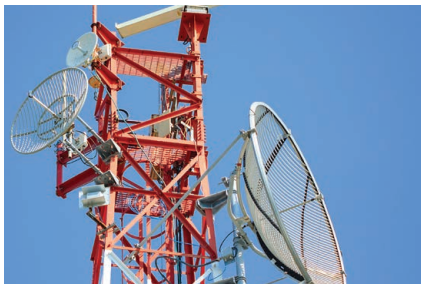
HEALTH AND SAFETY AUTHORITY



A Guide to the Safety, Health and Welfare at Work **(Electromagnetic Fields)** Regulations 2016

(S.I. No. 337 of 2016)

Our Vision: healthy, safe and productive lives

Contents

This guide gives a non-exhaustive overview of the Safety, Health and Welfare at Work (Electromagnetic Fields) Regulations 2016 and is not a legal interpretation of the Regulations.

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Introduction

Electromagnetic fields (EMFs) are generated whenever electricity is used. EMF sources exist in the majority of workplaces and most present little or no risk of causing illness or injury. Almost all workers are exposed to EMFs at work. For most workers, field strengths of EMFs are at a level that will not cause any adverse effects. However, in some workplaces, field strengths may present a risk. One of the challenges is to ensure that sources that may present a risk of exposing workers to levels in excess of the safe limits are adequately assessed and controlled, without the burden of having to assess the majority of sources that do not present a risk.

The Health and Safety Authority (The Authority) has produced this guide to explain the main provisions of the Safety, Health and Welfare at Work (Electromagnetic Fields) Regulations, 2016 (S.I. No. 337 of 2016) in a user-friendly way. The Regulations lay down the minimum health and safety requirements relating to the exposure of employees to risks from EMFs.

The Regulations transpose Directive 2013/35/EU of the European Parliament and of the Council of 26th June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (20th Individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) and repealing Directive 2004/40/EC.

The guide applies to all workplaces where employees may be exposed to EMFs. It is not intended as a legal interpretation of the legislation. This guide should be read in conjunction with the Regulations. This is especially so as the very detailed technical tables in Schedules 2 and 3 of the Regulations are not repeated in this guide.

As an employer, you are also strongly advised to read over the relevant sections of the following EU guides available at www.hsa.ie and on the links below as they provide good, practical, technical information; tables; examples; and case studies **not** repeated in this guide.

- Non-binding guide to good practice for implementing Directive 2013/35/EU Electromagnetic Fields, Guide for SMEs (relevant for all workplaces)
- Non-binding guide to good practice for implementing Directive 2013/35/EU Electromagnetic Fields, Volume 1: Practical Guide
- Non-binding guide to good practice for implementing Directive 2013/35/EU Electromagnetic Fields, Volume 2: Case Studies

EMF is a form of non-ionising radiation and should not be confused with ionising radiation, which is potentially more harmful. The Regulations do not specifically exclude any EMF source. However, many sources, such as electrical lighting and wiring to sockets, are trivial and present no risk. **The EU non-binding guide for SMEs** referred to above provides a list of safe EMF sources that can be assessed generically as not likely to exceed the safe limits contained in Regulation 4 of the Regulations.

There are other sources of EMF that may present a risk to workers as the safe limits may be exceeded. These situations include magnetic resonance imaging (MRI) equipment, electrolysis as part of a manufacturing process, use of dielectric heating equipment, use of induction heating equipment, and use of manually operated resistance welding equipment. Such sources will usually need a thorough risk assessment, possibly including measurements, to ensure safe limits are not exceeded. **The EU non-binding guides Volume 1 and 2** will assist employers in this regard.

Workers at particular risk include pregnant employees and those wearing active or passive implanted medical devices and bodily worn medical devices and these workers need special consideration.

General background information

The Regulations came into operation on 1st July 2016.

What are electromagnetic fields?

EMFs are generated whenever electricity is used. As the name implies, they are either electric or magnetic fields, or a mixture of both. They cover the frequency range 0 Hz to 300 GHz. Their intensity varies according to power and frequency, giving rise to different effects. EMFs are produced by a wide range of sources that workers may encounter in the workplace. They are generated and used in many work activities, including manufacturing, research, medical equipment, power generation, transmission and distribution, telecommunications, broadcasting, aeronautical and marine navigation and security. Some EMFs are incidental in that they are produced by cables distributing electrical power within buildings or from electrically powered equipment and appliances.

