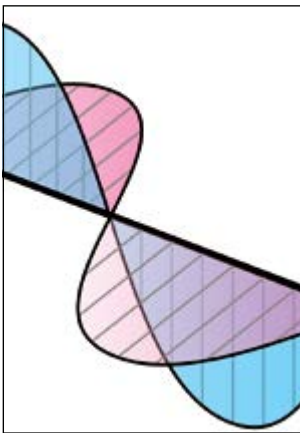


# Electromagnetic fields at work

## A guide to the Control of Electromagnetic Fields at Work Regulations 2016



**HSG281 (First edition)**  
**Published 2016**

Employers have a duty to take reasonable steps to prevent harm in the workplace and this duty includes considering any risks arising from exposure to electromagnetic fields (EMFs).

This guidance explains an employer's duties under the Control of Electromagnetic Fields at Work Regulations 2016 and will also be useful to others with responsibilities for health and safety such as employee and safety representatives. It explains what an EMF is, what the law says and how to assess employees' potential exposure to EMFs with reference to 'action levels' and 'exposure limit values'.

## **Introduction 4**

- Who will find this guidance useful? 4
- What does the guidance contain? 4
- The legal background 4

## **Electromagnetic fields (EMFs) and their effects 5**

- What is an EMF? 5
- Exposure to EMFs 5
- What are the effects of exposure? 5

## **What the law says 7**

### **EMFs in the workplace 8**

- Low-exposure work activities/equipment 8
- Work activities/equipment where EMFs may exceed the ELVs 11

### **Action levels and exposure limit values 12**

- Action levels 13
- Exposure limit values 13
- Exceeding the ELVs 13

### **EMF exposure assessment 14**

- What information is already available? 14
- Is there a need to measure? 15
- Do I need to keep a record? 15
- Review your exposure assessment 15
- Is an action plan needed? 16
- Is a risk assessment needed? 16
- Employees at particular risk 17

### **Exemption 24**

- General exemption 24
- Use of magnetic resonance imaging (MRI) for medical purposes 24
- Use of MRI for other purposes 25
- Military use of EMFs 25

### **Information and training 27**

### **Health surveillance 27**

## **Annex 1 Information to help you understand the terms used and comply with the limits stated in the Control of Electromagnetic Fields at Work (CEMFAW) Regulations 2016 28**

## Tables and figures

- Table 1 Examples of possible effects of EMFs in relation to work activities/  
equipment used **5**
- Table 2 Sources of EMF at levels below the ELVs and which will **not** exceed  
the indirect-effect ALs **9**
- Table 3 Sources of EMF which **may** exceed the ELVs and/or the indirect-effect ALs **11**
- Table 4 Examples of implanted and body-worn devices **18**
- Table 5 Sources of EMF which may pose a risk to expectant mothers **19**
- Table 6 Sources of EMF which may pose a risk to workers with passive  
implanted medical devices **20**
- Table 7 Sources of EMF which may pose a risk to workers with active  
implanted and active body-worn medical devices **21**
- Figure 1 Actions to take to comply with the CEMFAW Regulations after  
completion of the exposure assessment **23**
- Figure 2 Flow chart demonstrating exemption process **26**

## References and further reading **30**

## Further information **32**

# Introduction

## Who will find this guidance useful?

- 1 This guidance explains your duties as an employer under the Control of Electromagnetic Fields at Work Regulations 2016 (the CEMFAW Regulations).
- 2 It will also be useful to others with responsibility for health and safety, ie employee and safety representatives.

## What does the guidance contain?

- 3 The guidance includes advice on:
  - identifying sources of electromagnetic fields (EMFs) in your workplace;
  - assessing the exposure of employees to EMFs;
  - deciding what, if anything, you may need to do to protect your workers from the risk arising from exposure to EMFs;
  - assessing and controlling any risks from EMFs in the workplace;
  - information on exemption from certain aspects of the CEMFAW Regulations.

## The legal background

- 4 As part of managing the health and safety of your business, you already need to control the risks in your workplace under the Management of Health and Safety at Work Regulations 1999 (MHSW);<sup>1</sup> you need to think about what might cause harm to people and take reasonable steps to prevent harm – this includes considering any risks arising from exposure to EMFs.
- 5 The CEMFAW Regulations mean that you now have to assess employees' potential exposure to EMFs with reference to action levels (ALs) and exposure limit values (ELVs).

The majority of employers **will not** need to take any additional action to reduce the risk from EMFs. This is because either:

- the levels of EMFs in most workplaces are already at safe levels; or
- in workplaces where employees may be exposed to higher levels of EMFs, the levels and associated risks will already have been assessed and managed.

# Electromagnetic fields (EMFs) and their effects

## What is an EMF?

6 An EMF is produced whenever a piece of electrical or electronic equipment (ie TV, food mixer, computer, mobile phone etc) is used.

7 EMFs are static electric, static magnetic and time-varying electric, magnetic and electromagnetic (radio wave) fields with frequencies up to 300 GHz.

8 EMFs are present in virtually all workplaces and if they are of high enough intensity, you may need to take action to make sure your workers are protected from any adverse effects.

## Exposure to EMFs

9 Exposure to high levels of EMFs can give rise to effects that may be irritating or unpleasant.

10 The effects that occur depend on the frequency range and intensity of the EMFs to which a worker is exposed.

## What are the effects of exposure?

11 EMFs at different frequencies affect the human body in different ways, causing sensory and health effects; see Table 1. Indirect effects can also happen; indirect effects are caused by the presence of an object in an EMF which may become the cause of a health and safety hazard. One example would be the risk of injury from ferromagnetic objects in a large static magnetic field being attracted to the magnets and hitting anyone in the way. Table 1 provides examples of effects which may be produced by work activities and equipment in the different frequency ranges; in most cases, it will only be the highest power instances that may lead to effects being experienced.

**Table 1** Examples of possible effects of EMFs in relation to work activities/equipment used

Field and frequency range	Effects	Examples of activities and equipment
<b>Static electric and static magnetic fields</b> 0–1 Hz	<p><b>Indirect effects:</b> Uncontrolled attraction of ferromagnetic objects, ie the risk of injury from objects in a large static magnetic field being attracted to magnets in the workplace and hitting anyone in the way</p> <p><b>Sensory effects:</b> Nausea, vertigo, metallic taste in the mouth, flickering sensations (magnetophosphenes) in peripheral vision</p> <p><b>Health effects:</b> Micro shocks</p>	<p>MRI scanners (main magnet)</p> <p>Electrochemical processes, eg industrial electrolysis, aluminium extraction</p> <p>Nuclear magnetic resonance spectrometers</p> <p>Electromagnetic lifting cranes</p> <p>Electric vehicles (cars, underground trains)</p>

