# ELECTROMAGNETIC FIELDS: PRESENT AND FUTURE CHALLENGES FOR OCCUPATIONAL SAFETY AND HEALTH



## Introduction

Odourless, inaudible and invisible, electromagnetic fields (EMFs) – emitted by mobile phones, radio antennas, Wi-Fi routers, power lines and so on – are everywhere in modern society. The number and variety of sources in homes, public places and workplaces are only increasing. Indeed, in recent years, pervasive novel technologies based on EMFs have emerged, such as a new generation of mobile phone technologies (the fifth, also known as 5G), wireless power transfer and several medical applications. In fact, wireless technological advances are considered key drivers for the digitalisation of work[1] and Industry 5.0 (EC, 2022). These advances impact many areas relevant to the future of work[2], such as the internet of things (IoT), hybrid work and virtual work environments. They also play a crucial role in autonomous driving, unmanned aerial vehicles (UAVs), sensors and advanced robotics. Because of the omnipresence of EMF sources, however, the discussion around EMFs has been a growing area of interest both in scientific circles and among the general public. Moreover, due to their rapid deployment and increased use in occupational settings, the European Commission (EC) recently emphasised the importance of analysing workers' EMF exposures as well as the possible adverse health effects from EMF exposure (EC, 2021).

This paper aims to identify the emerging and future developments of occupational applications of EMFs and their potential implications for occupational safety and health (OSH). It also seeks to highlight the gaps in knowledge regarding (safe) levels of exposure. Additionally, the paper provides recommendations for workers and employers, health and safety professionals, and policymakers to minimise the associated risks related to EMF exposure. For information on the indirect OSH risks and benefits of applications relevant to the future of work enabled by EMFs, the relevant EU-OSHA publications[1,2] are referenced.

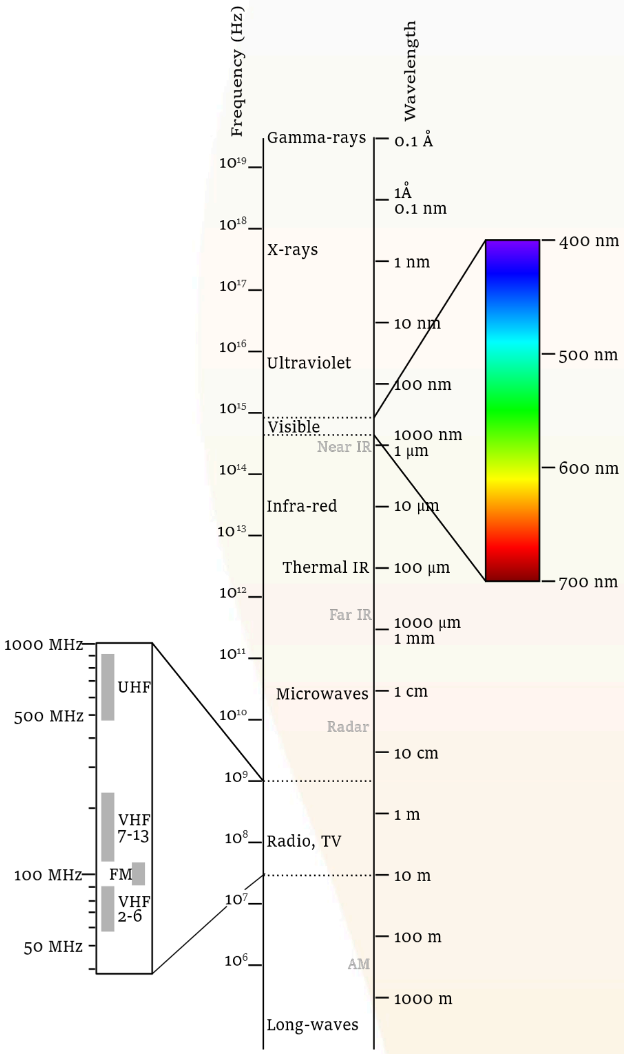
## What are electromagnetic fields?