The majority of sources of EMF found in the workplace produces extremely low levels of exposure. The extent and magnitude of EMFs produced will depend on the voltages, currents and frequencies at which the equipment operates or generates, along with the design of the equipment. Generally equipment that uses high currents, high voltages or that is designed to emit EMFs will produce high levels of exposure.

The magnitude of an EMF will decrease rapidly (exponential and not linear) with distance from its source. Therefore worker exposure can be reduced if it is possible to restrict access to areas close to equipment when it is switched on or in operation. It is also worth remembering that EMFs, unless generated by a permanent magnet or superconducting magnet, will normally disappear when the power source is switched off.

What are the effects of EMF?

EMFs in the workplace may cause direct or indirect effects. Direct effects are those arising from an interaction of the EMF with the body and may be either thermal or non-thermal. Indirect effects result from the presence of an object in the EMF, resulting in a safety or health hazard. The Regulations do not cover long-term health effects such as cancer, since there is currently no well-established scientific evidence of a causal relationship.

What are the direct effects of exposure to EMFs?

The type of effect that EMFs cause in people depends primarily on the frequency and intensity. Movement in static magnetic fields causes vertigo and nausea. At low frequencies, the effects are stimulation of the sensory organs, nerves and muscles, while at higher frequencies the effects are heating (thermal) of the whole body or parts of it. These are direct effects comprising non-thermal and thermal effects.

General background information cont'd

What are the indirect effects of exposure to EMFs?

Indirect effects may occur due to the presence of objects in an EMF, resulting in a safety or health hazard. Some of the indirect effects listed below affect workers at particular risk. Contact with a live conductor is excluded. Indirect effects include:

- interference with medical electronic equipment and other devices
- interference with active implanted medical devices or equipment, such as cardiac pacemakers or defibrillators;
- interference with medical devices worn on the body, such as insulin pumps;
- interference with passive implants (artificial joints, pins, wires or plates made of metal);
- effects on shrapnel, body piercings, tattoos and body art;
- projectile risk from loose ferromagnetic objects in a static magnetic field;
- unintentional initiation of detonators;
- fires or explosions from ignition of flammable or explosive material; and
- electric shocks or burns from contact currents when a person touches a conductive object in an electromagnetic field and one of them is grounded whilst the other is not.

Guide to the Regulations

Regulation 1: Citation and Commencement

The Regulations may be cited as the Safety, Health and Welfare at Work (Electromagnetic Fields) Regulations 2016.

These Regulations came into operation on 1st July 2016.

Regulation 2: Interpretation

This Regulation interprets and defines terms used in these Regulations.

'Act' means the Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005).

The physical quantities, exposure limit values (ELVs) and action levels (ALs) laid down in the Directive and Regulations are based on the recommendations of the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

The physical quantities used to describe exposure to EMFs are those indicated and explained in Schedule 1 of the Regulations.

The ELVs and ALs are those indicated in Schedule 2 (non- thermal effects) and Schedule 3 (thermal effects) of the Regulations.

Regulation 3: Application

These Regulations apply to activities in which employees are or are likely to be exposed to risks to their safety and health arising from exposure to EMFs while working and they impose obligations and duties on employers to protect their employees.

The Regulations cover all known direct biophysical and indirect effects caused by EMFs.

The ELVs in the Regulations cover only short-term, direct, biophysical effects and do not cover long-term effects.

The Regulations do not cover the risks resulting from direct contact with live electrical conductors.

Regulation 4: Exposure Limit Values and Action Levels

The employer is required to ensure that the ELVs set out in Schedule 2 (non- thermal effects) and Schedule 3 (thermal effects) of the Regulations are not exceeded unless certain conditions are met. Compliance with these ELVs can be demonstrated by the use of exposure assessment procedures referred to in Regulation 5.

When ELVs are exceeded, the employer shall take immediate action to reduce exposure below the ELVs, identify the reasons for them being exceeded and prevent them being exceeded again.

The employer is deemed to be in compliance with this Regulation where it is shown the relevant ALs in Schedules 2 and 3 are not exceeded.

Where the ALs are exceeded, the employer is required to prepare and implement an action plan in accordance with Regulation 6, unless the risk assessment carried out in accordance with Regulation 5 shows the relevant ELVs are not exceeded and safety risks are excluded.

The low ALs in Schedule 2 may be exceeded, provided certain conditions are met.