Field and frequency range	Effects	Examples of activities and equipment
<p><b>Low frequency magnetic and electric fields:</b></p> <p>1 Hz–10 MHz</p>	<p><b>Indirect effects:</b> Interference with active or passive implanted or body-worn medical devices (more information is provided later in this guidance), electric shocks, causing electro-explosive devices to initiate, ie when used in close proximity to explosives that have an electrical means of initiation</p> <p>Sparks caused by induced fields triggering fires or explosions where flammable fuels, vapours or gases are present</p> <p><b>Sensory effects:</b> Nausea, vertigo, metallic taste in the mouth, flickering sensations (magnetophosphenes)</p> <p><b>Health effects:</b> Nerve stimulation, effects on the central and peripheral nervous system of the body: tingling, muscle contraction, heart arrhythmia</p> <p>Contact currents caused by a person touching a conductive object in an EMF where one of them is grounded and the other is not, which can result in shocks or burns</p>	<p>High voltage power lines</p> <p>Production and distribution of electricity</p> <p>Welding (arc and spot)</p> <p>Electrical arc furnaces</p> <p>Industrial induction heating (eg large coils used around the site of a weld)</p> <p>AM radio</p> <p>Electric hand-held tools</p> <p>Electric vehicles (cars, trains, trams, metros)</p> <p>Magnetic resonance imaging (MRI) (switched gradient fields)</p>
<p><b>Intermediate frequency fields:</b></p> <p>100 kHz–10 MHz</p>	<p>The health effects of both high and low frequencies can be experienced as detailed above and below (see also Annex 1)</p>	<p>Surgical diathermy</p> <p>Broadcasting systems and devices (AM radio)</p> <p>Anti-theft devices</p> <p>Military and research radiofrequency systems</p>
<p><b>High frequency fields:</b></p> <p>100 kHz–300 GHz</p>	<p><b>Indirect effects:</b> Interference with active or passive implanted or body-worn medical devices (more information is provided later in this guidance), electric shocks, causing electro-explosive devices to initiate, ie when used in close proximity to explosives that have an electrical means of initiation</p> <p>Sparks caused by induced fields triggering fires or explosions where flammable fuels, vapours or gases are present</p>	<p>MRI (RF coils)</p> <p>Broadcasting and TV antennas</p> <p>Radar and radio transmitters</p> <p>Diathermy</p> <p>Dielectric heating (eg vulcanising, plastics welding or microwave drying)</p> <p>Anti-theft systems</p>

Field and frequency range	Effects	Examples of activities & equipment
100 kHz–300 GHz	<p><b>Sensory effects:</b> Auditory effects such as perception of clicks or buzzing caused by pulsed radar systems</p> <p><b>Health effects:</b> Thermal stress, heating effects leading to a rise in core body temperature or localised limb heating (eg knees or ankles)</p> <p>Contact with charged conducting bodies can lead to RF shock or deep tissue burns (see also Annex 1)</p>	<p>Broadcasting and TV antennas</p> <p>Radar and radio transmitters</p> <p>Diathermy</p> <p>Dielectric heating (eg vulcanising, plastics welding or microwave drying)</p> <p>Anti-theft systems</p>

## What the law says

12 The CEMFAW Regulations require you, as an employer, to:

- assess the levels of EMFs to which your employees may be exposed;
- ensure that exposure is below a set of ELVs, see 'Exposure limit values';
- when appropriate, devise and implement an action plan to ensure compliance with the exposure limits;
- when appropriate, assess the risks of employees' exposure and eliminate or minimise those risks. You must make sure you take employees at particular risk, such as expectant mothers and workers with active or passive implanted or body-worn medical devices, into account. See 'Employees at particular risk';
- provide information and training on the particular risks (if any) posed to employees by EMFs in the workplace and details of any action you are taking to remove or control them. This information should also be made available to their safety representatives, as appropriate;
- take action if employees are exposed to EMFs in excess of the ELVs;
- provide health surveillance or medical examination, as appropriate.

13 The CEMFAW Regulations contain a schedule which introduces limits, explains the effects of EMFs and provides details of safety conditions which must be met.

14 The CEMFAW Regulations allow the sensory-effect ELVs to be exceeded when certain safety conditions stated in the schedule to the regulations are met. In addition, exemptions to the exposure limits apply in the following circumstances:

- for any activity in respect of which a suitable and sufficient alternative exposure limitation system is in place and where the activity is carried out:
  - by a person acting in the capacity of a member of either Her Majesty's armed forces or a visiting force;
  - by any civilian working with such a person; or
  - on any premises or part of premises under the control of the Secretary of State for the purposes of the Ministry of Defence or the service authorities of a visiting force;

- during the development, testing, installation, use and maintenance of, or research related to, MRI equipment for patients in the health sector, where:
  - the exposure of employees above the ELV is at the lowest level reasonably practicable; and
  - employees are protected against the health effects and safety risks arising from their exposure to EMFs;
- if HSE has issued an exemption for your work activity and you meet the conditions of that exemption.

### Summary of an employer's duties relating to risk assessment

The majority of employers will not need to take any additional action to reduce the risk from EMFs as in most workplaces EMFs are already at safe levels. Where employees may be exposed to higher levels of EMFs, the levels and associated risks should already be assessed and managed under MHSW.

You should also be aware that you have responsibilities under MHSW regulation 11 to cooperate and coordinate with other employers to ensure the health and safety of all of your employees. This includes considering the safety of others who are not directly employed by you but who are working on site, eg contractors; the responsibilities for such staff will depend on who, if anyone, is employing them.

## EMFs in the workplace

### Low-exposure work activities/equipment

15 Many sources of EMF in the workplace produce such low levels of EMFs that it is likely, other than assessing exposure to EMFs, the procedures you already have in place to manage risks will be sufficient to make sure workers are protected and to meet the requirements of the CEMFAW Regulations.

16 Table 2 contains a non-exhaustive list of low-exposure equipment. Where workplaces only contain equipment on this list, the ELVs and indirect-effect ALs will not be exceeded and **you do not need to take any further action under the CEMFAW Regulations, except where:**

- your workforce has employees at particular risk (see 'Employees at particular risk'); and/or
- you have five or more employees, which means you will have to make a record of your findings.

17 Determining that your work equipment is on this list will be your exposure assessment. You will also need to consider work activities/equipment not under your direct control but which your employees may come into contact with as part of their work. If you have five or more employees you will need to record that you checked all equipment against this list. See 'Do I need to keep a record?'.

18 If your workplace contains equipment which is not on this list, this does not necessarily mean your work activities will be above the ELVs – but you will need to consult other sources of information on those particular pieces of equipment.

19 If you later obtain (or your employees may as part of their work come into contact with) other equipment which may lead to higher EMF exposures, you will need to revisit the exposure assessment.

20 For low-exposure work activities/equipment where there are no employees at particular risk, you will not have to take any further action.



**Table 2** Sources of EMF at levels below the ELVs and which will **not** exceed the indirect-effect ALs (for more information see 'Action levels')

### Wireless communications

Phones (landlines, mobile phones, cordless, digital enhanced cordless telephone (DECT) base stations) and fax machines in workplaces

Wireless communications devices (eg Wi-Fi or Bluetooth) including access points for wireless local area network (WLAN) (NB: Special consideration should be given to employees with active implants – see 'Employees at particular risk')

### Office

Audio-visual equipment: TVs, DVDs etc

Communication equipment and wired networks

Computer and IT equipment

Electric fans, fan heaters and room heaters

Office equipment, eg photocopiers, printers, shredders etc

### Buildings and grounds

Workplaces accessible to the general public which meet the exposure limits for the general public specified in Council Recommendation 1999/519/EC<sup>2</sup>

Alarm systems

Electrical room heating equipment

Base station antennas outside operator's designated exclusion zone

Electric garden appliances

Electric handheld and transportable tools

Household and professional appliances, eg washing machine/dryer, oven, toaster, **as long as wireless local area network (WLAN) and Bluetooth are not involved**; if they are, special consideration should be given to employees with active implants, see 'Employees at particular risk'

Lighting, including desk lamps

### Electrical supply

Overhead line at any voltage crossing the workplace (magnetic)

