

Editorial

Working with physical agents – The past, present, and future of Non-Ionizing Radiation (NIR) in occupational safety and health

Physical agents, sources of energy, may cause injury or disease and typically involve noise, vibration, non-ionizing radiation (NIR), optical radiation (e.g., Laser), and extreme temperature¹⁾. Workers should be appropriately protected from excess exposure to these factors. However, the biological effects of each factor vary, thus, the strategies for occupational safety and health measures also differ.

Among physical agents in the workplace, NIR is a unique physical factor. For example, all physical agents commonly cause short-term biological effects due to excess exposure, however, there are no established long-term effects of NIR exposure^{2–4)} compared to noise (noise-induced hearing loss)⁵⁾, vibration (hand-arm vibration syndrome)⁶⁾, and optical radiation exposure (loss of vision due to retinal damage)⁷⁾. Regarding preventive measures⁸⁾, there is no personal protective equipment for NIR exposure as opposed to other factors (ear plugs or muffs, anti-vibration gloves, and face shields or welding masks).

NIR is produced by household appliances and industrial equipment. Similar to other physical factors, high intensity exposure to NRI can cause biological effects, which are frequency dependent. The static magnetic fields produce electrical and mechanical effects and time-varying electromagnetic fields cause nerve stimulation (<10 MHz) or heat generation (>100 kHz)^{4, 9–11)}. Based on these established short-term effects, the exposure limits have been set by guidelines or standards by the International Commission on Non-Ionizing Radiation Protection or Institute of Electrical and Electronics Engineers^{4, 9–11)}. There have been reported numbers of occupational safety and health (OSH) research regarding NIR exposure since high-intensity NIR exposures occurred in certain work environments, such as welding and magnetic resonance imaging (MRI) examination. Therefore, are there no requirements for further OSH studies on NIR? To answer this question, this paper reviewed the past and present research status of OSH research on NIR and discussed the prospective needs.

Directive 2013/35/EU¹²⁾ in the European Union (EU)

had a great impact on NIR exposure related with OSH research. This directive established limits for the occupational exposure to electromagnetic fields and required member states to introduce limit values equal to or more stringent than the Directive¹²⁾. Non-binding guidance have been prepared to assist employers to understand the implementation of the Directive^{13–15)}. When the Directive was issued, the number of exposure assessments in the work environment revealed the actual exposure levels, compliance with the limit values, and the potential hazards in certain tasks or workplaces, which contributed to the accumulation of knowledge. These studies made progress in OSH research on NIR. Hence, what are the current and future topics in this research field?

At the European Electromagnetic Fields Forum, held on November 15–16, 2021, the OSH authorities of the EU member states and other countries participated and discussed the implementation of the Directive and the future challenges¹⁶⁾. In addition to the discussion of the complicated exposure sources and health surveillance, issues related with the risk assessment of workers under particular risks, such as employees who had implantable medical devices or were pregnant, were discussed with significant interest. Considering that the number of older adult and female workers of childbearing age will increase, this has become a major issue in OSH research on NIR exposure. In particular, electromagnetic interference with other devices is a unique problem occurred in the environment using NIR. Therefore, further research is required with new technological innovations, such as the use of wearable devices, 5G, and wireless power transmission, as well as the research needs for pregnant workers.

As described above, OSH research on NIR exposure produced certain results. However, continued research is desirable. In addition, exposure to the physical factors, mentioned previously, is often combined, such as NIR and noise exposure or vibration. Therefore, the effects of multiple physical agents should also be considered.

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