

EUROPEAN EMF DIRECTIVE POSTPONED DUE TO OPEN QUESTIONS CONCERNING ASSESSMENT OF OCCUPATIONAL EXPOSURE TO ELECTROMAGNETIC FIELDS

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The European Directive 2004/40/EC on the minimum health and safety requirements for occupational exposure of workers to electromagnetic fields (EMF) was to be implemented in European Union (EU) Member States by May 2008 [1]. Due to some unexpected problems, the deadline of implementation is now postponed until 2012. Some of the problems identified, with suggestions for possible solutions, have recently been reviewed by Hansson Mild et al [2], and are shortly discussed below.

In the EU Directive, the exposure limit of 40 mA/m² for induced current density is given for magnetic fields with frequency < 1 Hz. The action level is set at 200 millitesla (mT), but no value is specified for static magnetic field ($f = 0$ Hz). Movement in the static field gives rise to induced currents. These should be treated in the same way as currents resulting from exposure to a time-varying magnetic field. At the moment it is not clear if this is the case.

The difference between the emission and exposure standards is another problem. Emission standards are created to provide standardized procedures for laboratory testing. Exposure standards are applicable to the real work environment and the measurements should refer to the worst-case exposure scenario. The use of CENELEC emission standards is therefore problematic in exposure assessments.

The limits for exposure to ELF fields are set to protect against nerve excitation, which can happen during exposure <10 ms. However, the limits are set as rms-values, and the same applies to the corresponding time to be used in assessing induced current density and contact current. For example, at spot welding the total welding time is typically shorter than one second. The whole welding period is over before the averaging time is up. When discussing handheld tools, the CENELEC standard EN 62233:2008 states that the first 200 ms should be neglected. In practice, a welding machine usually draws 10 times more current during the first few periods. The aim of Directive 2004/40/EC is to protect against nerve excitation and this exception is in conflict with the biomedical rationale for safety guidance.

An identified problem is exposure assessment carried out by people with insufficient knowledge and experience in physics, instrumentation and statistics related to EMF. There have been many reports of people trying to take microwave measurements with ELF instruments, etc. One way of reducing such assessment errors is to demand accredited commercial measuring services in order to guarantee compliance with the Directive. It is also possible to at least demand documented basic knowledge of instrumentation, measurement techniques, fundamental knowledge on the biological effects of exposure to EMF, and periodic calibration of instruments.

The basic problems related to calculating of workers' exposure level are correct representations of (a) the realistic posture of a worker's body; (b) the electrical grounding conditions at the workplace; (c) realistic impedance of near-field produced by, e.g., electrosurgery or welding devices; and (d) dynamic changes in EMF level in the course of application. Proper calculations in assessing exposure require advanced skills, specialized software, and can be both very time-consuming and expensive. Validation and verification of the skills of persons who do the calculations are also important.

Some of the aforementioned questions can be solved by administrative decisions, but for others further research is necessary. How should exposure be assessed in the vicinity of an EMF source of dynamically-changing geometry and EMF emission levels (e.g., welding devices)? Can limit values for limb current be exceeded although E-field value is below the action level? When is it necessary to use spectrum analysers? What are the requirements regarding conditions of measurements representing real exposure of workers?

Finally, risk assessment of occupational exposure to EMF for highly exposed workers and workers at particular risk (pregnant workers, workers with metallic active or passive medical implants, young workers and other vulnerable workers) requires specific considerations. Directive 2004/40/EC indicates the need for special attention in assessing occupational risk for those groups. Although the Directive states that protective actions should be taken, the details have not been specified yet

REFERENCES

- [1] 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). Official Journal of the European Union L 159, 1-26, April 2004.
- [2] K. Hansson Mild, T. Alanko, Decat, R. Falsaperla, K. Gryz, M. Hietanen, J. Karpowicz, M. Sandström. Exposure of workers to electromagnetic fields. A review of open questions on exposure assessment techniques. *Int J Occ Safety Erg* JOSE, 15 (1), 3-33, February, 2009.