Overhead line at any voltage crossing the workplace if the exposure is indoors, or if the exposure is outdoors but not directly underneath the line (electric)

Overhead line at any voltage up to and including 275 kV. If the exposure is outdoors and directly underneath the line (note that 400 kV lines will often not pose a risk either, but it is theoretically possible for some low-clearance line to exceed the low action level) (electric)

Any electrical circuit or installation (including cables, busbars, switchgear and transformers), where the cables carrying the electrical currents are bundled together so that they are always touching or nearly so and there are no unusual earthing arrangements that could create unbalanced currents

Any electrical circuit or installation (including cables, busbars, switchgear and transformers), where the cables or busbars carrying the electrical currents are separated, and the rating of the circuit or that part of it is <100 A (equivalent to 23 kW for a single-phase 230 V circuit, 69 kW for a three-phase 230 V circuit, or 1.9 MW for a three-phase 11 kV circuit)

### Light industry

Coating and painting equipment

Control equipment not containing radio transmitter

Measuring equipment and instrumentation not containing radio transmitters

### Miscellaneous

Equipment placed on the European market as compliant with Council Recommendation 1999/519/EC or harmonised EMF standards

Battery chargers, non-inductive coupling designed for household use

Battery-powered portable equipment that does not contain radio frequency transmitters

Hydraulic ramps

Workplaces containing electrical handheld, portable tools

### Employees at particular risk

You must give special consideration to the safety of employees at particular risk.

This includes employees who have informed you of any condition which could mean they are more susceptible to effects from EMF exposure (such as their wearing of active implanted medical devices (AIMDs), passive implanted medical devices (PIMDs) or body-worn medical devices (BWMDs) or of their pregnancy) and employees who work in close proximity to electro-explosive devices, explosive materials or flammable atmospheres. For more information see 'Employees at particular risk'.

## Work activities/equipment where EMFs may exceed the ELVs

21 Some work activities will involve exposure to levels of EMFs which may exceed the ELVs and so potentially pose a risk to employees; Table 3 contains a non-exhaustive list of such work activities/equipment, where further consideration will be necessary.

22 Please note that this **does not** mean you need to measure exposure directly – you can refer to other sources of information first (see ‘EMF exposure assessment’) to determine whether the ELVs are exceeded.

**Table 3** Sources of EMF which **may** exceed the ELVs and/or the indirect-effect ALs

### Infrastructure (buildings and grounds)

Broadcast and telecoms base stations, inside operator’s designated exclusion zone

Radio frequency or microwave energised lighting equipment

Radio and TV broadcasting systems and devices

### Electrical supply

Any electrical circuit or installation (including cables, busbars, switchgear and transformers), where the cables carrying the electrical currents are bundled together so that they are always touching or nearly so, but there are earthing arrangements that mean the cables collectively carry an unbalanced current of >100 A

Any electrical circuit or installation (including cables, busbars, switchgear and transformers), where the cables or busbars carrying the electrical currents are separated, and the rating of the circuit or that part of it is >100 A (equivalent to 23 kW for a single-phase 230 V circuit, 69 kW for a three-phase 230 V circuit, or 1.9 MW for a three-phase 11 kV circuit)

### Light industry

Dielectric heating and welding

Resistance welding: manual spot and seam welding

Induction heating

Induction soldering

Magnetic particle inspection (crack detection)

Industrial magnetiser and demagnetisers, eg tape erasers

Microwave heating and drying

RF plasma devices including vacuum deposition and sputtering

## Heavy industry

Industrial electrolysis

Furnaces, arc and induction melting

## Construction

Microwave drying in the construction industry

## Medical

MRI equipment

Medical diagnostic and treatment equipment using EMFs, eg diathermy and transcranial magnetic stimulation

## Transport

Electrically-powered trains and trams (for overhead line equipment and third rail you should also refer to 'Electrical supply' in this table)

Radar, air traffic control, weather and long range

## Military activities

Maintenance of radar or high-powered communications systems

# Action levels and exposure limit values

23 The requirements in the CEMFAW Regulations are based on two sets of values related to EMFs: ALs and ELVs. These physical quantities are based on the recommendations of the International Commission on Non-Ionizing Radiation Protection (ICNIRP); more information can be accessed via the ICNIRP<sup>3</sup> web pages.

24 ELVs are the legal limitations on the exposure of employees to EMFs and primarily relate to the levels of exposure to EMFs within the body. These are often impossible or difficult and expensive to measure directly. For this reason a separate set of values, known as ALs, has been produced relating to quantities which can be measured more easily.

## Action levels

25 ALs have two main purposes.

- Certain ALs may be used to demonstrate that EMF levels are below particular ELVs.  
If the AL is not exceeded, exposure cannot exceed the corresponding ELV. If the AL is exceeded, further consideration and assessment is required to determine whether the corresponding ELV may be exceeded. It is still possible, and it is often the case, that the corresponding ELV will not be exceeded.  
  
Simple measures to reduce exposure may be the easiest way to make sure that exposure is beneath the relevant ELV, eg by moving your employee further away from the EMF source, or by installing screening – see ‘Is an action plan needed?’.
- Indirect-effect ALs are not tied to a particular ELV; instead they detail the EMF levels above which particular indirect effects may take place, such as:
  - interference with pacemakers; or
  - the risk of ferromagnetic objects becoming projectiles in the vicinity of strong magnet.

The indirect-effect ALs are the Low ALs in Table AL1, and the ALs in Tables AL5 to AL7, in the schedule to the CEMFAW Regulations.

26 You will already be expected to know what these risks are and factor them in to your risk assessment. The indirect-effect ALs do not cover all indirect effects – employees at risk of the remaining effects, such as the potential initiation of electro-explosive devices, are included in the definition of ‘employees at particular risk’ (employees near these hazards will be at particular risk of the indirect effects).

27 Further information on ALs can be found in the schedule to the CEMFAW Regulations and at Annex 1.

## Exposure limit values

28 ELVs are limits specified to protect your employees from the health and sensory effects of EMFs. Health-effect ELVs are used to prevent possible harm from the heating of tissue and electrical stimulation of nerve and tissue caused by exposure to EMFs. Sensory-effect ELVs are used to prevent effects such as magnetophosphenes (a flickering sensation), or a feeling of nausea, vertigo or a metallic taste caused by static magnetic fields.

29 Table 2 provides a list of sources of EMFs where employees will not be exposed to EMFs in excess of any ELV.

30 Tables 3, 5, 6 and 7 provide details of sources of EMFs which may exceed particular ALs or ELVs, and may need a more detailed assessment of exposure.

## Exceeding the ELVs

31 In certain circumstances the ELVs can be exceeded.

- Exposure may exceed the sensory-effect ELVs during work activities as long as the applicable safety conditions stated in the schedule to the CEMFAW Regulations are met. You will not need to produce an exposure action plan and no further risk assessment will be needed **unless** exposure exceeds any of the indirect-effect ALs or the workplace includes employees at particular risk. Where any sensory effects are reported to you, the risk assessment must be updated as necessary.

- HSE may exempt specific work activities from the exposure limits stated in the regulations; you should refer to the information contained on HSE's Non-ionising radiation web pages<sup>4</sup> to determine if your work activity is included. Any exemption is subject to the employer meeting safety conditions – see 'Exemption'.

### **Workplaces accessible to the general public**

Employers with workplaces which are accessible to the general public, and which meet the exposure limits specified in Council Recommendation 1999/519/EC<sup>2</sup> for the general public, will normally be in compliance with the CEMFAW Regulations 2016.