In essence, EMFs are generated by moving electrical charges and travel as a combination of oscillating electric and magnetic waves at the speed of light. The electric field arises from forces that the charged particles exert on each other, while the magnetic field is produced by moving charges (electric currents). EMFs are characterised by their frequency or wavelength, signal characteristics and intensity. The frequency, measured in hertz (Hz), refers to the number of cycles the wave completes per second. The wavelength, measured in metres (m), is the distance between two peaks of the wave. Signal characteristics refer to continuous sinusoidal or pulsed EMFs, for example. The intensity is the energy of the wave, correlated to the amplitude (height of the peak) of the wave. The exposure level is the intensity of the incident wave at the location of the body, usually time-, volume-, and/or spatially-weighted (averaged) over a set period, surface and/or volume. This level is measured in terms of power density (in watt per square metre) or the electric-field strength (in volt per metre). Frequency and wavelength are inversely related (Figure 1): the wavelength (in metre) can be calculated by dividing the speed of light (30 million metres per second, in vacuum) by the frequency (in hertz, Hz). Note that, typically, the electric and the magnetic field are coupled at distances further than 10 wavelengths from the source; this region is called the far field.

[1] See: https://osha.europa.eu/en/themes/digitalisation-work

[2] See EU-OSHA´s discussion papers addressing topics relevant to the future of work at: https://osha.europa.eu/en/publications?f%5B0%5D=facet_tags%3A51&f%5B1%5D=publication_type%3A9&search_api_fulltext=&search_api_language_1%5B0%5D=en&sort_by=field_publication_date

**Figure 1: The electromagnetic spectrum**




The extremely-low frequency (ELF) range and part of the intermediate frequency (IF) range (1 Hz – 100 kHz) are not included in this figure.
List of abbreviations: MHz = megahertz, with Hz the unit of frequency, indicating the number of cycles/sine waves per second; UHF = ultra-high frequency, VHF = very high frequency; AM = amplitude modulated; FM = frequency modulated; IR = infrared; m = metre, cm = centimetre; mm = millimetre; µm = micrometre, nm = nanometre, Å = angstrom = 0.1 nm.

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Both naturally occurring and man-made sources of EMF exist. Broadly speaking, man-made sources emit EMFs manipulated to transmit either information or energy. However, the practical applications range as widely as their frequency: from extremely low frequencies (ELF, i.e. frequencies ranging from 1 Hz to 300 Hz), observed in power generation, to intermediate frequencies (IF, i.e. frequencies between 300 Hz and 10 MHz, with 1 MHz = $10^6$ Hz; Figure 1) to radiofrequencies (RF, i.e. frequencies ranging from 10 MHz to 300 GHz, with 1 GHz = $10^9$ Hz; Figure 1), used in radar and mobile communication applications.

It is important to note that this document only considers EMFs with frequencies of up to a few terahertz (with 1 THz = $10^{12}$ Hz, Figure 1), so-called radio waves (ITU, 2020), which reside below the visible-light region and are well within the part of the spectrum that is considered non-ionising, for instance, those lacking the energy to remove tightly bound electrons from atoms or molecules (which can lead to molecular damage and health effects). This means that, besides infrared and visible light, other well-known parts of the electromagnetic spectrum such as UV radiation, X-rays and gamma rays are not considered here.

# Latest developments regarding EMFs in the workplace

## Mobile communication networks

The **fifth generation of telecommunication networks (5G)** operates at previously unused frequencies, some of which are significantly higher than those used in previous generations (up to 71 GHz (with 1 GHz = $10^9$ Hz), Figure 1). It introduces technological advancements that allow more users to be served simultaneously by the same base station. This is achieved by dividing the transmitted energy in space and focusing it in a beam-like manner towards the users. In most European countries, regulators have now allocated and auctioned the new frequencies.

