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Scientific rationale of ICNIRP guidelines

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Standards on protection against possible health effects of electromagnetic fields (EMF) have been developed by various international and national bodies. Over the years, they have evolved from simple recommendations on exposure limits in a restricted frequency range to a comprehensive and complex system of protection, covering a large frequency spectrum from static fields to microwaves. At the international level, guidelines for the safe exposure of workers and the general public have been issued by the International Commission on Non Ionizing Radiation Protection (ICNIRP). A wide consensus exists on these guidelines, that have formed the basis for national regulations of several countries and, more recently, for a Recommendation and a Directive of the European Union, that aim at the protection of the general public and workers, respectively.

A few, fundamental criteria drive the development of ICNIRP guidelines. The guidelines are only based on science, with no consideration for social and economic factors. Biological and health effects reported in different areas of research – *in vitro* studies, animal studies, epidemiological surveys – are evaluated based on scientific quality, reproducibility and consistency.

To link the observed effects to EMF exposure, biologically effective quantities (or “dosimetric” quantities) have been identified. Such quantities are related to the interaction mechanisms that are effective in each frequency range. In the range of extremely low frequencies (ELF) the interaction mechanism is the induction of internal electric fields and currents, that may stimulate electrically excitable tissues; in the radiofrequency (RF) region, electromagnetic energy is absorbed and converted into heat, possibly resulting in “thermal” effects.

Established, acute effects are only evident above definite thresholds. The effect that exhibits the lowest threshold is called the “critical effect”, and is the criterion for setting basic restrictions. For ELF and RF fields, exposure limits are set below the identified thresholds, incorporating safety factors to take into account uncertainties. In the case of static magnetic fields, however, no significant effects have been reported even at the highest exposure levels that may be created by the technology. Basic restrictions are therefore based on the absence of effects up to a given exposure level rather than on the presence of effects down to a threshold.

ICNIRP guidelines – as well as other international standards – have been the object of lively debates. On one side it has been claimed that the exposure limits are too restrictive, since they are based in some cases on minor symptoms such as annoyance and discomfort. Safety factors have also been criticized for lacking a solid scientific justification. On the other hand, the same limits are considered by some groups of the society as far too high to protect against possible long-term effects of EMFs. Finally, special groups of the population, in particular children, might be more vulnerable than the general public and therefore be not adequately protected by the standard.

A comprehensive revision of the guidelines is in ICNIRP’s agenda. In the meantime, ICNIRP monitors the advancement of research and is ready to update or refine its recommendations if new findings so require. It is however the opinion of ICNIRP that present guidelines provide adequate protection against any adverse effect established so far. This judgement is consistent with the conclusions of several expert panels, including the recent document of the Scientific Committee for the Evaluation of Newly Identified Health Risks (SCENIHR).