Scand J Work Environ Health 2002;28(4):285
Issue date: Aug 2002

**Non-ionizing Radiation, Part 1: Static and Extremely Low-frequency (elf) Electric and Magnetic Fields**

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**Key terms:** book review; low-frequency electric fields; low-frequency magnetic fields; non-ionizing radiation



Print ISSN: 0355-3140 Electronic ISSN: 1795-990X

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*Non-ionizing radiation, part 1: static and extremely low-frequency (elf) electric and magnetic fields* (IARC monographs on the evaluation of carcinogenic risks to humans, vol 80). By a working group of the International Agency for Research on Cancer (IARC). Lyon: IARC Press, 2002:429 p. ISBN 92-832-1280-0. Distributed by IARC Press (telefax + 33 4 72 73 83 02, e-mail: press@iarc.fr) and by WHO Marketing and Dissemination (telefax: +41 22 791 4857, e-mail: publications@who.int).

In June of 2001, a panel of 21 scientists assembled by the International Agency for Research on Cancer (IARC) evaluated the possible carcinogenicity of exposure to static and extremely low-frequency (ELF) electric and magnetic fields to humans. This monograph represents the views and the expert opinions of the working group. This volume is the first of the two planned IARC monographs on electromagnetic fields (EMF), the next one focusing on radiofrequency (RF) fields.

The monograph starts with a preamble explaining the work and evaluation procedures of the IARC monograph program. It is very helpful for readers who are not familiar with the IARC classification criteria. In short, the evidence for carcinogenicity is based on human and experimental animal data, and the overall evaluations are given using the following categorizations: Group 1 = agents carcinogenic to humans, group 2A = agents probably carcinogenic to humans, group 2B = agents possibly carcinogenic to humans, group 3 = agents not classifiable as to their carcinogenicity to humans, and group 4 = agents probably not carcinogenic to humans.

After a general introduction to the physical characteristics of EMF and their interactions with biological material, a detailed description of sources and the methods used to assess exposure is given. It contains, for instance, three tables including information on measuring instruments, giving not only technical characteristics of static and ELF field meters, but also listing companies and their product data. Surprisingly, some globally well-known enterprises are missing from this list of manufacturers.

Chapter 2 summarizes studies on cancer in humans, reviewing in detail the comprehensive epidemiologic literature since the first report suggesting an association between residential EMF and cancer in children was published in 1979. There seems to be no consistent evidence that residential or occupational exposures of adults are related to risk of any type of cancer. However, pooled analyses of data from studies on children exposed to residential magnetic fields show a nearly two-fold increase in leukemia. No consistent relationship between any other childhood cancers and residential EMF has been found.

Chapter 3 deals with studies on carcinogenicity in experimental animals, such as exposures of rats and mice to magnetic fields in combination with known carcinogens. Multistage studies have shown no consistent enhancement of chemically initiated tumors or leukemia in animal models. Hence evidence for the carcinogenicity of ELF magnetic fields was judged inadequate. No relevant data of static electric or magnetic fields or of ELF electric fields were available.

The chapters on carcinogenicity research are followed by a review of studies on biological effects other than cancer, both in humans and in experimental systems. It summarizes a variety of studies on cardiovascular diseases, perception and hypersensitivity, reproductive and development effects, and the like. In addition, a separate section concerning the beneficial effects of ELF electric and magnetic fields on bone healing was compiled by the IARC secretariat after the working group meeting. All these noncarcinogenicity data were regarded as relevant and of sufficient importance for the overall evaluation of carcinogenicity and its mechanisms.

The conclusion by the panel was that, although many hypotheses have been suggested to explain possible carcinogenic effects of ELF electric and magnetic fields, no scientific explanation for the mechanisms has been established. Overall, ELF magnetic fields were unanimously evaluated as possibly carcinogenic to humans (group 2B), on the basis of the statistical association between residential ELF magnetic fields and the increased risk of childhood leukemia. Static electric and magnetic fields, as well as ELF electric fields, were not classifiable as to their carcinogenicity to humans (group 3).

The monograph covers the main topical issues concerning the possible health risks of exposure to static and ELF fields. Although the review of published papers could have been more condensed, the text is easily readable, and hence the monograph certainly will be a very important source of data on EMF research for many years ahead.

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