This is a pre print version of the following article:

Occupational health surveillance of workers exposed to electromagnetic fields according to the current Italian legislation / Modenese, A., Gobba, F.. - (2022). (VI Convegno Nazionale “Interazioni tra Campi Elettromagnetici e Biosistemi” (ICEMB) Cagliari 8-10 giugno 2022).

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11/11/2026 03:38

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Occupational health surveillance of workers exposed to electromagnetic fields according to the current Italian legislation

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Summary—**The health surveillance (HS) of workers exposed to electromagnetic fields (EMF) aims at the prevention of known EMF adverse effects. No specific lab tests or medical investigations are useful for routine monitoring of exposure and/or in the prevention of adverse effects occurrence. The main HS scopes are the recognition of workers at particular risk and/or of the occurrence of unexpected symptoms.**

I. Introduction

In Italy occupational Health Surveillance (HS) of workers exposed to Electromagnetic fields (EMF) is compulsory according to the Legislative Decree n. 81/2008, the consolidated norm for occupational health and safety prevention at work, as modified by the more recent Legislative Decree n. 159/2016, transposing the European Directive 2013/35/EU. Accordingly, the HS is aimed at the prevention of all known direct biophysical effects and indirect effects caused by EMF, while the suggested long-term effects of EMF are not addressed [1-3].

II. Effects of EMF exposure of interest for the HS

According to the regulation, the direct biophysical effects are divided in thermal effects, related to exposure to high frequency (HF) fields, and non-thermal effects associated to the currents' induction with stimulation of muscles, nerves or sensory organs when exposed to static or extremely-low frequency magnetic fields (SMF, ELF-MF) [1-3]. For intermediate frequencies both the types of effects are possible. Direct biophysical effects are further classified into sensory and health effects. The formers, including nausea, vertigo, magneto-phosphenes and others, are reversible, and are considered less relevant, even if they can be associated to an increased risk of injuries. Health effects based on non-thermal mechanisms include changes in the limbs' hematic flow, modifications of the heart and brain functions (mainly related to SMF) and symptoms as involuntary contractions of muscles or nerves' stimulation, or changes in heart rhythm (mainly due to ELF-MF exposure). Health effects occurring with thermal mechanisms are e.g. skin burns or thermal cataracts [1-3] Health effects are induced only as a consequence of (very) high EMF exposure levels, while sensory effects may appear at lower levels. Indirect effects of relevance for HS mainly include EMF interference with active medical electronic devices as pacemakers, ICDs and others. An indirect interaction of EMF is possible also with passive devices, both medical or accidentally implanted objects, containing metal, with induction of currents, overheating or magnetic dislocation. Workers with these conditions are recognized as "workers at particular risk", to be specifically considered when designing training and information activities, performing risk evaluation and health surveillance aimed at the identification of the most appropriate preventive measures for EMF risk. It should be noted that, while exposure limit values (ELV) are adequately protective for direct biophysical effects related to EMF, for "workers at particular risk" the respect of the ELV in force may be not adequately protective for all, and e.g. interference problems are possible, especially in case of older active medical devices, with unipolar configuration [1-3].

III. Indications for the Health Surveillance

In principle, occupational HS should usually include medical investigations, evaluations of exposure and relevant occupational and medical anamnesis, perhaps with ad-hoc questionnaires, and, when appropriate, other specific tests. Based on current scientific knowledge, in case of EMF related HS no specific lab tests or medical investigations prove being useful for the prevention and/or early detection of direct and indirect EMF associated effects. Even in the case of the extraordinary medical surveillance, specifically required when workers report unexpected symptoms possibly associated to EMF and/or in case of overexposures, no standard examination protocols can be a priori identified. Accordingly, the main objectives of HS have to be the adequate recognition, and following, of workers at particular risk, and the contents of HS include an in-depth medical investigation and a scrupulous anamnesis, while any other integrative examinations should be prescribed by the occupational physicians on an individual basis, and justified based on the exposure and on personal conditions [1].

IV. Conclusions

Occupational HS of EMF-exposed workers is currently compulsory in Italy, as well as in other EU countries, according to a EU Directive aimed at the prevention of known direct and indirect EMF effects. Regarding the contents of HS of these workers, except on specific individual basis, no lab tests and/or medical examinations can be a priori identified as useful, while HS should mainly focus on the recognition of conditions determining a particular susceptibility of the workers to the EMF risk, such as the presence of active medical devices, possibly undergoing interference problems, and/or on the occurrence of unexpected symptoms.

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