Introduction Directives 2013/35/EU lays down minimum health and safety requirements regarding the exposure of workers to electromagnetic fields, including those present in Magnetic Resonance Imaging (MRI) facilities. For what concerns the Static Magnetic Field (SMF), the Directive follows a ‘flexible approach’ introduced by the 2009 ICNIRP guidelines, which is based on the distinction between sensory and health effects, thus allowing in some circumstances exposed workers to possibly experience unpleasant sensory effects. In addition, the Directive provides for the possibility of derogating from the health exposure limits, explicitly referring to the case of MRI. However, protection issues related to effects associated with movements of workers in the SMF are not completely addressed by EU limits. ICNIRP has published a guideline on this matter in 2014, but it has not yet been transposed into the Directive.

Methods Measurements were performed of low frequency switched gradient magnetic fields and of the magnetic flux density experienced as variable by workers moving in the SMF of 1.5 T, 3 T and 7 T MRI scanners. In the latter case, three different metrics were applied to collect the data and compare them with the EU Directive Exposure Limit Values (ELVs) for SMF, the ICNIRP basic restrictions (BRs) aimed at preventing vertigo effects and the ICNIRP reference levels (RLs) intended to prevent stimulation effects.

Results Regarding movement in the SMF, reported values of the peak magnetic flux density, of its variation in 3 s and of the weighted-peak indices for stimulation effects show several cases of non-compliance with the corresponding ICNIRP BRs and RLs even when EU Directive ELVs are complied with. The results support the association between subjective symptoms and EMF exposure in MRI operators. Another conclusion is that the appearance of the specific group of ‘core symptoms’ may be usefully investigated in health surveillance of MRI operators.

Conclusion Our extensive studies on workers’ SMF exposure near MRI scanners has shown that the set of SMF action levels (0.5, 3, 50, 200, 400 mT; 1, 2, 8T) may sufficiently characterise various hazards caused by the static and dynamic influence of SMF on workers and various objects. The three-dimensional mapping of SMF distribution near MRI magnets, and its graphical representation in the diagnostic room, provides significant practical information for managers and workers in the MRI centre, leading to an understanding of how to develop the work practice in order to reduce daily exposure to SMF.

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