If you have five or more employees, you must keep a record that you have checked and are in compliance with the public exposure limits. If anything changes you will also have to review your assessment.

**You will not need to take any further action.**

## EMF exposure assessment

32 You must determine whether or not the exposure of employees to EMFs exceeds the ELVs. In order to determine that specific ELVs are not exceeded, you can assess exposure against the ALs – see the schedule to the CEMFAW Regulations and Annex 1.

### What information is already available?

33 Your assessment may take into account information already available, eg:

- information included in this guidance (Tables 2, 3, 5, 6 and 7 provide information to help you in your assessment);
- evidence from your own workplace, eg records of reports of any ill-health effects experienced by employees;
- emission information and other safety-related data provided by the manufacturer or distributor of equipment used in your workplace or any place where employees will be working for you;
- sector or industry standards and guidelines, as available;
- the EC's *Non-binding guide to good practice for implementing Directive 2013/35/EU: Electromagnetic fields*<sup>5</sup> (see volume 1 Practical guide and volume 2 Case studies);
- exposure databases, if available;
- information provided by trade associations and other industry bodies;
- Medicines & Healthcare Products Regulatory Agency (MHRA) guidance *MRI equipment in clinical use*.<sup>6</sup>

34 Regulation 11 of MHSW requires employers to cooperate to ensure the health and safety of their employees. Where a work activity is not under your control but may affect your employee as part of their work activity, information should be shared. For example: contractors working on the site of another employer, or if you have contractors working on your site, you should share information on the work activities your employees may encounter and the precautions to be taken.

35 It should be noted that under the MHSW Regulations, employees also have duties to undertake work activities safely and inform their employer of any work situation which could pose a serious and immediate danger to health and safety.

36 To demonstrate compliance with the ELVs, you may use the information from your EMF exposure assessment and compare it to the information for the appropriate AL. See Annex 1 for examples of how this information can be used.

### Is there a need to measure?

37 In most cases, you should be able to find enough information from material already available to allow you to undertake a suitable and sufficient assessment of the EMF levels. For many businesses, consulting the list in Table 2 may be enough to demonstrate that exposure does not exceed any ELV.

38 Employers may permit employees to be exposed in excess of the sensory-effect ELVs where the safety conditions stated in the schedule to the CEMFAW Regulations are met. Measurement or calculations should only be necessary for those employers where no exemption applies and information already available is insufficient to determine that the health-effect ELVs are not exceeded.

#### **Work activity exempted by HSE**

If your exposure assessment shows that your employees may be exposed to EMFs in excess of ELVs and it would be difficult to reduce exposure below the ELVs **(even though employees are kept safe during the work activity in which this may happen)**, HSE may be able to exempt the work activity. See 'Exemption'.

**You will not necessarily need to undertake any measurements or calculations in respect of a work activity to show that an exemption is needed.**

### Do I need to keep a record?

39 If you employ five or more employees you must keep a suitable record of:

- the significant findings from the most recent exposure assessment;

and, where required:

- the most recent action plan;
- the significant findings of the most recent risk assessment.

### Review your exposure assessment

40 You must review the exposure assessment when:

- there is reason to suspect it is no longer valid (see 'Is an action plan needed?');  
or
- there has been a significant change in the matters to which it relates.

41 You should then make any necessary changes to make sure it remains suitable and sufficient.

### Is an action plan needed?

42 Employers must devise and implement an action plan to ensure compliance with the exposure limits **unless**:

- the exposure assessment shows that the ELVs are not exceeded; or
- the exposure limits are only exceeded during:
  - work activities where the applicable safety conditions stated in the schedule to the CEMFAW Regulations are met (this only allows the sensory-effect ELVs to be exceeded); and/or
  - work activities covered by the MRI or military exemption; or
  - work activities exempted from the exposure limits by HSE.

43 If you need to produce an action plan, it must include consideration of:

- other working methods that entail less exposure to EMFs;
- the choice of equipment emitting less intense EMFs, taking account of the work to be done;
- technical and/or organisational measures that limit the duration and/or intensity of emission of EMFs, including, where necessary, the use of interlocks, screening or similar health protection mechanisms. In many situations ELVs are only exceeded where the employee is close to the EMF source; this can be remedied by moving the person further away from the EMF source or by installing screening (you should note that screening may not be effective for low-frequency work activities);
- the use of signage, access controls and floor markings. If areas are already suitably restricted for other reasons, cannot be entered accidentally, and if workers in the areas are informed of the risks arising from EMF exposure, signs may not be required;
- exposure to electric fields – measures and procedures to manage spark discharges and contact currents through technical means and through the training of workers;
- appropriate maintenance of equipment and design of workplaces and, when replacing or hiring equipment, consider selecting equipment which emits less intense EMFs;
- providing personal protective equipment, eg insulating shoes, gloves and other protective clothing, where appropriate.

44 You may wish to involve your trade union safety representatives or other worker representatives when deciding risk control measures.

45 If a work activity is exempt from the limits a formal action plan is not needed, but you will still need to ensure that exposure is as low as reasonably practicable. You may find it helpful to record how you are achieving this, but this is not a requirement.

### Is a risk assessment needed?

46 Where your exposure assessment demonstrates that:

- the ELVs are, or may be exceeded (even when this is permitted, eg by an exemption); and/or



- the indirect-effect ALs are exceeded; and/or
- you have employees at particular risk;

you must carry out an assessment of any risks to your employees arising from EMF exposure.

47 The risk assessment must include, as relevant, consideration of:

- the ALs and ELVs;
- the frequency of the EMFs, level, duration and type of exposure, including the distribution over the employee's body and the variations between areas in the workplace;
- direct effects;
- indirect effects;
- employees at particular risk;
- simultaneous exposure to multiple frequency fields;
- multiple sources of exposure;
- information available from the manufacturer of relevant equipment;
- information obtained from any appropriate health surveillance undertaken;
- the existence of replacement equipment designed to reduce the level of exposure to EMFs;
- other health and safety-related information.

48 You can find more information on risk assessment on HSE's Risk management web pages.<sup>8</sup>

### **Risk assessments**

**You must undertake a suitable and sufficient assessment of the risks arising from your employees' exposure to EMFs.**

**Where a risk assessment is required **and** you employ five or more employees you must:**

- **keep a suitable record of the significant findings of your most recent risk assessment; and**
- **keep a suitable record of the most recent action plan.**

### **Employees at particular risk**

49 You must give special consideration to the safety of employees at particular risk (even if you are in compliance with the exposure limits).

50 An employee at particular risk is:

- an employee who has declared to their employer a condition which may lead to a higher susceptibility to the potential effects of exposure to EMFs. This includes expectant mothers who have informed you of their condition and workers who have declared the use of active implanted medical devices (AIMDs), passive implanted medical devices (PIMDs) or body-worn medical devices (BWMDs); or
- an employee who works in close proximity to electro-explosive devices, explosive materials or flammable atmospheres.

51 Examples of devices and implants are shown in Table 4; more information is available in *Non-binding guide to good practice for implementing Directive 2013/35/EU: Electromagnetic fields*.<sup>5</sup>

52 If there are employees at particular risk in your workforce this does not necessarily mean that your workplace is more hazardous to them. It does mean that you will have to assess if there are specific additional risks and address any you identify.

