

Risks of electromagnetic fields

European legislation is clear cut and can now be put into practice

European Norm 50499 was ratified on 21st October 2008. In contrast, the deadline for implementing Directive 2004/40/EG, known as the “Workers Directive” was put back to the year 2012 by Directive 2008/46/EG. Confused? Perfect chaos? On closer inspection, the legal situation is quite clear. It gives employers and their appointed safety representatives the chance to gradually adapt their processes to the new Directive so they can be on the safe side of the law.

Uniform European minimum standards for exposure to electromagnetic fields are intended to protect the working population and at the same time prevent distortion of competition within the European Community. With this aim in mind, the European Parliament and the Council of Europe published “Directive 2004/40/EC of the European Parliament and the Council of 29 April 2004 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields)” [1]. All EC member states were to incorporate this Directive into their national legislation by 30th April 2008. At the same time, the European Committee for Electrotechnical Standardization CENELEC was given the task of preparing a preliminary standard (prEN) which was to describe standardized rules for risk assessment and mandatory measures for minimizing exposure. This is because the EC Directive does not contain any regulations for verification, even though it includes the limit values for occupational exposure set out by the ICNIRP [2].

In the meantime, CENELEC has completed its task: EN 50499, entitled “Determination of workers exposure to electromagnetic fields” [3] has been ratified. In contrast, the deadline for implementing the “Workers Directive” 2004/40/EC has been extended by four years by means of Directive 2008/46/EC [4]. This was triggered by fundamental discussions about the limit values in the low frequency range, i.e. limit values that would possibly restrict the use of medical imaging techniques such as magnetic resonance tomography. There is a collision of opposing requirements here: the right to a safe working environment, and the patient’s interest in a correct diagnosis. For this reason, the European Parliament and the Council of the European

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Union would prefer to wait for the results of further studies that are being evaluated at the moment by ICNIRP and the World Health Organization, and which may lead to changes in the limit values.

The situation

The postponement of the implementation deadline has contributed to a general sense of confusion. What are the current rules? Are we in a sort of legal no man's land? Well, one thing is certain: According to Article 14 of Directive 2004/40/EC the directive "is effective from the day of its publication in the Official Journal of the European Union". In other words, it applies since April 2004. True, it does contain the following clause: "Until all pertinent cases of evaluation, measurement, and calculation are covered by harmonized European Standards from the European Electrotechnical Standardization Committee (CENELEC), member states can use other scientifically based standards or guidelines for the evaluation, measurement and / or calculation of the exposure of workers to electromagnetic fields." But this uncertainty has been eliminated with the completion of EN 50499. So member states have time until 2012 only with respect to incorporating the Directive into national law. This means that employers and their safety representatives now have the chance to gradually adapt their processes to the new directive. EN 50499 gives clear rules, and even provides a degree of relief in some respects

The risk-assessment process

The risk assessment process in itself is nothing new. What is new is the consistent application to *all* work environments: According to Article 4 of Directive 2004/40/EC, the employer must be in possession of a risk assessment and this must be recorded on suitable data media.

In EN 50499, CENELEC has produced a list of workplaces that can be classified a priori as safety compliant to avoid an unacceptable increase in the amount of extra work for employers. These include, for example, office workstations that are equipped solely with CE-compliant devices or places of work in the medical field with equipment that does *not* purposely generate electromagnetic fields or currents.

This thus excludes any therapeutic applications such as diathermy, the deep heat treatment of tissue using electromagnetic fields or high frequency currents. Obviously, field strengths that can be proven to have practically no effect – the ICNIRP limit values were specified such that the thermal effect on the body is close to the limit of detection – are of no therapeutic value.

The test equipment

EN 50499 allows verification of exposure limit values by means of both measurement and calculation.

In environments with one or more known field sources, calculation can be the easier option. Nevertheless, it is a good idea to also make random sample measurements.

Where the environment contains additional, unknown field sources, the actual exposure level can only be verified by means of measuring equipment. The device used must be capable of weighting the different parts of the field according to frequency and in line with the prescribed limit values so that it can display the overall field exposure level. A frequency-selective measuring set also gives information about the contribution each field source makes to the total exposure level.

