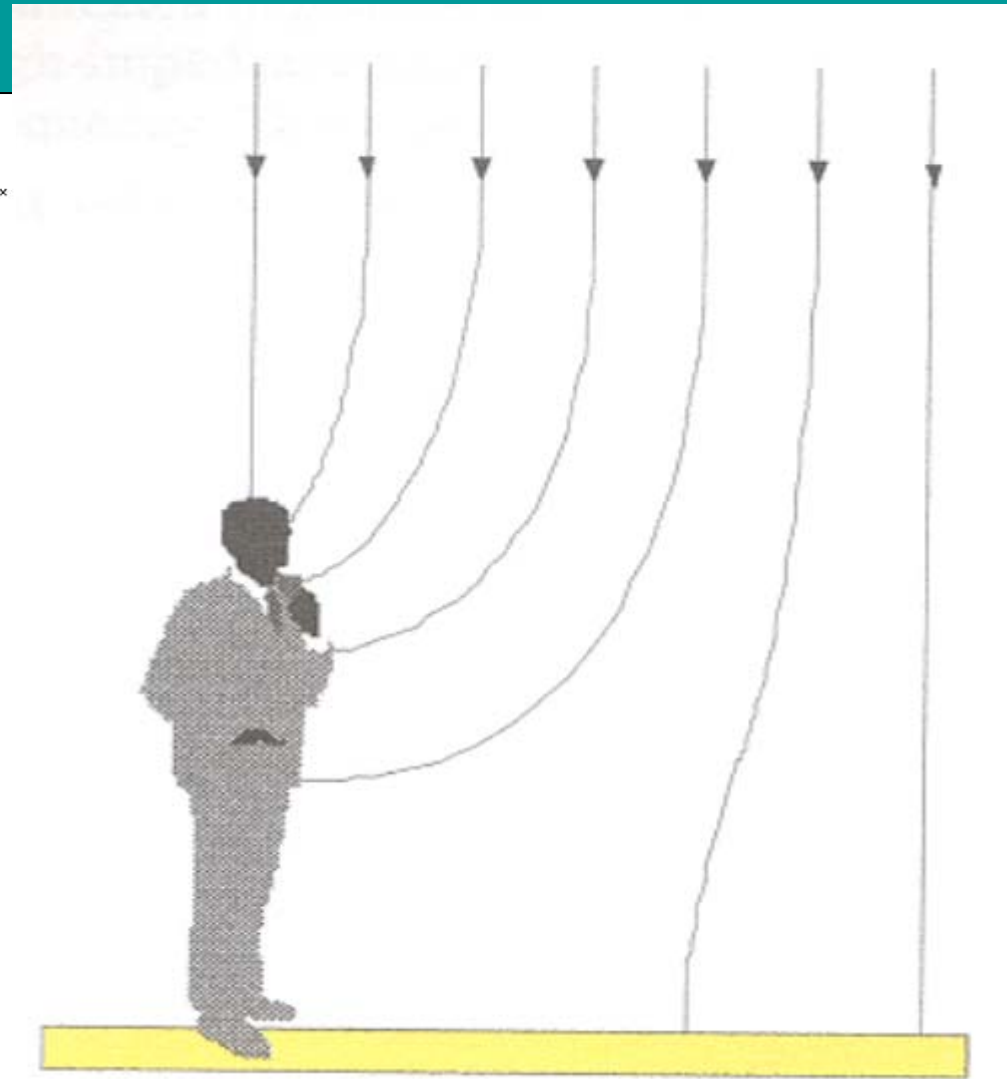
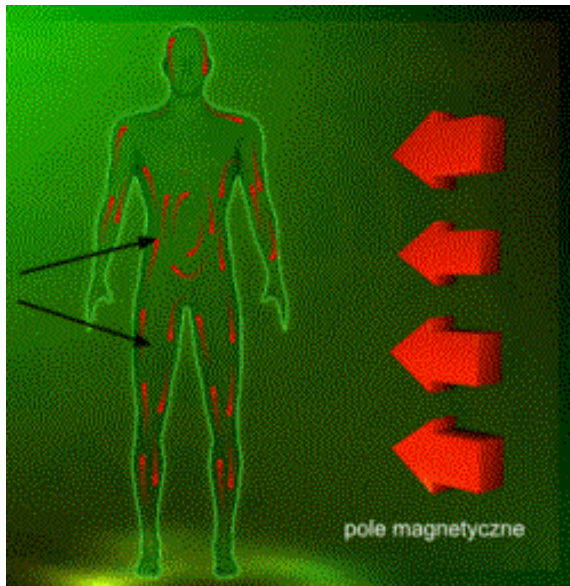
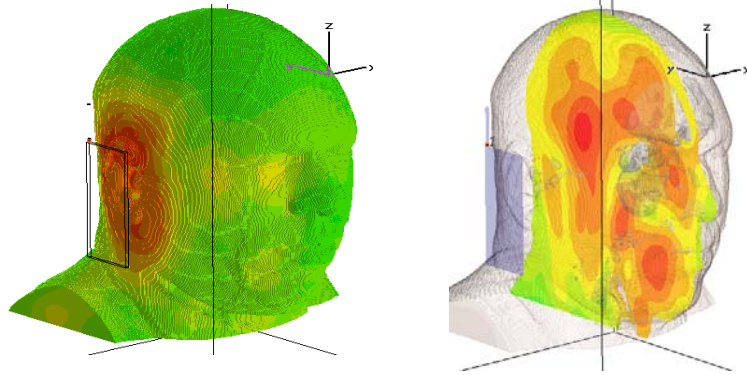
- industrial appliances
 - induction heaters - operating from 1 kHz to low MHz
 - welding devices - common sources of ELF EMF but can be also a source of tens/hundreds kHz EMF)
 - microwave heaters
 - plastic welding
- medical devices
 - MRI scanners – static fields, low kHz + & RF pulses
 - electrosurgery units - sources of 300 kHz - 1.5 MHz)
- telecommunication - antennas
- anti-theft devices and more others