**Table 4** Examples of implanted and body-worn devices

Active implanted medical devices	Passive implanted medical devices	Body-worn medical devices
Cardiac pacemakers	Orthopaedic implants or joints	Insulin pumps
Implantable cardiac defibrillators	Pins, plates, screws	Hormone infusion pumps
Cochlea implants	Surgical staples and clips, ie tubal ligation clips – used in female sterilisation and aneurism clips	Hearing aids
Brainstem implants	Stents	Continuous glucose monitoring systems
Inner ear prostheses	Heart valve prostheses	Metallized drug-delivery patches (over the counter or prescription)
Neurostimulators	Annuloplasty rings	
Retinal encoders	Intrauterine contraceptive device (IUD) or other metallic contraceptive implants	
Implanted drug infusion pumps	Penile implants – used to treat erectile dysfunction (impotence)	

53 You should refer to the information provided in this guide on controlling the risks and record details of any significant findings from the risk assessment and the controls you have put in place to minimise the risks, as appropriate.

### *Expectant mothers*

54 As working with certain levels of EMFs could result in a greater risk to an expectant mother, you should encourage your workers to advise you in writing if they become pregnant. You may wish to take a practical approach and limit the exposure of expectant mothers to the public exposure limits stated in Council Recommendation 1999/519/EC.

55 If risks to expectant mothers from EMFs are identified you must take appropriate action to eliminate, reduce or control the risks; they must be included and managed as part of the general workplace risk assessment. You will find more general information on HSE's web page on New and expectant mothers.<sup>9</sup>

56 Table 5 contains a non-exhaustive list of sources of EMFs which may pose specific risks to expectant mothers. You will need to consider these in addition to the information contained in Table 3 on sources of EMF which may exceed the ELVs and/or the indirect-effect ALs.

**Table 5** Sources of EMF which may pose a risk to expectant mothers

<b>Electrical supply</b>
Where workers need to be in close proximity to cables carrying high currents
<b>Light industry</b>
Automated induction heating systems: fault-finding and repair involving close proximity to the EMF source
Automated welding systems, fault-finding: repair and teaching involving close proximity to the EMF source
<b>Medical</b>
MRI equipment

*Passive implanted medical devices, active implanted medical devices and body-worn medical devices*

57 Some levels of EMFs could cause devices to malfunction or workers to receive injuries as a result of EMFs interacting with them. For example, very strong static magnetic fields could create turning forces that move ferromagnetic PIMDs and intermediate frequencies may cause them to heat up, which may lead to injury to the surrounding tissues.

58 Examples of these devices are:

- PIMDs: orthopaedic implants or joints, pins or screws and metallic contraceptive implants – see Table 6;
- AIMDs: cardiac pacemakers, implanted drug infusion pumps and cochlear implants – see Table 7;
- BWMDs: insulin pumps and hearing aids – see Table 6.

59 You should encourage workers to consider the information provided here and advise you if they may be affected. If they have implants or devices fitted, ask them to obtain information/instructions from the manufacturer of the medical device. If the device is implanted, they should also obtain advice from the medical professional who completed the implant procedure.

**Information on limiting exposure**

**In the absence of any specific advice, you may wish to take a practical approach and limit the exposure of workers fitted with active implants to the public exposure limits – see Council Recommendation 1999/519/EC.**

60 When conducting a risk assessment for workers with metallic PIMDs, you may want to consider the following:

- metallic PIMDs may warm up if your employee is exposed to time-varying EMFs. If the heating is sufficient, it can cause damage to the surrounding tissue; if the implant is less than 20 mm in size you can assume that heating effects will be minimal;
- some passive implants may contain ferromagnetic material which can be affected by static magnetic fields. Workers with implants containing ferromagnetic materials should not be exposed to static magnetic flux densities exceeding 3 millitesla (mT).

For more information on the procedures for the assessment of the exposure to EMFs of workers who have AIMDs (including the specific assessment for workers with cardiac pacemakers) see BS EN 50527.<sup>10,11</sup>

61 Tables 6 and 7 contain examples of sources of EMF which you should consider in addition to the information in Table 3 on sources of EMF where exposure of employees to EMFs is at levels which may pose a risk.

**Table 6** Sources of EMF which may pose a risk to workers with passive implanted medical devices

### Electrical supply

Where workers need to be in close proximity to cables carrying high currents

### Light industry

Automated induction heating systems, fault-finding and repair involving close proximity to the EMF source

Hand-held induction heating coils

Automated welding systems, fault-finding, repair and teaching involving close proximity to the EMF source

### Medical

MRI equipment

**Table 7** Sources of EMF which may pose a risk to workers with active implanted and active body-worn medical devices (and exceed the AL in the schedule to the CEMFAW Regulations, Table AL6)

### Wireless communications

Wireless communications devices (eg Wi-Fi or Bluetooth), including access points for WLAN

Use of cordless phones, DECT base stations and fax machines

Use of mobile phones

### Office

Audio-visual equipment containing radio-frequency transmitters

### Infrastructure (buildings and grounds)

Use of electric garden appliances

### Security

Article surveillance equipment and radio-frequency identification

Tape or hard drive erasers

Metal detectors

### Electrical supply

Work on generators or emergency generators and where workers need to be in close proximity to cables carrying high currents

Inverters, including photovoltaic systems

### Light industry

Arc welding processes including MIG, MAG and TIG

Industrial and large professional battery chargers

Corona discharge surface-treating equipment

Electrostatic painting equipment

Use of heat guns

Use of glue guns

Use of hand-held and portable tools, eg drills, sanders, circular saws and angle grinders

Furnaces resistively heated

Welding systems – working close to the EMF source, fault-finding and teaching

Automated induction heating systems, fault-finding and repair involving close proximity to the EMF source

Automated welding systems, fault-finding, repair and teaching involving close proximity to the EMF source

Radio-frequency heater/sealer equipment

Machine tools, eg pedestal drills, grinders, lathes, milling machines, saws

### **Medical**

---

MRI equipment

### **Construction**

---

Construction equipment, eg working close to concrete mixers, cranes etc

### **Transport**

---

Motor vehicles and plant – working close to starter, alternator and ignition systems in motor vehicles and workplaces

Maintenance of inverters used on mainline trains

### **Miscellaneous**

---

Battery chargers inductive or proximity-coupling

Equipment generating static magnetic fields greater than 0.5 mT, eg by magnetic chucks, tables and conveyors, lifting magnets, magnetic brackets, nameplates, badges