The global rollout of 5G networks has been met with public apprehension regarding suspected health risks due to an assumed increase in overall EMF exposure and the use of higher frequencies (of which the possible biological effects have not yet been thoroughly studied), as well as with misinformation and even acts of vandalism against infrastructure (ITU, 2021). While the addition of 5G networks could indeed increase the total EMF exposure, this situation is expected to last as long as previous generation networks remain in operation (SCHEER, 2023a). To alleviate the public's concerns about 5G and to monitor the actual impact on the total RF-EMF exposure, four international studies have been funded by the EU Horizon programme with the objective of assessing the health and environmental impact of the 5G rollout, in occupational settings[3] as well. These projects started in 2022 and will finish between 2025 and 2027.

At higher frequencies, an increasing number of base stations are required to maintain high-quality wireless links. Therefore, small-cell base stations are employed, placed on trees, streetlights or buildings at just a few hundred metres apart (SCHEER, 2023a). Small cells are also increasingly used in private/enterprise networks[4] and deployed in large factories, manufacturing halls, (air)ports, campuses and so on.

5G's combination of transmission techniques, higher frequencies and concurrent network densification allows for wireless communications with (very) high data throughputs and (ultra-)low latency, both of which make it a key driver for the digitalisation of work and many future work applications. However, it is anticipated that the technological innovations that 5G is introducing will only come to full fruition in the next generation of 6G, with a projected launch in 2030. The EU flagship project Hexa-X[5] even projects 6G to become a general-purpose technology (GPT) instead of simply an enabling technology, empowering (fully immersive) telepresence such as the metaverse; massive twinning (i.e. real-time dashboards and virtual models of devices and (production) facilities); e-health for all; cobots (i.e. robots supporting humans in their tasks); and full integration of IoT, with masses of sensors, on and off the body. This means that 6G is expected to have a far-reaching impact on societal and industrial transformations (Industry 5.0). For this, 6G will be using parts of the radio spectrum far above what is used or will be used by 5G (>100 GHz), which not only allows for ultra-high throughputs, but also enables centimetre-level localisation and sensing.

## Energy transition

The ongoing energy transition to renewable sources requires extensions and upgrades to the power grid (e.g. deployment of high-voltage lines and inverter stations) as well as improved monitoring of the instantaneous energy consumption at the individual level (e.g. through a wireless network of sensors called smart metres). The exposure risks to workers (e.g. builders, electricians and maintenance engineers) and workers involved in developing and maintaining new (energy) infrastructure, with potential high exposure due to high currents, are well known and the workers in power plants seem to be well aware of the risks and how to protect themselves (Stege et al., 2020), even though sub-contractors in the power plants may not be fully aware the health, safety and environment (HSE) officers will be able to instruct them. In addition, smart metres generally contribute little to the total RF-EMF exposure, due to their sparse transmissions and specific locations (Aerts et al., 2019). Finally, (industrial) heating applications are switching increasingly from hydrocarbon fuels to electric induction,



[3] See: https://www.emf-health-cluster.eu/

[4] Private/enterprise 5G networks are not publicly accessible and very secure.

[5] See: https://hexa-x.eu/. The European Commission has launched various flagships to address major science and technology challenges and boost innovation in the EU: https://digital-strategy.ec.europa.eu/en/activities/flagships.

leading to more low frequency magnetic field sources, which may potentially be of high intensity, but can be kept well below the exposure limit values (EC, 2015a, b).

### Wireless power transfer

Wireless power transfer (WPT) has emerged as the leading technology for the recharging of personal devices (e.g. smartphones and laptops, but also power tools) and is also investigated or rolled out for medical devices (e.g. pacemakers), electric vehicles, drones and other industrial autonomous vehicles/robots. WPT either applies focused radiofrequency EMFs (beams) or uses inductive or resonant technologies, which emit EMFs at frequencies between 10 kHz and 50 MHz (ETSI, 2019). In the former case, energy-through-the-air allows non-stop operating for devices and machinery, robots and drones. In occupational settings, WPT occurs mainly in the maintenance and repair sector, manufacturing industry, transport and logistics sector and all the sectors with jobs using (mobile) robotics. Wireless vehicle charging will also be implemented on a larger scale through integration into (roadside) infrastructure. For instance, a variety of vehicles, such as cars, buses and trucks, are already being charged by loops[6] at parking lots and bus stops. Moreover, in the (near) future, charging loops will be integrated into roads to continuously charge vehicles on the move. Recent studies – though not performed in occupational settings – indicate that nearby exposure to WPT systems is lower than the exposure limits (Stam, 2022). However, future increases in power for systems, for example, to charge large electric vehicles, could lead to increased exposure, especially in occupational settings.