The sensory effect ELVs in Schedule 2 and 3 may be exceeded, provided certain conditions are met.

Regulation 5: Assessment of Risks and Determination of Exposure

Where employees are liable to be exposed to EMFs at work, the employer is required to carry out a risk assessment. If necessary, the risk assessment will include measuring or calculating the levels of EMFs.

The risk assessment can be made public on request, subject to data protection laws. Public authorities that are in possession of the risk assessment may refuse a request for access to it or to make it public where disclosure would undermine the commercial interests of the employer, unless there is an overriding public interest in such disclosure. Employers may also refuse to disclose or make public the risk assessment where disclosure would undermine the protection of their commercial interests.

In carrying out the risk assessment, the employer can take account of the practical guides made available by the European Commission and any other relevant standards or guidelines available, including exposure databases.

Where compliance with ELVs cannot be reliably determined on the basis of readily accessible information, the employer shall ensure that the assessment of the levels of EMFs is carried out based on measurements or calculations; these must be carried out by a competent person at suitable intervals. A person is deemed to be competent where they possess sufficient training, experience and knowledge appropriate to the nature of the work to be undertaken.

When carrying out the risk assessment, the employer should give attention to:

- the health and sensory effect ELVs and ALs referred to in Regulation 4 and Schedules 2 and 3;
- the frequency, level, duration and type of exposure;
- any direct biophysical effects;
- any effects on employees at particular risk, such as employees who wear active or passive implanted medical devices, employees with medical devices worn on the body, and pregnant employees;
- any indirect effects;
- replacement equipment with reduced exposure to EMFs;
- information from health surveillance referred to in Regulation 8;
- information from equipment manufacturers;
- other relevant health and safety information;
- multiple sources of exposure; and
- simultaneous exposure to multiple frequency fields.

Workers at particular risk will normally be adequately protected by compliance with the reference levels specified in Council Recommendation 1995/519/EC (Limitation of Exposure of the General Public to EMFs (0 Hz to 300 GHz)), as the levels for the protection of the public are more restrictive than those for employees. However, for a very small minority, especially those with active implants, even these reference levels may not provide adequate protection. These individuals will have received appropriate advice from the doctor responsible for their care, and this should assist an employer to establish if the employee is at risk in the workplace.

Table 3.2: Requirements for Specific EMF Assessments in Respect of Common Work Activities, Equipment and Workplaces of Non-binding guide to good practice for implementing Directive 2013/35/EU Electromagnetic Fields, Guide for SMEs lists many common work activities, equipment and workplaces and provides an indication of whether EMF assessments are likely to be required for:

- employees with active implants;
- other employees at particular risk; and
- employees not at particular risk.

In workplaces open to the public, a separate risk assessment for employees is not necessary if an evaluation has already been conducted applying the exposure limits for the general public to employees, and health and safety risks are excluded. The exposure limits for the general public are outlined in Council Recommendation 1999/519/EC and are more restrictive than those for employees.

The risk assessment should be reviewed at regular intervals and an employer can take account of the emission levels and other safety data provided by the manufacturer or distributor of the equipment.

Regulation 6: Provisions Aimed at Avoiding Risks

An employer shall ensure that the risk of exposure to EMFs of employees is either eliminated at source or reduced to a minimum, taking account of technical progress and availability of measures to control the production of EMFs at source and the General Principles of Prevention, as set out in Schedule 3 of the 2005 Act.

General Principles of Prevention:

1. The avoidance of risks.
2. The evaluation of unavoidable risks.
3. The combatting of risks at source.
4. The adaption of work to the individual, especially as regards the design of places of work, the choice of work equipment and the choice of systems of work, with a view, in particular, to alleviating monotonous work and work at a predetermined work rate and to reducing the effect of this work on health.
5. The adaption of the place of work to technical progress.
6. The replacement of dangerous articles, substances or systems of work by safe or less dangerous articles, substances or systems of work.
7. The giving of priority to collective protective measures over individual protective measures.
8. The development of an adequate prevention policy in relation to safety, health and welfare at work, which takes account of technology, organisation of work, working conditions, social factors and the influence of factors related to the working environment.
9. The giving of appropriate training and instructions to employees.

Where the risk assessment indicates that the relevant ALs and ELVs are exceeded and safety risks cannot be excluded, the employer must prepare and implement an action plan comprising either technical and organisational measures or both to prevent exposure exceeding the health and sensory effect ELVs.