Headphones producing strong magnetic fields

Professional inductive cooking equipment

Two-way radios, eg walkie-talkies, vehicle radios

Battery-powered transmitters

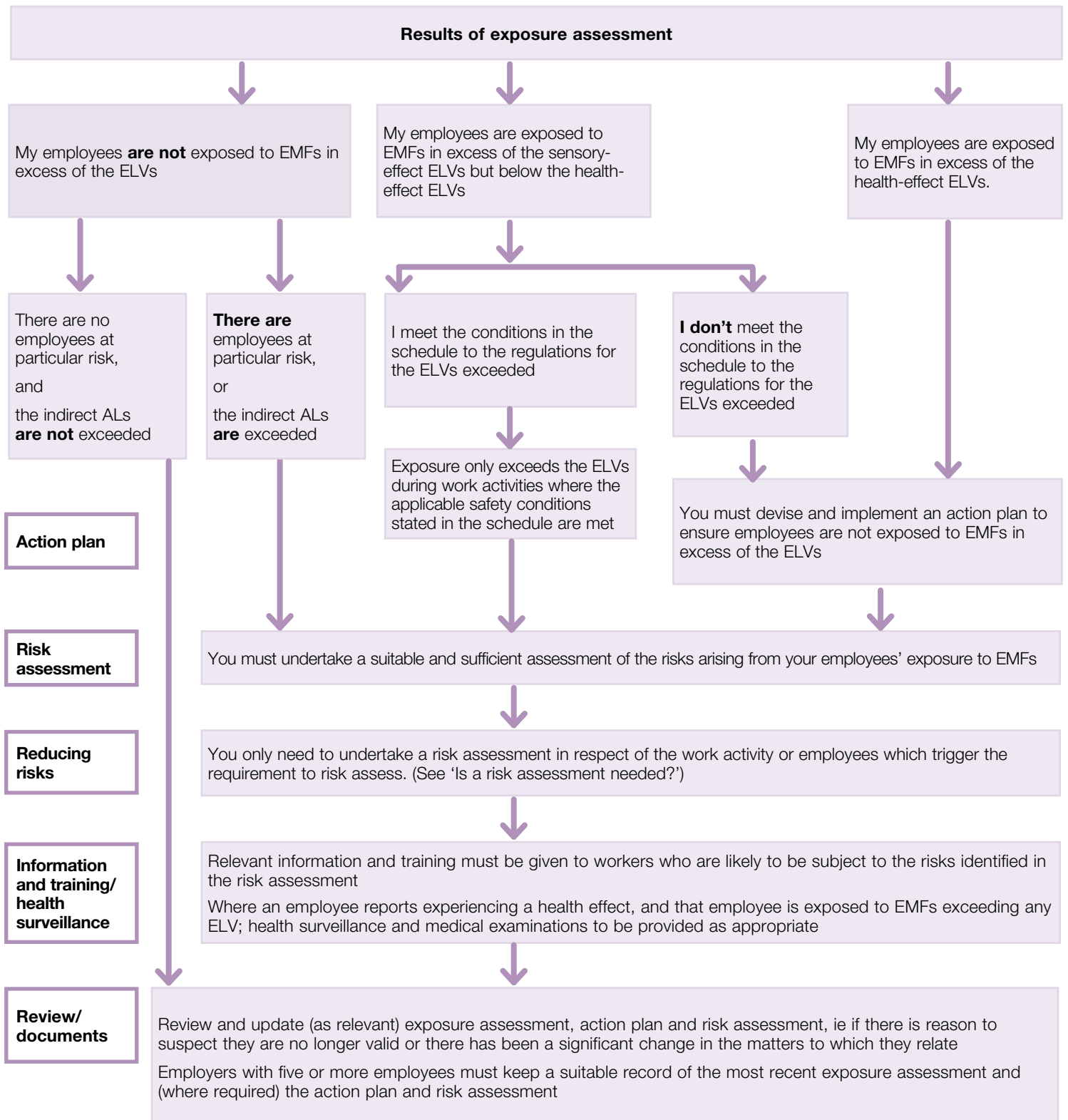
### **Military activities**

---

Maintenance of radar or high-powered communications systems

**Figure 1** Actions to take to comply with the CEMFAW Regulations after completion of the exposure assessment

This flow chart is for work activities for which **HSE has not issued an exemption** from the exposure limits. If your work activity has an exemption, please see the exemption flow chart at Figure 2.



# Exemption

## General exemption

62 HSE may exempt work activities from the exposure limits stated in the CEMFAW Regulations, however workers must be protected from the risk of harm from EMFs. An exemption would only be required where ELVs are, or are likely to be, exceeded.

63 If your work activity is exempt you will not have to comply with the exposure limits in respect of that activity, **but you will have to meet the exemption conditions**. These are:

- exposure is as low as reasonably practicable; even though exposure is permitted to be above the ELVs you are still required to bring exposure to the lowest levels you can, ie you must ensure the ELVs are exceeded to the lowest extent reasonably practicable. To help you with this you may wish to consider the information in 'Is an action plan needed?'; and
- your employees are protected against the health effects and safety risks posed by that exposure.

64 An exemption does not affect your other responsibilities under the CEMFAW Regulations, such as undertaking a risk assessment and providing suitable information and training. However, in most cases, you **will not be required** to develop an action plan or to use measurements or calculations in your exposure assessment. This is because such measurements etc are only required where it is necessary to demonstrate compliance with the exposure limits; however, employers will still need to make sure that workers remain protected against the health effects and safety risks posed by that exposure.

65 If you undertake a work activity for which you think you may need an exemption, you should refer to HSE's Non-ionising radiation web pages, where you will find information on activities which have been exempted by HSE.

66 To help you decide if you can use an exemption, refer to Figure 2 on the exemption process. More information is included on HSE's Non-ionising radiation web pages. You will not be required to notify HSE before you can benefit from the exemption, but you must always meet the exemption conditions.

## Use of magnetic resonance imaging (MRI) for medical purposes

67 The exposure limit requirements of the CEMFAW Regulations do not apply during the development, testing, installation, use and maintenance of, or research related to, MRI equipment for patients in the health sector, where:

- the exposure of employees to EMFs is as low as reasonably practicable as per the 1st bullet in paragraph 63; and
- employees are protected against the health effects and safety risks related to that exposure.

68 You will need to comply with all other requirements of the CEMFAW Regulations, except the requirement to develop an action plan.



69 For additional information see:

- EC's *Non-binding guide to good practice for implementing Directive 2013/35/EU: Electromagnetic fields*;
- MHRA's *MRI equipment in clinical use*.

### Use of MRI for other purposes

70 If MRI is used in any circumstances **not** related to patients in the health sector – and where the ELVs are exceeded – you should consider if HSE has granted an exemption for the activity by referring to Figure 2 and the information on HSE's Non-ionising radiation web pages.