Increased exposure is also to be expected at industrial workplaces: Industrial electrolysis, electrical smelting of metals, induction welding, the use of microwaves for heating and drying – these are just some of the examples cited by EN 50499. The same applies to working on transmitting and radar equipment or to workplaces in the direct vicinity of such equipment. A detailed risk assessment must be performed for all these places of work.

Exposure limit values and action values

The primary assessment criterion for human safety is the effect of the electromagnetic radiation on the human body. Directive 2004/40/EC therefore defines *exposure limit values* for the following quantities:

- Current density for head and torso in the frequency range 1 Hz to 10 MHz
- SAR (specific absorption rate) for the entire body, for head and torso, and for the limbs in the frequency range 100 kHz to 10 GHz
- Flux density in the frequency range 10 GHz to 300 GHz

In practice, current densities and SAR values are difficult to determine. That is why Directive 2004/40/EC contains a table of equivalent *action values*. These are the magnitudes of physical parameters such as electric field strength, (E), magnetic field strength (H), magnetic flux density (B), and power density (S), all of which can be measured comparatively easily. In addition, suitable test equipment can make an automatic frequency dependent assessment and display the results as a percentage of the permitted limit values, “which if reached require one or more of the measures specified in this Directive to be implemented”.

Technical and / or organizational measures

Article 5 of Directive 2004/40/EC envisages an “action program with technical and / or organizational measures”. The initial goal is obviously to reduce exposure by technical means. Where this cannot be achieved to the desired degree, Annex G of EN 50499 provides assistance: Division into zones.

Zone 0 includes all workplaces where the exposure limit values for the general public are adhered to [5]. Workplaces that are equipped only with devices that are included on the a priori list will in most cases be in Zone 0.

Zone 1 covers all workplaces where the occupational safety exposure limit values apply. For this reason, Zone 1 should not otherwise be accessible to the general public.



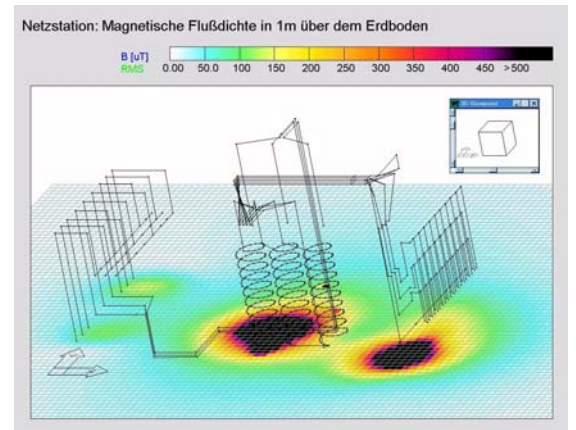
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Zone 2, where even the occupational safety limit values are exceeded, must be specially secured and only accessed by specifically trained personnel. The length of time of exposure should be restricted by regulations and this exposure time must be recorded in each case.

Safety and added value

There are advantages to adapting the workplace risk assessment to the new standard now. This adaptation can take place without any time pressures. As long as standardized measurement procedures and traceably calibrated test equipment are used, employers will be on the safe side of the law, as they will be able to demonstrate the physical safety of their workers.

The physical effect should also not be forgotten. If employers regularly make efforts to ensure the safety of their employees, this not only prevents unnecessary anxiety, but is also a visible sign of appreciation. Even the added expenditure can be justified economically, since only workers who feel appreciated will really bring in added value to the company.



Calculating the magnetic flux density of a transformer substation

Standards and Directives

- [1] Directive 2004/40/EC
of the European Parliament and the Council of 29 April 2004 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 of 30 April 2004
- [2] Guidelines on Limiting Exposure to Non-Ionizing Radiation, International Commission on Non-Ionizing Radiation Protection (ICNIRP) and World Health Organization (WHO), July 1999.
ISBN 3-9804789-6-3
- [3] FprEN 50499:2008:
Determination of workers exposure to electromagnetic fields.
Final draft
- [4] Directive 2008/46/EC
of the European Parliament and the Council of 23 April 2008 amending Directive 2004/40/EC on 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 114/88 of 26 April 2008
- [5] Council Recommendation of 12 July on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC).
Official Journal of the European Communities L 199/59, 30.7.1999
- [6] prEN 50413:2006:
Basic standard on measurement and calculation procedures for human exposure to electric, magnetic and electromagnetic fields (0 Hz – 300 GHz).
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