LONDON METROPOLITAN UNIVERSITY

Non-Ionising Radiation Policy

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1. Introduction

This Policy on Non-Ionising Radiation outlines the responsibilities of employees of the University under the Control of Artificial Optical Radiation at Work Regulations (2010) and EU Directive 2013/35/EU (The 'Electromagnetic Fields Directive'). The aim of this guidance is to assist staff and students in identifying potentially hazardous sources of non-ionising radiation; technical guidance on the control of exposure can be found in the two AURPO guidance documents available.

In all instances a suitable and sufficient risk assessment must have been completed as a requirement of the Management of Health and Safety at Work Regulations 1999 and under the Provision and Use of Work Equipment Regulations 1998 (PUWER) by a competent person who has also received training in both risk assessment and PUWER.

These regulations do not cover exposure to the sun however a link to relevant Health & Safety Executive Guidance is made available here:
https://www.hse.gov.uk/skin/sunprotect.htm

The Health and Safety Office have prepared separate guidance on the Management and Use of Lasers available here: H & S Standard ~ Management and Use of Lasers

2. Roles and responsibilities

2.1. Heads of School/ Department

Ensure that within their areas of responsibility the department risk registers identify Non-Ionising Radiation risks, and that effective risk controls are in place.
Ensure that relevant and responsible persons have the necessary training to assess risks arising from Non-Ionising Radiation

2.2. Responsible person (i.e. Project leads/Senior Managers/Principal Investigators)

- Ensure that any foreseeable risk of adverse health effects to the eyes or skin of employees as a result of exposure to non-ionising radiation is documented in a risk assessment.
- If necessary, measure or calculate, the levels of artificial optical radiation to which employees are likely to be exposed.
- Devise and implement an action plan comprising technical and organisational measures designed to prevent exposure exceeding the ELVs.
- Ensure the provision of training, instruction, and information to users of non-ionising radiation and other persons-at risk.
- Make arrangements for Health Surveillance when identified in a risk assessment or following an incident that it is required.
- Review the risk assessment at the scheduled intervals or earlier if necessary

2.3. Staff and students

- Participate in training provided

- Notifying the Responsible Person of any issues or hazards associated with the non-ionising radiation source
- Using personal protective equipment when and as instructed.

2.4. Occupational Health

Provision of Health Surveillance services as required.

2.5. Health & Safety Office

Provision of advice and guidance for the management of non-ionising radiation risks and control measures
Review of risk control arrangements through audit and inspection

3. Part One – Artificial Optical Radiation

This artificial optical radiation (AOR) procedure applies to activities using UV, IR and visible light sources that are not lasers, as part of the University business that present a significant risk to health and safety. It is likely that staff and students will be exposed to some form of artificial light at work/study, whether from general lighting, equipment or from a work process. Work with AOR can not only lead to damage to the eye and/or burns but can also cause damage to the skin.

It forms part of the University's Health and Safety Policy for controlling health and safety risks arising from AOR sources and compliance with the Control of Artificial Optical Radiation at Work Regulations 2010. The regulations require the University to protect the eyes and skin of employees and others from exposure to AOR by eliminating the risk, or reducing the risk to low a level as is reasonably practicable.

3.1. Scope

AOR includes light emitted from all artificial sources (i.e. light in all its forms such as ultraviolet, infrared and laser beams, but excluding sunlight). This procedure does not apply to non-photobiological hazards (i.e. no risk of burns or damage to the eye) under foreseeable conditions, such as natural light, domestic and office lighting, computer monitors, equipment displays and indicator lamps.

4. Sources of risk

The vast majority of light sources are known to be safe. Only those sources likely to cause harm need to be identified and appropriate measures taken. These are most likely to be sources of invisible optical radiation (UV and IR) where safety is not necessarily afforded by the aversion response.

The safety classification of non-coherent (not laser) sources is defined in BS EN 62471 and is based upon maximum accessible emission levels (i.e. ELVs). Lasers are a type of AOR however the classifications are slightly different (in ascending order of risk). The classification of the laser should be written on the laser product, if not then further technical advice should be sought from the supplier/manufacturer.
Four risk groups have been identified by BS EN 62471 with only the highest risk group presenting a significant risk of harm.