### Healthcare

In healthcare, applications of EMFs tend to evolve to more precise and increasingly powerful methods, often using higher frequencies, focused beams and/or higher (localised) powers. New developments in diagnostic tools include magnetic particle imaging (5–50 kHz) (Billings et al., 2021) – which could significantly increase the exposure of medical workers – radar for superficial imaging (1–60 GHz) (de Waard-Schalkx et al., 2015) and monitoring of vital signs (up to 120 GHz) (Cardillo and Caddemi, 2020), and terahertz frequencies for imaging, spectroscopy and treatment (Amini et al., 2021). Furthermore, new cosmetic treatments using pulsed low frequency (15 Hz) or radiofrequency EMFs (27 MHz – 5.8 GHz) could also pose risks for medical workers (Stam, 2022).

### Security

Terahertz and millimetre wave frequencies are also used in security and scanning applications such as full-body scanners at airports, postal scanners and in non-destructive testing. These applications can differ significantly in intensity: while the field levels in security scanners are restricted to intensities below exposure limits due to exposure of the general public, medical and industrial applications may use higher intensities and should be used by well-trained workers.

## Occupational safety and health implications of EMFs

### Adverse health effects and regulation and legislation of EMF exposure

Research into the health impacts of EMFs has been extensive, but exposure guidelines are principally focused on acute, short-term effects. These effects depend on the frequency of EMFs, their intensity and the duration of exposure. For instance, effects of low-frequency EMF exposure beyond OSH exposure limits include the perception of surface electric charge, direct stimulation of nerve and muscle tissue, and the induction of retinal phosphenes (i.e. false light flashes). At higher frequencies (100 kHz – 300 GHz, Figure 1), effects of nerve stimulation and changes to the permeability of cell membranes (at very high exposure levels) diminish, with possible local and body core temperature rises occurring and inducing so-called thermal effects. Furthermore, it is known that EMFs can also produce indirect effects that may cause safety risks, such as contact currents, spark discharges and electromagnetic interference with or heating of medical implants.

All these effects are well understood and form the basis for current exposure guidelines established by international bodies such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP), which has compiled the scientific evidence for adverse health effects due to exposure to

[6] Charging loops transfer energy wirelessly through electromagnetic induction. This method is also widely applied in household appliances such as electric toothbrushes and wireless charging pads for smartphones.

EMFs in three publications: one for static magnetic fields (ICNIRP, 2009), a second for the low-frequency range (i.e. from 1 Hz to 10 MHz) (ICNIRP, 2010) in which magnetic and electric fields should be treated separately as they are not coupled in a single electromagnetic field as it is in the far field, as workers operate EMF sources mostly not yet in the far field, and another for the range between 100 kHz and 300 GHz (ICNIRP, 2020). From this scientific evidence, ICNIRP has established exposure limits known as basic restrictions and reference levels. The reference levels are derived from the basic restrictions and offer equivalent levels of protection but are much easier to assess at workplaces. Note that the exposure limits are defined per frequency (band), and ICNIRP defines a weighting method for the concurrent exposure of multiple sources at a certain location in the same or other frequency bands. To account for scientific uncertainty (including the variability in thermal physiology across the population and in physical activity levels and environmental conditions), additional reduction factors have been applied to the basic restrictions first, which are (five times) smaller for occupational exposure than that for the general public, since the latter is considered more variable in age and health status and unaware of or unable to control the potential risks (ICNIRP, 2020). Compliance with the ICNIRP reference levels and/or basic restrictions is deemed to be sufficient to protect against the established adverse health effects.

Furthermore, EU guidance and legislation on EMF exposure is based on the ICNIRP guidelines and consists of the 1999 European Council Recommendation 1999/519/EC for general public exposure to EMFs and the 2013 Directive 2013/35/EU for occupational exposure, which has been implemented in all Member States since 2017 with some national variations.