The action plan should include reference to:

- other methods of work that reduce the risk of exposure to EMFs;
- choice of work equipment that emits less intense EMFs;
- technical measures to reduce the emission of EMFs, including use of interlocks, shielding or similar health protection mechanisms;
- appropriate delimitation and access measures, such as signals, labels, floor markings or barriers to limit or control access;
- measures and procedures to manage spark discharges and contact currents by technical means and employee training;
- appropriate maintenance programmes for work equipment, place of work, workstations and systems of work;
- design and layout of workstations and places of work;
- limit duration and intensity of exposure to EMFs; and
- provision of Personal Protective Equipment (PPE).

Where the risk assessment indicates that there is a workstation where relevant ALs are likely to be exceeded, the employer must display mandatory signs that convey this information and prevent unauthorised access by barriers or other measures, unless access is already restricted for other reasons and employees are informed of the risks from EMFs.

If, despite the measures taken to comply with this Regulation, the health and sensory effect ELVs are exceeded, the employer shall:

- take immediate action to reduce exposure to EMFs below those ELVs;
- identify the reason for the ELVs being exceeded; and
- amend the measures taken to prevent the ELVs being exceeded again.

An employer shall adapt any measures taken to comply with this Regulation to take account of any employee who is at particular risk (employees with active or passive implanted medical devices or medical devices worn on the body, and pregnant employees) from EMFs and any risks from indirect effects.

An employer shall take specific protection measures where low ALs for electric fields are exceeded, such as:

- training of employees in accordance with Regulation 7; and
- use of technical means and personal protection, such as grounding of work objects, bonding of workers with work objects (equipment bonding) and use of insulating shoes, gloves and protective clothing.

An employer shall take specific protection measures where sensory effect ELVs are exceeded temporarily, such as controlling movements.

Regulation 7: Employee Information, Training and Consultation

Where employees are exposed to EMFs at work, the employer must provide them with information and training about the outcome of the risk assessment.

The information and training shall include:

- technical and organisational measures taken to comply with the Regulations;
- values and concepts of ELVs and ALs, the associated potential risks and preventive measures taken;
- possible indirect effects;
- results of the assessment and measurement or calculations or both of level of exposure to EMFs and an explanation of their significance and potential risks;
- how to detect and report signs of adverse health effects;
- possibility of transient symptoms and sensations related to central or peripheral nervous system effects;
- health surveillance and its purpose under Regulation 8;
- safe working practices to minimise risk from exposure to EMFs;
- employees at particular risk; and
- use of personal protective equipment (PPE).

Regulation 8: Health Surveillance

Health surveillance intended to prevent or rapidly diagnose any adverse health effect due to exposure to EMFs must be made available by the employer to those employees for whom the risk assessment reveals a health risk.

Health surveillance is defined in the 2005 Act as the periodic review for the purposes of protecting health and preventing occupational related disease of the health of employees, so that any adverse variations in their health that may be related to working conditions are identified as early as possible.

Where an employee undergoes health surveillance, the employer shall ensure that a health record is made and maintained and kept available in a suitable form to permit appropriate access at a later date, taking any confidentiality concerns into account.

The employer shall:

- allow an employee access to his or her health records;
- provide the Authority, or a person designated in writing by the Authority who is a registered medical practitioner, with copies of such health records as it requires;
- provide the registered medical practitioner, under whose responsibility an employee receives health surveillance, with the results of the risk assessment, where such results may be relevant to health surveillance; and
- notify the Authority in writing if they cease to trade, and make available all health records kept in accordance with this Regulation.

Where ELVs are exceeded, the employer shall make available to the employee the services of a registered medical practitioner to carry out a medical examination.

Where, as a result of health surveillance, an employee is found to have an illness or adverse health effects, and it is the opinion of the registered medical practitioner that it is as a result of exposure to EMFs, the doctor will:

- inform the employee of the results, including information and advice on health surveillance following end of exposure; and
- inform the employer of any significant findings of the health surveillance, taking into account medical confidentiality.

As a result the employer must:

- review the risk assessment;
- review the measures to eliminate or reduce the risk;
- take account of the advice of the doctor or a competent person or the Authority in implementing any measures to eliminate or reduce the risk;
- arrange continued health surveillance and a review of the health status of any employee who has been similarly exposed; and
- take account of the recommendations of the doctor or competent person regarding further medical examination.

