

Possible effects of electromagnetic fields (EMF) on human health—Opinion of the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR)[☆]

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Upon request of the European Commission, the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) has updated the previous opinion on “Possible effects of Electromagnetic Fields (EMF), Radio Frequency Fields (RF) and Microwave Radiation on human health” by the Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) from 2001,² with respect to whether or not exposure to electromagnetic fields (EMF) is a cause of disease or other health effects. The opinion is primarily based on scientific articles, published in English language peer-reviewed scientific journals. Only studies that are considered relevant for the task are cited and commented upon in the section Scientific Rationale in the full text of the opinion.³ The opinion is divided into frequency (f) bands, namely: radio frequency (RF) ($100 \text{ kHz} < f \leq 300 \text{ GHz}$), intermediate frequency (IF) ($300 \text{ Hz} < f \leq 100 \text{ kHz}$), extremely low frequency (ELF) ($0 < f \leq 300 \text{ Hz}$), and static (0 Hz) (only static magnetic fields are considered in this opinion). There is a separate section for environmental effects.

1. Radio frequency fields (RF fields)

Based on a review of scientific papers that were published after 2001 the SCENIHR has updated the CSTEE opinion and concludes the following in regard to non-thermal effects.

The balance of epidemiologic evidence indicates that mobile phone use of less than 10 years does not pose any increased risk of brain tumour or acoustic neuroma. For longer use, data are sparse and any conclusions, therefore, are uncertain. From the available data, however, it does appear that there is no increased risk for brain tumours in long-term users, with the exception of acoustic neuroma for which there are some indications of an association.

For diseases other than cancer, very little epidemiologic data are available.

A particular consideration is mobile phone use by children. While no specific evidence exists, children or adolescents may be more sensitive to RF field exposure than adults in view of their continuing development. Children of today may also experience a much higher cumulative exposure than previous generations. To date no epidemiologic studies on children are available.

RF exposure has not consistently been shown to have an effect on self-reported symptoms (e.g., headache, fatigue, dizziness and concentration difficulties) or well-being.

Studies on neurological effects and reproductive effects have not indicated any health risks at exposure levels below the ICNIRP⁴-limits established in 1998.

[☆] TOXICOLOGY agreed with the European Commission that the journal will publish Opinions of the independent EU-Scientific Committees. The following Opinion is the first in line

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¹ on behalf of SCENIHR.

² http://ec.europa.eu/health/ph_risk/committees/sct/documents/out128.en.pdf.

³ http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_007.pdf.

⁴ International Committee on Non-Ionizing Radiation Protection.

Animal studies have not provided evidence that RF fields could induce cancer, enhance the effects of known carcinogens, or accelerate the development of transplanted tumours. The open questions include adequacy of the experimental models used and scarcity of data at high exposure levels.

There is no consistent indication from in vitro research that RF fields affect cells at the nonthermal exposure level.

In conclusion, no health effect has been consistently demonstrated at exposure levels below the ICNIRP-limits established in 1998. However, the database for this evaluation is limited especially for long-term low-level exposure.

2. Intermediate frequency fields (IF fields)

In its opinion from 2001 the CSTE did not comment specifically on intermediate frequencies (IF). SCENIHR, however, updates the CSTE opinion with the following statement regarding intermediate frequencies.

Experimental and epidemiological data from the IF range are very sparse. Therefore, assessment of acute health risks in the IF range is currently based on known hazards at lower frequencies and at higher frequencies. Proper evaluation and assessment of possible health effects from long-term exposure to IF fields are important because human exposure to such fields is increasing due to new and emerging technologies.

3. Extremely low frequency fields (ELF fields)

The previous conclusion in the 2001 opinion, that ELF magnetic fields are a possible carcinogen, chiefly based on childhood leukaemia results, is still valid. There is no generally accepted mechanism to explain how ELF magnetic field exposure may cause leukaemia. Animal studies have not provided adequate evidence for a causal relationship.

No consistent relationship between ELF fields and self-reported symptoms (sometimes referred to as electrical hypersensitivity) has been demonstrated.

In addition, for breast cancer and cardiovascular disease, recent research has indicated that an association is unlikely. For neurodegenerative diseases and brain tumours, the link to ELF fields remains uncertain.

4. Static fields

In its opinion from 2001 the CSTE did not comment specifically on static magnetic fields.

SCENIHR, however, updates the 2001 opinion with the following statement regarding static magnetic fields.

Adequate data for proper risk assessment of static magnetic fields are very sparse. Developments of technologies involving static magnetic fields, e.g., with MRI equipment require risk assessments to be made in relation to the exposure of personnel.

5. Environmental effects

The CSTE did not consider environmental effects in its opinion of 2001.

The continued lack of good quality studies in relevant species means that there are insufficient data to identify whether a single exposure standard is appropriate to protect all environmental species from EMF. Similarly the data are inadequate to judge whether the environmental standards should be the same or significantly different from those appropriate to protect human health.

6. Overall conclusion

The Committee is mindful of the mandate that requested particular attention to be paid to a wide variety of issues. In view of the identified important gaps in knowledge the following research recommendations are being made.

7. Research recommendations

7.1. RF fields

- A long-term prospective cohort study. Such a study would overcome problems that were discussed in relation to existing epidemiological studies, including the Interphone study. These problems include recall bias and other aspects of exposure assessment, selection bias due to high proportions of non-responders, too short induction period, and restriction to intracranial tumours.
- Health effects of RF exposure in children. To date no study on children exists. This issue can also be addressed by studies on immature animals. This research has to take into consideration that dosimetry in children may differ from that in adults.
- Exposure distribution in the population. The advent of personal dosimeters has made it possible to describe individual exposure in the population and to assess the relative contribution of different sources to the total exposure. Such a project would require that groups of people with different characteristics are selected and that they wear dosimeters for a defined period of time.

There are several experimental studies that need to be replicated. Examples are studies on genotoxicity and cognition involving sleep quality parameters. For studies on biomarkers it is essential that the impact on human health is considered. Valid exposure assessment including all relevant sources of exposure is essential. A general comment is that all studies must use high quality dosimetry.

7.2. IF fields

- Data on health effects from IF fields are sparse. This issue should be addressed both through epidemiologic and experimental studies.

7.2.1. ELF fields

- Epidemiological results indicate an increased risk of leukaemia in children exposed to high levels of ELF magnetic fields, however, this is not supported by animal data. The

mechanisms responsible for the childhood leukaemia and the reasons for the discrepancy are unknown and require a better understanding and clarification.

7.3. Static fields

- A cohort study on personnel dealing with equipment that generates strong magnetic fields is required. The start of this would have to be a thorough feasibility study.
- Relevant experimental studies, such as studies on carcinogenicity, genotoxicity as well as developmental and

neurobehavioural effects would have to be conducted as well.

7.4. Additional considerations

- Studies including exposure to combinations of frequencies as well as combinations of electromagnetic fields and other agents need to be considered.

Link to the full opinion: http://ec.europa.eu/health/ph_risk/committees/04_scenihhr/docs/scenihhr_o_007.pdf.