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ELECTROMAGNETIC FIELDS AND THEIR IMPACT ON WORKERS' HEALTH

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Electromagnetic fields (EMFs) are produced by differences in voltage (electric field) or by electric current flow (magnetic field). Everyone is exposed to a complex mixture of weak electromagnetic fields in their living and working environment. Most of the workplaces, such as office environments, have only low electromagnetic fields that can be regarded as harmless. On the other hand, in some work environments there are higher EMFs that need to be taken into account. For example, occupational activities that can result to higher EMF exposure are electric welding, certain medical imaging devices, RF (radio frequency) sealing, induction heating and electrolysis processes. In addition, there are also synergistic effects due to simultaneous exposure to various biological, chemical, and physical agents that need to be considered. These types of workplaces should conduct an exposure assessment to ascertain that the workers‘ exposure is below the recommended limits. In very high overexposure situations, individuals can experience acute health effects, such as nerve stimulations at low frequencies or thermal effects at higher frequencies. The risks and exposure in the workplace can be reduced by appropriate technical measures.

Changes in our environment or external stimuli may evoke biological effects. These effects are part of normal life and the body can adjust to most of these situations. Biological effects themselves are not dangerous to health. However, in some cases, when the stimulus is very strong or long lasting, the effects can lead to adverse health effects. The way that the electromagnetic fields can affect health will depend on the frequency, strength and duration of the exposure. The occupational exposure limits are set in such a way that there will be no adverse health effects as long as there is adherence to the limits.

With low frequency fields (<100 kHz), the main biological effect is the stimulation of the nervous system and subsequent sensory effects. Very strong

electromagnetic fields can induce internal electric fields that stimulate nerves and muscles. The induced electric fields may disrupt the activity of nerves and these can trigger, for example, visual magnetophosphenes (flashes of light seen when one is subjected to a changing magnetic field such as when in an MRI). However, there is no evidence that the magnetophosphenes have any adverse health effects. Nonetheless, continuous visual disturbances are annoying and may lead to other secondary risks in the workplace. Very strong static magnetic fields can also produce nausea and vertigo due to static field gradients. The effects at low frequencies are acute and will cease when the source is removed. Well-known biological effects are nerve stimulation at low frequencies and heating at high frequencies. Occupational exposure to IF fields in certain areas is higher than the exposure of the general public. However, there is a paucity of research on IF and health risks in occupational settings or for the general public are scarce.

With respect to radio frequency fields the tissue heating is the principal mechanism. Tissue heating is the most widely accepted mechanism of interaction between RF energy and the human body. Short exposure durations may not be sufficient to significantly contribute to tissue temperature rise. In this case, the time rate of rise in temperature is proportional to SAR (specific adsorption rate). With longer exposure durations the rise in temperature depends on the tissue, thermal regulatory behaviour and an active compensation mechanism. Under normal conditions, a temperature rise of the order of 1°C can result from an SAR input of 4 W/kg. It should be noted that this temperature rise is within the normal range of human thermoregulatory capacity. However, if there is human contact with metallic objects in the high-frequency EMF field, then this can lead to shocks and burns as adverse indirect effects.

In 2018 the Cancer epidemiology, stated that radiofrequency electromagnetic fields should be categorised as carcinogenic to humans (Group 1) based on animal experimental evidence as well on epidemiological studies. In the workplace, all the risks arising from the electromagnetic fields must be assessed. If needed, the electromagnetic fields to which the workers are being exposed should be measured or calculated [1].

During the risk assessments, the following issues need to be taken into account: the frequency, the level, duration and type of exposure, including distribution over the worker‘s body and the space of workplace; any direct biophysical effects in the human body directly provoked by the presence in electromagnetic field; any effects concerning the health and safety of workers at articular risk, in particular workers who wear implanted medical device, pregnant workers; the existence of replacement equipment designed to reduce the level of exposure to electromagnetic fields; information provided by the manufacturer of equipment and other relevant health and safety related information; multiple sources of exposure; simultaneous exposure to multiple frequency fields.Under certain circumstances, the EMF can pose an additional risk to specific workers. For example, these workers at particular risk are: individuals with passive or active medical devices (e.g. cardiac pacemakers);

individuals using body worn medical devices (e.g. insulin pumps); pregnant women. [2].

Due to the nature of electromagnetic fields, there is very little advantage to be gained in using personal protecting equipment (PPE) to reduce the exposure. Certain PPE are needed and useful to protect the worker from the physical risks related to EMF. The most effective way to reduce the EMF exposure is to control it at its source. There are several approaches that can be used for prevention and mitigation of exposure. For example, the following means can be applied at the workplace: technical measures to reduce the emission of electromagnetic fields, including, where necessary, the use of interlocks, shielding or similar health protection mechanisms;

adopting other working methods that entail less exposure to electromagnetic fields;

the choice of equipment emitting less electromagnetic fields, taking account of the work to be done;

in the case of exposure to electric fields, measures and procedures to manage spark discharges and contact currents via technical means and the training of workers;

appropriate maintenance programmes for work equipment, workplaces and workstation systems;

limitation of the duration and intensity of the exposure;

safety signs, e.g. warning signs for people with active implanted cardiac devices;

procedures and supervision;

information and training. [3]

For employees whose work is related to electromagnetic fields, proper health surveillance is provided, as well as the provision of medical records and their availability in accordance with national legislation. Employees must, upon their request, have access to their own personal medical records. If an employee reports any unwanted or unexpected health effects, or in any case where exposures exceeding the EMA are found, the employer must provide appropriate medical examination or individual health surveillance of the employee(s) concerned, as appropriate to national legislation.

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