[Journal JOSE vol. 1/2009]

Kopenhagen 24 – 25 September 2009

CIOP  PIB

Human in EMF



EMF exposure effects (#1)

- 1) established mechanism of human interaction with EMF (Reilly, 1998)
 - ➔ synapse activity alteration by membrane polarization (e.g. phosphenes)
 - ➔ peripheral nerve excitation via membrane depolarization
 - ➔ muscle cell excitation by membrane depolarization (skeletal)
 - ➔ electroporation
 - ➔ **resistive (joule) heating**
 - ➔ audio effects via thermoelastic expansion
 - ➔ magneto hydrodynamic effects

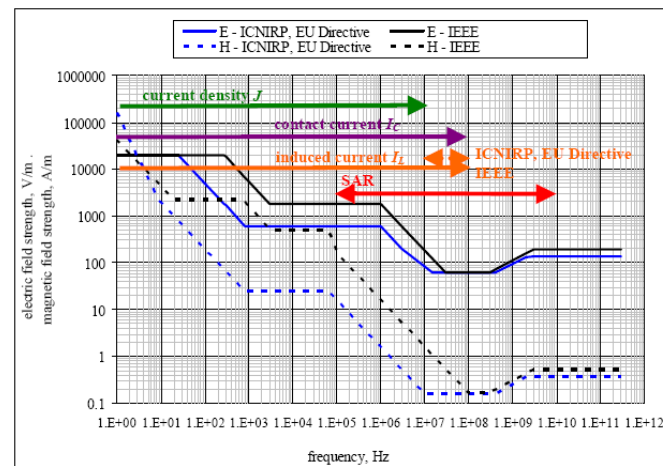
OSH legislation on workers' exposure to EMF

mandatory risk assessment (Directive 2004/40/EC) –
assessment, measurements or calculations of EMF
exposure

- exposure level (***E*** and ***H***)
- computational quantities (***J*** and ***SAR***)

for occupational exposures, where the source
is directly coupled to the body

- local SAR
- induced currents
- contact currents



DIRECTIVE 2004/40/EC
+ 2008/46/EC (implementation by 2012
⇒ mandatory legislations + voluntary standards)

DIRECTIVE 2004/40/EC OF THE EUROPEAN
PARLIAMENT AND OF THE COUNCIL
ON THE MINIMUM HEALTH AND SAFETY
REQUIREMENTS REGARDING THE EXPOSURE
OF WORKERS TO THE RISKS ARISING FROM
PHYSICAL AGENTS
(ELECTROMAGNETIC FIELDS)
(18TH INDIVIDUAL DIRECTIVE WITHIN THE
MEANING OF ARTICLE 16(1) OF DIRECTIVE
89/391/EEC)

EMF exposure – new and future trends (public environment)



- ➔ multi years exposure to low-level of radiofrequency EMF from wireless communication (mobile phone systems & new and emerging technologies)

For such exposure to EMF investigations on health results of exposure are still inconclusive.

The possibility of elevated hazards of cancer were published.