Several studies (e.g. Rijs and Stam, 2019) have explored possible links between long-term EMF exposure and various health issues, including cancer, reproductive problems, developmental delays and neurodegenerative disorders. Despite extensive research, however, scientific evidence remains inconclusive, with some studies indicating an association but no scientifically casual relations such as dose effect responses, while others finding no significant link (ICNIRP, 2020).

## EMF exposure in the workplace

The EC has provided extensive information to help employers understand what they need to do to comply with Directive 2013/35/EU in three non-binding practical guides (EC, 2015a; 2015b; 2015c), focusing on working environments with potentially high-intensity EMFs. Furthermore, several source- and job-exposure matrices exist for reference (Vila et al., 2017; Migault et al., 2019). However, the new developments in EMF applications described above could result in additional, increased, or altered EMF exposure in occupational settings as follows.

- Mobile-phone network densification (i.e. more base station antennas per surface area) is resulting in an increasing number of people working closer to telecommunication antennas than before, in particular when small-cell base stations are deployed. This is true in general (e.g. roofers and electricians) but more particularly for workplaces with their own wireless networks (i.e. private/enterprise mobile-phone, Wi-Fi and/or sensor networks), especially when the amount of (personal) wireless devices and sensors is increasing in these workplaces. On-body sensors (e.g. for personal health of exposure monitoring), in particular, could increase the worker's exposure to EMFs, in a localised manner, however (i.e. limited to the area of the body the sensor is applied to). These technological innovations are expected to be pervasive and not linked to a specific sector.
- The increasing presence of (large-scale) WPT systems could increase EMF exposure at technology-dependent frequencies (see Section 3) in the transport and logistics sectors (e.g. bus and lorry drives). This also applies to workplaces where personal tools and robots/UAVs are wirelessly charged on platforms similar to but larger than those used for mobile phones, instead of using pin contact charging.
- Electrification could increase exposure to low-frequency magnetic fields (from high-voltage power lines, inverters and industrial heating process, such as induction heating) (SCHEER, 2023b).
- As the amount of EMF applications in the medical sector is increasing, more medical personnel (including non-technical personnel) could be exposed to EMFs at a wide range of frequencies (Stam and Yamaguchi-Sekino, 2017; Turuban, 2023).

- The use of ever higher frequencies (not only in mobile-phone networks, but also in medical and security scanning applications) could result in increasing localised, but superficial exposures, of which the risks are not yet clear.

## Prevention of OSH risks related to EMFs

According to the EU Directive 2013/35/EU, employers are obliged to assess all risks due to EMF exposures in the workplace and put in place adequate prevention measures. In particular, they have to ensure compliance with the limit levels of the Directive. First, this is done on the basis of readily accessible information: specifications shared by the manufacturer (e.g. whether the specific application meets the requirements of relevant EU law on products that may establish stricter safety levels than those provided by Directive 2013/35/EU), source- and/or job-exposure matrices (Vila et al., 2017; Migault et al., 2019), review studies, and/or practical guides published by the EU, national institutions, and standardisation bodies. For instance, the documents (EC, 2015a; 2015b) contain lists of equipment and workplaces that potentially require **specific risk assessments**. They also provide guidance on the need for EMF risk assessment for workers at particular risk, such as those with active medical devices including pacemakers (Modenese and Gobba, 2021). However, this information may not be sufficient yet to assess whether compliance with the exposure limit values for newly emerging EMF applications and associated OSH risks will be met. In that case, *in situ* measurements or dosimetric calculations should be performed and compared to the legal limits, factoring in all the uncertainties inherent to them.

If the limit levels are exceeded, protective and preventive measures must be taken (examples can be found in (EC, 2015a; 2015b)). Since EMF intensity decreases rapidly with increasing distance from the source, the most effective exposure reduction measure is increasing the distance between the source and the worker. This can be attained by technical and organisational measures such as barriers, signage and working instructions. Furthermore, shielding is effective for all forms of EMF except low-frequency magnetic fields. Information on EMF exposure reduction is also provided in guidance from the EC (EC, 2015a), including workstation design measures and provisions relating to work equipment and methods. For instance, coils, transformers and wireless charging platforms should be safe by design when kept at a distance from workstations. It should not be possible to stand right in front of transmitting antennas.