Exempt	No photo-biological hazard (i.e. no risk of burns or damage to the eye) under foreseeable conditions e.g. Domestic and Office lighting, computer monitors, equipment displays and indicator lamps
Risk Group 1	**Low Risk**: limited by normal behaviour on exposure. Safe for most applications - requires prolonged direct eye exposure to cause discomfort or harm e.g. Bright torch.
Risk Group 2	**Moderate risk:** the risk is limited by the aversion response (blinking) to very bright light sources. However, such reflex responses do not occur universally. Be wary of situations in which people may be staring at a light source, sources of invisible optical radiation where the aversion response is not effective; situations where young people may be involved or where people involved may be the under the influence of drugs or alcohol.
Risk Group 3	**High Risk**: May pose a risk of harm even from a brief exposure, such as welding. Training and safety control measures required for sources falling into this category include written schemes of work and contingency plans for accidents. ELVs do exist for some hazardous wavelength bands. Further information is available in the AURPO Guidance.

Below is a list of potentially hazardous sources identified, as well as those sources that do not pose a hazard so that time and effort is not wasted on these (see Appendix A for additional information). This list is not exhaustive, and the EC non-binding guide gives a more extensive review of optical sources.

Potential hazardous light sources	**Identified light sources where aversion response should ensure safety but *staring at these sources for long periods or being in close proximity could be a problem*[1]**	**Identified safe light sources**
Metal working-welding and plasma cutting[2]	High pressure mercury floodlights	All forms of ceiling mounted lighting in offices
Pharmaceutical and research – UV fluorescence and sterilisation systems	Medical theatre and task lights including foetal transilluminators and x-ray viewing boxes	Compact fluorescent lamps and tungsten halogen lamps >60cm from user
Hot industries with furnaces	Interactive whiteboards	All forms of task lighting (includes desk lamps etc.)
Printing- UV curing processes	Vehicle headlights	Vehicle lights other than headlights
Motor vehicle repairs – UV curing processes	Desktop projectors	Computer type displays
Medical and cosmetic treatments	UV insect traps	Photographic flash lamps
		Gas-fired overhead heaters
		Photocopiers

[1] Of the sources listed in this section, the Interactive whiteboards are the least likely to exceed ELVs, but should be treated with caution, avoiding extended periods in proximity with- or staring at- them, as it is possible that the aversion responses will not operate.

[2] Precautions should already be taken for all the identified hazardous situations e.g. welders' goggles, visors and gloves for welding (adventitious UV) and hot metal work, visors for UV work.

5. Risk assessment

High risk sources of AOR must be identified in the Departmental Hazard Register. A full risk assessment will need to consider all the hazards associated with the work activity. The Responsible Person must ensure that any risk of adverse health effects to the eyes or skin of employees as a result of exposure to artificial optical radiation which is identified in a risk assessment and documented. There must be in place a suitable and sufficient assessment of the exposure risk for the purpose of identifying the measures needed to eliminate or, where this is not reasonably practicable, reduce risk to as low a level as is reasonably practicable.

It is important to stress that the Regulation requires “risks” to be eliminated or reduced to a minimum. This does not necessarily mean that the amount of optical radiation should be reduced to a minimum. Clearly, turning all the lights out will compromise safety and increase the risk of injury

5.1. Considerations

The risk assessment must include consideration of the following:

5.2 The level, wavelength, and duration of exposure

This is the fundamental information about the scenario considered. If the exposure level is significantly below the exposure limit that would apply for exposure for a complete working day (assumed to be 8 hours) then no further assessment is required unless exposure to multiple sources are a concern

5.3. The ELVs

Sometimes the hazard is obvious and the precautions to be taken well established, and as such measurements may not need to be taken as part of the risk assessment. However, a lot depends on the information that has been provided by the manufacturer in relation to lamp output. With good data, calculations can be made to establish safe working distances and the relative hazard at normal working positions. Prospective purchasers should ask manufacturers/suppliers for the relevant information and, if this is not forthcoming, alternative products should be sought.

From the information in 5.2, it should be possible to identify the applicable exposure limit values. It is necessary to know the wavelength range of the optical radiation before the correct ELV can be selected.

There may be times then when measurements need to be taken and this will necessitate the use of some specialist equipment that might not be readily available. Please contact the Safety Office for further assistance for specialist measurements.

The effects of exposure on employees or groups of employees whose health is at particular risk from exposure

The approach should be reactive rather than proactive. There may be some workers who know that they are particularly sensitive to flickering light, for example. The responsible person must then consider whether modifications to the work activity can be introduced.