Regulation 9: Exemptions

ELVs may be exceeded for employee exposure to EMFs related to the installation, testing, use, development, maintenance of or research related to magnetic resonance imaging (MRI) equipment for patients in the healthcare sector, provided that all the following conditions are met:

- The risk assessment has demonstrated that the ELVs are exceeded
- Technical and organisational measures have been applied
- The circumstances duly justify exceeding the ELVs
- The characteristics of the workplace, work equipment or work practices have been taken into account
- The employer demonstrates that employees are still protected against adverse health effects and safety risks, including that the instructions for safe use of medical devices provided by the manufacturer in accordance with Council Directive 93/42/EEC of 14 June 1993 concerning medical devices are followed

Schedule 1:
(Annex I to Directive 2013/35/EU)
PHYSICAL QUANTITIES REGARDING THE EXPOSURE TO ELECTROMAGNETIC FIELDS

The following physical quantities are used to describe the exposure to electromagnetic fields:

Electric field strength (E) expressed in volt per metre (Vm^{-1}).

Limb current (I_L) expressed in ampere (A).

Contact current (I_C) expressed in ampere (A).

Electric charge (Q) expressed in coulomb (C).

Magnetic field strength (H) expressed in ampere per metre (Am^{-1}).

Magnetic flux density (B) expressed in tesla (T).

Power density (S) expressed in watt per square metre (Wm^{-2}).

Specific energy absorption (SA) expressed in joule per kilogram (Jkg^{-1}).

Specific energy absorption rate (SAR), expressed in watt per kilogram (Wkg^{-1}).

Of these quantities, magnetic flux density (B), contact current (I_C), limb current (I_L), electric field strength (E), magnetic field strength (H), and power density (S) can be measured directly.

Schedule 2:
(Annex II to Directive 2013/35/EU) NON-THERMAL EFFECTS EXPOSURE LIMIT VALUES AND ACTION LEVELS IN THE FREQUENCY RANGE FROM 0 Hz TO 10 MHz

Schedule 2 describes the ELVs and associated ALs for non-thermal effects over a range of frequencies from 0 Hz to 10 MHz. The ELVs and ALs for different frequencies are specified in tables in the Regulations which are very detailed and technical and are not repeated in this guide.

The ELVs are divided up further into sensory and health effects, which are considered to be more serious.

Sensory effects resulting from movement in a static magnetic field from 0 to 1 Hz include vertigo and other disturbances of the human balance organ.

Sensory effects for electric fields in the range 1 Hz to 400 Hz include effects on the central nervous system in the head, such as retinal phosphenes and transient changes in some brain functions.

Health effects from electric fields in the frequency range 1 Hz to 10 MHz include electric stimulation of all peripheral and central nervous system tissues in the body.

Adherence to appropriate ALs, which can be split into Low and High, is deemed to show compliance with relevant ELVs. Low ALs relate to sensory ELVs while High ALs relate to health ELVs. Health ELVs are considered more serious than sensory ELVs.

There are separate ALs for exposure to electric and magnetic fields in the range 1 Hz to 10MHz.

Schedule 3:
(Annex III to Directive 2013/35/EU)
THERMAL EFFECTS
EXPOSURE LIMIT VALUES AND ACTION LEVELS IN THE FREQUENCY RANGE FROM 100 kHz TO 300 GHz

Schedule 3 describes the ELVs and associated ALs for thermal effects over a range of frequencies from 100 kHz to 300 GHz. The ELVs and ALs for different frequencies are specified in tables in the Regulations which are very detailed and technical and are not repeated in this guide.

The ELVs are further divided up into sensory and health effects.

Health effect ELVs for frequencies from 100 kHz to 6 GHz are limits for energy and power absorbed per unit mass of body tissue generated from exposure to electric and magnetic fields.

Health effect ELVs for frequencies from 6 GHz to 300 GHz are limits for power density of an electromagnetic wave incident on the body surface.

Sensory effect ELVs for frequencies from 0.3 GHz to 6 GHz are limits on absorbed energy in a small mass of tissue in the head from exposure to electromagnetic fields.

Adherence to appropriate ALs is deemed to show compliance with relevant ELVs.
There are separate ALs for on both sustenance's in the range 100 kHz to 300 GHz.
There are also ALs for steady state contact currents and induced limb currents in the frequency range 100 kHz to 110 MHz.

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