# Gaps, needs, priorities and recommendations regarding EMFs and OSH

## Scientific research

There is a general lack of studies regarding the health effects and the exposure intensity of EMFs at:

1. frequencies used in emerging technologies for mobile communications (i.e. between 6 and 300 GHz);
2. the intermediate frequencies used in wireless power transfer;
3. the (sub-)THz frequencies used in novel imaging and scanning technologies (and expected use with 6G). The largest gaps in research are on:
    a. the levels of exposure, especially in occupations using equipment generating a potential strong magnetic, electric, or electromagnetic fields (Turuban, 2023);
    b. the potential health effects (due to which potential biological interaction mechanisms) (Jeschke, 2022);
    c. the long-term cumulative EMF exposure in occupational settings (Hansson Mild, 2023); and
    d. the most relevant metric of exposure (Turuban, 2023).

Moreover, health and sensory effects due to EMF exposure can significantly differ between workers. Exposure to EMF is influenced by various personal and environmental factors, including:

- personal characteristics: anatomy, bodily characteristics including implants or piercings and medication use);
- working posture: the position and movement of the body during work;
- work environment:

- construction materials: concrete can mitigate and partly shield RF-EMF through iron meshes while wood provides the use of shielding;
- tool usage: handling or usings tools (Jeschke, 2023) can affect exposure levels.

This variability both within and between workers induces substantial uncertainty in current exposure assessment studies and the exposure matrices that use this data (Turuban, 2023).

Therefore, study designs are required that use realistic workplace exposure scenarios (e.g. high peak exposures followed by periods with no exposure (Hansson Mild, 2023) or exposures near the limit levels for durations of eight hours or more (Jeschke, 2022)) and/or that collect detailed, descriptive data on:

(a) typical occupational criteria such as the worker's anatomy, working positions and postures, physical activity, harsh environments and the handling of tools, in particular those emitting EMF (Jeschke, 2022);
(b) the EMF emission characteristics (e.g. frequency and modulation of occupational sources (Jeschke, 2022);
(c) the potential exposures over the duration of the working life (Hansson Mild, 2023); and
(d) health outcomes other than those already known (e.g. due to thermal effects for RF-EMF) (Jeschke, 2022).

These types of studies would significantly improve the scientific understanding of EMF exposure levels and durations across the diversity of occupational settings and could be used as a more accurate starting point for epidemiological studies on health effects due to EMF exposure, which at the moment barely consider occupational exposure. What are required, however, are long-term, individual data on occupational exposure levels in combination with other (relevant) environmental/occupational exposures (e.g. through IoT sensor networks), to look for co-founders or determinants (Stam and Rijs, 2019; Hansson Mild et al., 2023). Unfortunately, appropriate, low-cost measurement devices to acquire these data are (often) not yet available and will need to be developed and distributed among (highly-) exposed individuals especially.

## EU policy

Since ICNIRP issued new guidelines in 2020 to which several technical standards already refer (e.g. IEC 62232:2023 and IEC TR 63377:2022) and Directive 2013/35/EU is still based on the 1998, 2009 and 2010 guidelines, the legal situation has become challenging. The Scientific Committee on Health, Environmental and Emerging Risks (SCHEER) therefore recently "advise[d] positively on the need of a technical revision of the annexes in Council Recommendation 1999/519/EC and Directive 2013/35/EU with regard to radiofrequency EMF (100 kHz to 300 GHz)" (SCHEER, 2023a). Indeed, compared to the 1998 guidelines, the 2020 guidelines also contain adaptations relevant to exposure to emerging sources of EMF, such as 5G telecommunications, based on brief, localised exposures at higher frequencies (up to 300 GHz). It is clear that the introduction of novel EMF technologies is increasing the complexity of workplace EMF exposure assessment, requiring more and more detailed knowledge on measurement and modelling methods from the HSE officers (Jeschke, 2022; Stam, 2022).