### Military use of EMFs

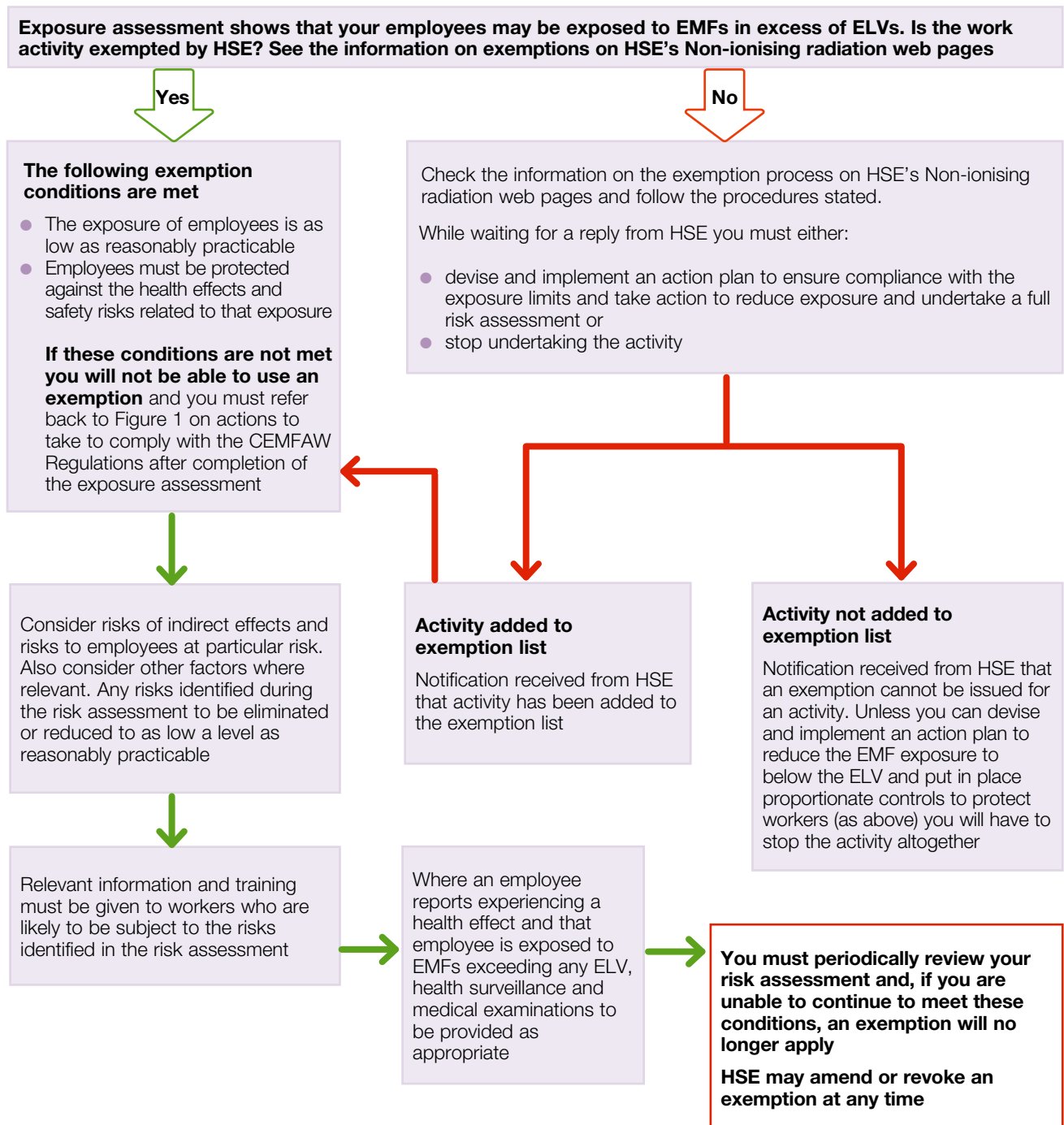
71 The exposure limit requirements of the CEMFAW Regulations do not apply to any activity in respect of which a suitable and sufficient alternative exposure limitation system is in place and where the activity is carried out:

- by a person acting in the capacity of a member of either Her Majesty's armed forces or a visiting force;
- by any civilian working with such a person; or
- on any premises or part of premises under the control of the Secretary of State for the purposes of the Ministry of Defence or the service authorities of a visiting force.

72 The other requirements of the CEMFAW Regulations, except the requirement to produce an action plan, apply in full.

73 If the ELVs are exceeded in any circumstances **not** related to personnel working in these situations, and it is deemed the circumstances are appropriate, you should consider if HSE has granted an exemption for the activity.

Figure 2 Flow chart demonstrating exemption process



## Information and training

72 If your assessment identifies that there are risks that need to be managed, you must provide relevant information and training for workers who are likely to be subject to those risks (and/or their representatives).

73 This information should include:

- an explanation of ALs and ELVs;
- details of possible health, sensory or indirect effects and what to do if these are experienced;
- details of the safe working practices you will adopt to eliminate or reduce risks arising from exposure;
- an explanation of any safety signage used;
- details of appropriate personal protective equipment;
- information for employees at particular risk such as:
  - workers who have declared the use of AIMDs, PIMDs or BWMDs;
  - expectant mothers who have informed you of their condition;
  - employees who work in close proximity to electro-explosive devices, explosive materials or flammable atmospheres;
- the circumstances in which they may be entitled to an appropriate medical examination and/or health surveillance.

## Health surveillance

74 The CEMFAW Regulations only relate to short-term effects resulting from exposure to EMFs and while it is possible to incur health effects (see Table 1), there is no well-established scientific evidence of long-term effects. Therefore, health surveillance is only likely to be necessary in very limited circumstances.

75 Where an employee is exposed to EMFs in excess of any health-effect ELVs and reports experiencing a health effect, you must make sure that health surveillance and medical examinations are provided as appropriate.

76 Any health surveillance and/or medical examination must be provided during hours chosen by the employee and a suitable record kept of any health surveillance and medical examinations undertaken.

77 HSE's website provides more information on health surveillance.<sup>12</sup>

# Annex 1

## Information to help you understand the terms used and comply with the limits stated in the Control of Electromagnetic Fields (EMFs) at Work (CEMFAW) Regulations 2016

### Definitions used in the CEMFAW Regulations

A *contact current* ( $I_c$ ) is the current created when a person comes into contact with an object in an EMF expressed in ampères (A). A steady-state contact current occurs when a person is in continuous contact with an object in an EMF. In the process of making such contact, a spark discharge may occur with associated transient currents.

*External electric field strength* ( $E$ ) is a vector quantity corresponding to the force exerted on a charged particle in the environment, irrespective of its motion in space, expressed in volts per metre ( $Vm^{-1}$ ).

*Internal electric field strength* ( $E$ ) is a vector quantity corresponding to the force exerted on a charged particle inside the human body, irrespective of its motion in space, expressed in volts per metre ( $Vm^{-1}$ ).

A *limb current* ( $I_L$ ) is the current induced in the limbs of a person exposed to EMFs in the frequency range from 10 MHz to 110 MHz, expressed in ampères (A). This may result from contact with an object in an EMF or the flow of capacitive currents induced in the exposed body.

*Magnetic flux density* ( $B$ ) is a vector quantity resulting in a force that acts on moving charges, expressed in teslas (T). In free space and in biological materials, magnetic flux density and magnetic field strength (H) are related by the magnetic permeability of free space ( $B = \mu H$ , where  $\mu = 4\pi \times 10^{-7} \text{ Hm}^{-1}$ ). These quantities can be interchanged using this relationship. A magnetic field strength  $H = 1 \text{ Am}^{-1}$  is approximately equivalent to a magnetic flux density of  $B = 1.25 \mu\text{T}$  (microtesla).

*Power density* ( $S$ ) is the radiant power incident perpendicular to a surface, divided by the area of the surface, expressed in watts per square metre ( $Wm^{-2}$ ). It is used for very high frequencies, where the depth of penetration in the body is low.

*Specific energy absorption* (SA) is the energy absorbed per unit mass of biological tissue, expressed in joules per kilogram ( $Jkg^{-1}$ ). It is used for establishing limits for effects from pulsed microwave radiation.

*Specific energy absorption rate* (SAR), averaged over the whole body or over parts of the body, is the rate at which energy is absorbed per unit mass of body tissue, expressed in watts per kilogram ( $Wkg^{-1}$ ). Whole-body SAR is a widely accepted quantity for relating adverse thermal effects to radio frequency (RF) exposure. Besides the whole-body average SAR, local SAR values are necessary to evaluate and limit excessive energy deposition in small parts of the body resulting from special exposure conditions. Examples of such conditions include: an individual exposed to RF in the low MHz range (eg from dielectric heaters) and individuals exposed in the near field of an antenna.

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.

The frequency of EMFs is expressed in hertz (Hz) or cycles per second. Multiples used are 1000 Hz or 1 kilohertz (kHz); 1 000 000 Hz or 1 megahertz (MHz) and 1 000 000 000 Hz or 1 gigahertz (GHz).

It is important to consider the potential for harmonic frequencies to be present and they should be taken into account in any assessment made.

