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## Encountered problems in ELF exposure assessment of highly exposed groups

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The EC directive issued 2004 on occupational exposure to electromagnetic fields (EMF) calls for occupational risk assessment and implementation in the EC states national occupational safety and health regulations before 2008. Sources of EMF exist at almost all workplaces and they should be assessed with regard to this exposure. Some examples of the most important occupational exposure places are given here, as well as some of the problem we encounter when doing an exposure assessment of these workplaces.

At electrolytic processes static magnetic field levels at operator's locations can be about 8-15 mT, AC rectification's component of the level up to app. 30 % of it and basic frequency of 50-300 Hz is also possible. Sometimes the rectification is not smooth and one or two of the different phases may show up in the frequency analyses and have to be dealt with.

Operators of induction furnaces and heaters are highly exposed; at 1 meter from a 1-10 kHz heating equipment, flux densities typically range from 0.03 to 0.5 mT, and may reach 5 mT at 10 cm. Similarly, devices working at a frequency of 50 Hz, may produce 5 mT fields at 20 cm, and over 0.1 mT at a distance of several meters, and the guidelines (30.7  $\mu$ T for 1-10 kHz and 500  $\mu$ T for 50 Hz) are exceeded manifold during work procedures close to furnaces.

In arc welding, electric current up to 1 kA can be used. The cable carrying welding current can touch the welder or even be wrapped around a shoulder of the welder. Magnetic flux densities are about 1-2 mT at the surface of the welding cable and power supply, exposing the welders to strong ELF fields. In resistance welding (spot welding) the currents can reach tens of kA with a corresponding high magnetic field. The time for a weld is of the order of 10 periods of the 50 Hz current and thyristor regulated, which means that it is extremely hard to measure, and there are no commercially instruments available. We have used a pick-up coil and an oscilloscope, and then the difficulties start with interpretation of the signal!

When doing an exposure assessment for compliance with an exposure standard is necessary to distinguish this from measurement for emission or for use in epidemiological studies. It is also necessary to find the worst case situation for the measurement, since there is no long term time averaging in the ELF range.

Another problem we are facing is the local exposure versus whole body exposure. " ICNIRP (1998) states: "The reference levels are intended to be spatially averaged values over the entire body of the exposed individual, but with the important proviso that the basic restrictions on localized exposure are not exceeded. How can this be shown without extensive numerical calculation?? To be on the safe side we can not do any spatial averaging, or .....

How to measure household appliances and other such machines when that standard says that the harmonic content should be taken care of by doing a summation over the squared ratios of field strength divided by the reference value, respectively. All other measurements in this frequency range should be done with a linear summation?

Hopefully we can get a discussion on these questions and come to some conclusion on how best to do an exposure assessment for showing compliance with the guidelines.