Therefore, practical considerations relevant to workplace EMF exposure assessment, regarding exposure durations during working hours over decades, are essential for a reliable OSH risk assessment practice (Jeschke et al., 2022). Those considerations are yet to be developed, along with appropriate measurement devices, and could be addressed in updated versions of EC literature (EC, 2015a; 2015b; 2015c) or provided in relevant technical standards.

Finally, it is important to note that although ICNIRP (2020) states the importance of the workers' 'sensory and behavioural capacity' to 'be aware of potential RF-EMF risks and to employ appropriate harm-mitigation measures', Jeschke et al. (2022) rightly point out that the EU's 1989 Framework Directive (89/391/EEC) 'prioritises collective technical and organisational protective measures over personal (individual) protective measures'. However, for OSH, conducting (individual) risk assessments for workers at particular risk is mandatory. Therefore, adequate guidelines are necessary and could be easily extended to all workers.

## Employers, workers and OSH experts

Despite the availability of exposure matrices and practical guides on EMF exposure in occupational settings (including exposure reduction measures), workers´ knowledge of occupational EMF sources and exposures is ‘typically low’ (Turuban, 2023). Moreover, workers may not perceive them as dangerous and therefore may not pay necessary attention to prevention, possibly even perceiving prevention measures as inconvenient (Stege, 2022). In order to more effectively inform employers, workers and OSH experts, sensors measuring EMF exposure (Bhatt et al., 2022) could be provided by the employer to be worn by workers or installed in high-intensity EMF environments. These wearables will provide early warning as well as the data required for scientific studies on occupational EMF exposures and potential health effects (see 5.1). Specific target groups for monitoring with wearable sensors include workers that actively use EMF sources (e.g. physical therapists and security personnel) or those who work near them such as electricians. More importantly, it includes workers who may unknowingly come near active EMF sources, unaware of the potential risks such as nurses or maintenance and cleaning personnel. This latter group is becoming increasingly significant with the introduction of private 5G networks and WPT systems.

Although *in situ* measurements are used extensively in OSH-EMF assessment, if there is reason to assume the limit levels are exceeded, simulation and numerical determination are required to determine compliance with the exposure limits, which have proven to be very challenging for OSH practitioners due to the involved costs and required expertise (Jeschke, 2022). Therefore, there is a demand for rules of thumb that allow for quick calculation to ensure compliance with the limits. Various countries have already drafted such guidelines, see, for example, Bolte and Pruppers (2006).

# Concluding remarks

This document provides a comprehensive overview of the implications of emerging applications of EMFs in OSH, highlighting the omnipresence of EMFs in modern work environments due to technological advancements which make them key drivers of the digitalisation of work and Industry 5.0 (including advanced automation, robotics, virtualisation, remote work, control rooms and so on).

Assessing EMF exposure risks is very complex due to the diversity of sources in terms of frequency, intensity and use, especially in occupational settings, as well as the variety of related adverse health effects. Moreover, while the acute effects of high-level EMF exposure at currently used frequencies are well understood, controversies and gaps remain regarding the long-term effects of low-level exposures and the future use of increasingly higher frequencies. Therefore, regulatory standards and (practical) guidelines which aim to protect workers need to be continuously updated, based on up-to-date research. For this, long-term monitoring of EMF exposure levels in the workplace, in relevant frequency bands, using both fixed and wearable sensors and in combination with worker health parameters is highly recommended.

In summary, a multidisciplinary approach to EMF exposure assessment and risk prevention is required, involving occupation-specific research, continuous policy adaptation and effective communication among OSH stakeholders to ensure the health and safety of workers in an increasingly wirelessly connected and powered environment.

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*Authors: Sam Aerts, John Bolte.*

*Smart Sensor Systems research group, Faculty Technology, Innovation & Society, The Hague University of Applied Sciences (THUAS), the Netherlands.*

*Project management: Annick Starren, Emmanuelle Brun - European Agency for Safety and Health at Work (EU-OSHA).*