A harmonic frequency is a whole-number multiple of the fundamental frequency of an EMF. For example, the mains AC power supply has a fundamental frequency of 50 Hz. The frequencies of the next harmonics are 100 Hz (2nd harmonic), 150 Hz (3rd harmonic). For equipment operating at other fundamental frequencies, these mains harmonics may be present in addition to the harmonics of the equipment's fundamental frequency and must all be assessed if they are significant potential sources of exposure.

### *Information to help you understand and use the tables in the schedule to the CEMFAW Regulations*

In the regulations, the action levels (ALs) and exposure limit values (ELVs) are set out in tables and grouped according to their potential effects:

- thermal effects, related to the heating of tissue due to its absorption of EMFs;
- non-thermal effects, related to the stimulation of nerves or sensory organs due to the presence of EMFs.

For exposures to EMFs with frequencies below 100 kHz, the heating effects are negligible. Tissue temperatures remain within the normal range for body temperature. In the 'overlap' frequency region between 100 kHz and 10 MHz the exposure assessment will need to consider whether the non-thermal effects or the thermal effects dominate. The two assessments are not added together.

The low ALs in Table AL1 in Part 2, and the ALs in Part 3 of the schedule to the regulations, specify the EMF levels above which specific indirect effects may occur.

The remaining ALs in Part 2 of the schedule to the regulations are defined physical quantities related to the direct biophysical effects of exposure to EMFs.

Employers may, as part of their exposure assessment, assess EMF levels against these ALs. Each AL table states which ELV or ELVs will be complied with if EMF levels at a particular frequency do not exceed that AL.

To demonstrate compliance with the ELVs, you may use the information from your EMF exposure assessment and compare it the information for the appropriate AL. The health-effect ELVs are linked to the energy absorbed in either the whole or part of the body and therefore may be averaged over six minutes.

- For example, when considering thermal effects, if the fields to which workers are exposed exceed the ALs, employers may be able to use time averaging to take account of variations in the intensity of fields over short periods (duty cycle). The values of the assessed field strengths are squared and then time averaged over six minutes. The square root of that time-averaged field strength should then be compared with the relevant AL value given in Table AL3 of the schedule to the regulations.

- When considering the induced limb current, the same consideration applies. The assessed limb current is squared and then time averaged over six minutes. The square root of the time-averaged limb current is compared to the AL given in Table AL4 of the schedule to the CEMFAW Regulations.

Exposure to EMF levels in excess of the AL may still be below the relevant ELV but the employer will have to undertake further assessment to determine this under regulation 5.

Except where otherwise indicated:

- 'f' is the frequency expressed in hertz;
- the ALs and ELVs relate to exposure in any part of the body;
- notes to the tables apply only to the table under which they appear.

The applicable safety measures referred to in regulation 4(2) are those required by the notes to the table, or tables, containing the sensory-effect ELV which is to be exceeded:

- the note to Table ELV1;
- note 2 to Tables ELV3 and ELV5.

## References and further reading

### References

- 1 *Management of Health and Safety at Work Regulations 1999* SI 1999/3242 The Stationery Office [www.legislation.gov.uk](http://www.legislation.gov.uk)
- 2 Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) 1999/519/EC <http://eur-lex.europa.eu/homepage.html>
- 3 International Commission on Non-Ionizing Radiation Protection (ICNIRP) webpages [www.icnirp.org/en/home/index.html](http://www.icnirp.org/en/home/index.html)
- 4 Non-ionising radiation [www.hse.gov.uk/radiation/nonionising/index.htm](http://www.hse.gov.uk/radiation/nonionising/index.htm)
- 5 *Non-binding guide to good practice for implementing Directive 2013/35/EU: Electromagnetic fields (in 3 volumes: Practical guide, Case studies and Guide for SMEs)* <http://ec.europa.eu/social>
- 6 *MRI equipment in clinical use* Medicines & Healthcare Products Regulatory Agency (MHRA) [www.gov.uk/government/publications/safety-guidelines-for-magnetic-resonance-imaging-equipment-in-clinical-use](http://www.gov.uk/government/publications/safety-guidelines-for-magnetic-resonance-imaging-equipment-in-clinical-use)
- 7 *Risk assessment: A brief guide to controlling risks in the workplace* INDG163(rev4) HSE 2014 [www.hse.gov.uk/pubns/indg163.htm](http://www.hse.gov.uk/pubns/indg163.htm)
- 8 Risk management [www.hse.gov.uk/risk](http://www.hse.gov.uk/risk)

9 New and expectant mothers [www.hse.gov.uk/mothers](http://www.hse.gov.uk/mothers)

10 BS EN 50527-1:2010 *Procedure for the assessment of the exposure to electromagnetic fields of workers bearing active implantable medical devices – General* British Standards Institution

11 BS EN 50527-2-1:2011 *Procedure for the assessment of the exposure to electromagnetic fields of workers bearing active implantable medical devices – Part 2-1 Specific assessment for workers with cardiac pacemakers* British Standards Institution

12 Health surveillance [www.hse.gov.uk/health-surveillance](http://www.hse.gov.uk/health-surveillance)

## Further reading

### *HSE publications*

*Safety signs and signals. The Health and Safety (Safety Signs and Signals) Regulations 1996. Guidance on Regulations L64* (Third edition) HSE 2015  
[www.hse.gov.uk/pubns/books/l64.htm](http://www.hse.gov.uk/pubns/books/l64.htm)

*Electromagnetic fields (EMF) in the welding environment* HSE Research Report 1018 2014 Prepared by TWI Ltd for the Health and Safety Executive  
[www.hse.gov.uk/research/rrhtm/rr1018.htm](http://www.hse.gov.uk/research/rrhtm/rr1018.htm)

### *Useful links*

More information about EMFs and links to other useful documents at [www.hse.gov.uk/radiation/nonionising](http://www.hse.gov.uk/radiation/nonionising)

*Directive 2013/35/EU on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields)* <http://eur-lex.europa.eu>

*Management of risk when planning work: The right priorities* [www.hse.gov.uk/construction/lwit/assets/downloads/hierarchy-risk-controls.pdf](http://www.hse.gov.uk/construction/lwit/assets/downloads/hierarchy-risk-controls.pdf)

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) [www.icnirp.org/en/home/index.html](http://www.icnirp.org/en/home/index.html) (as an independent organisation ICNIRP provides scientific advice and guidance on the health and environmental effects of non-ionising radiation)

## Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit [www.hse.gov.uk/](http://www.hse.gov.uk/). You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory, unless specifically stated, and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance.

British Standards can be obtained in PDF or hard copy formats from BSI: <http://shop.bsigroup.com> or by contacting BSI Customer Services for hard copies only Tel: 0845 086 9001 email: [cservices@bsigroup.com](mailto:cservices@bsigroup.com).

The Stationery Office publications are available from The Stationery Office, PO Box 29, Norwich NR3 1GN Tel: 0870 600 5522 Fax: 0870 600 5533 email: [customer.services@tso.co.uk](mailto:customer.services@tso.co.uk) Website: [www.tsoshop.co.uk](http://www.tsoshop.co.uk). (They are also available from bookshops.) Statutory Instruments can be viewed free of charge at [www.legislation.gov.uk](http://www.legislation.gov.uk) where you can also search for changes to legislation.

This document is available at: [www.hse.gov.uk/pubns/hsg281.htm](http://www.hse.gov.uk/pubns/hsg281.htm).