EMF exposure – new and future trends (industrial and health care environment)



- ➔ significantly growing up exposures to static and low frequency magnetic fields (e.g. high field MRI scanners, welding devices, electrolytic installations)

For low frequency exposure to magnetic fields possible link with carcinogenic process and neurodegenerative diseases were found

EMF exposure effects (#2)

2) proposed mechanism of human interaction with EMF:

- ➔ soliton mechanism through cell membrane proteins
- ➔ spatial/temporal cellular integration
- ➔ stochastic resonance
- ➔ temperature mediated alteration of membrane ion transport
- ➔ Plasmon resonance
- ➔ **radon decay product attractors**
- ➔ rectification by cellular membranes
- ➔ ion resonance
- ➔ Ca⁺⁺ oscillations
- ➔ **nuclear magnetic resonance (MRI)**
- ➔ **radical pair mechanism**
- ➔ magnetite interactions
- ➔

EMF exposure effects (#3)

- ➔ The health consequences of various interactions of EMFs with human body are not established (**but it does not mean that risk not exist**) (WHO, 1987, WHO, 1993, WHO, 2006; WHO, 2007,).
- ➔ Some acute effects of exposure, which can significantly reduce work-ability are also known, as **vertigo, magneto phosphenes, nausea, metallic taste in mouth, difficulties in eye-hand coordination**, related for example to movements in the static magnetic field of high level (Karpowicz, Hietanen, Gryz, 2007; WHO, 2007).

EMF exposure effects (#4)

- ➔ Occupational exposure to EMFs, extended over a period of years, may affect health and ability to work performance.
- ➔ So far, results of investigations have not excluded the possibility of adverse health effects of many-years exposure, especially exposures of high level.
- ➔ Hypotheses of possible adverse health results linked with EMFs exposure under research covers e.g.:
development of tumours or malfunctions of the cardiovascular, nervous and immunological systems

EMF exposure effects (#5)

Example: **Cellular/Mobile Phone Use and Intracranial Tumours** [by National Collaborating Centre for Environmental Health at the BC, Centre for Disease Control with funding from the Public Health Agency of Canada, July 2008]

- ➔ Meta-analyses based on ≥ 10 years duration of use have detected a slightly increased risk (OR: 1.25, 95%CI: 1.01-1.54) for all intracranial tumours (Kan et al 2008)⁴. Pooled analyses using shorter duration did not indicate an association (Lahkola et al 2006)².
- ➔ Restricting the analyses to ≥ 10 years and ipsilateral use (cell phone use on the same side as the tumour), the risk increased and was significantly associated for glioma (OR: 2.0, 95%CI: 1.2-3.4) and acoustic neuroma (OR: 2.4, 95%CI: 1.1-5.3, but not for meningioma (OR: 1.7, 95%CI: 0.99-3.1) (Hardell et al 2008)

Conclusion.

- ➔ There is insufficient evidence to indicate a causal association between cell phone use and intracranial tumours.
- ➔ There is weak evidence supporting an increase in odds of glioma, acoustic neuroma, and meningioma in adults with regular, ipsilateral use for 10 years or longer.
- ➔ Existing findings are **suggestive but preliminary** because they **are based on few studies with small numbers and potential biases (!!!)**.

Public concern on EMF

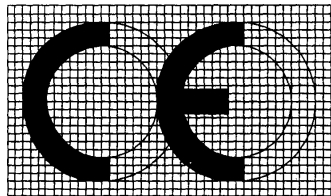
- ➔ The results of research related to EMF health hazards remains uncertain
- ➔ Public concern linked with EMF in environment is therefore rapidly growing up.



- ➔ Special attention is needed for particular groups, like electronic active implants users or persons supported by electronic monitoring of life parameters.

Population of such persons is increasing in aging society.

Examples of significant challenges for future management of environmental EMF



- ➔ evaluation of health hazards related to new EMF components of environment - both multi years exposure and high level exposure
- ➔ harmonisation on preventive policy on EMF in work and public environment
- ➔ management of public concern related to growing up use of wireless systems in work environment open to public access

Examples of significant challenges for future management of environmental EMF



- ➔ harmonisation of electromagnetic compatibility (EMC) requirements with parameters of EMF environment accessible for electronic implants users



- ➔ efficient allocation of budget dedicated to solving of OSH practical problems for solving appropriately identified EMF related issues.

Thank you for your kind attention

Future challenges with respect to
electromagnetic component of working
and living environment



Jolanta Karpowicz
CIOP-PIB, Warszawa, Poland
jokar@ciop.pl,
<http://www.ciop.pl/> EMF