Any possible effects on the health and safety of employees resulting from interactions between artificial optical radiation and photosensitising chemical substances

It is suggested that responsible persons should specifically consider the possibility of photosensitisation from chemical substances used in the workplace. However, as with 4.1.3, the responsible person may need to react to issues raised by workers where the photosensitivity is caused by chemical substances used outside of the workplace

Any indirect effects of exposure on the health and safety of employees such as temporary blinding, explosion, or fire

Eye exposure to bright lights may be an issue for some work practices. The normal aversion responses should provide a level of protection at exposure levels below the ELV. However, the responsible person should consider sources of artificial optical radiation that may cause distraction, dazzle, glare, and afterimages, where such exposures could compromise the safety of the worker or others.

The optical radiation from some artificial optical radiation sources may be capable of causing an explosion or a fire, especially in environments where flammable or explosive agents may be present.

The availability of alternative equipment designed to reduce levels of exposure

This should be considered where the exposure of workers to artificial optical radiation above the ELVs is possible

Appropriate information obtained from health surveillance, including where possible published information

This information may come from within the employer's organisation, from industry representative groups or from international organisations such as the World Health Organisation and the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

Multiple sources of exposure

From the information obtained in 4.1.1 and 4.1.2, it may be possible to determine the proportion of the exposure limit that will be provided by each artificial optical radiation source. A simplified approach will be to consider this for the number of sources that may expose workers and add the proportions. If the sum is less than one, then the ELVs are unlikely to be exceeded. If the sum exceeds one, then a more detailed assessment will be required

For a single source, if the exposure at the location of the worker is less than 20 % of the ELV for a full working day, then it might be considered trivial. However, if there are 10 such sources, then the exposure from each source would need to be less than 2 % of the ELV to be considered trivial

Any class 3B or 4 laser that is classified in accordance with the relevant International Electrotechnical Commission standard that is in use by the employer and any artificial optical radiation source that is capable of presenting the same level of hazard information provided by the manufacturers of artificial optical radiation sources

Class 3B and Class 4 laser products emit accessible laser radiation that could lead to the ELVs being exceeded.

However, under some circumstances, lower hazard class lasers may also need assessment. BS EN 62471 assigns non-laser artificial optical radiation sources into a different classification scheme. Consideration should also be given to the likely exposure scenarios for all risk groups

Information provided by the manufacturers of optical radiation sources and associated work equipment in accordance with the relevant Community Directives.
Responsible persons should request adequate information from manufacturers and suppliers of artificial optical radiation sources and products to ensure that they can undertake the assessments required by the Regulations

5.4 Review

The risk assessment must be reviewed at specified intervals, or sooner if there is reason to suspect that it is no longer valid; or there has been a significant change in the work to which the assessment relates

6. Controls

The Responsible Person must devise and implement an action plan comprising technical and organisational measures designed to prevent exposure exceeding the ELVs.

This action plan must take into account

- Other working methods.
- Choice of appropriate work equipment emitting less artificial optical radiation.
- Technical measures to reduce the emission of artificial optical radiation including, where necessary, the use of interlocks, shielding or similar health protection mechanisms.
- Appropriate maintenance programmes for work equipment, workplaces, and workstation systems.
- The design and layout of workplaces and workstations; • limitation of the duration and level of the exposure.
- The instructions of the manufacturer of the equipment.
- The requirements of employees belonging to particularly sensitive risk groups.
- The availability of personal protective equipment.

If, despite the measures taken above, employees are still exposed to levels of artificial optical radiation that exceed the ELVs, the responsible person must take immediate action to—

- Reduce exposure to below the ELVs.
- Identify the reasons why employees have been exposed to levels which exceed the ELVs
- Modify the measures taken to prevent employees being exposed again to levels which exceed the ELVs.

All available information about the sources of optical radiation and the possible personal exposure should be gathered. In general, a comparison of either the radiation exposure obtained from the equipment specifications or measured data together with

the applicable ELV(s) allows an assessment of a personal workplace exposure to optical radiation. The aim is to get an unambiguous result stating whether the applicable limit value(s) is likely to be exceeded or not.

If a clear statement can be made that optical radiation exposure is insignificant and that the ELVs will not be exceeded, no further action is necessary.

If emissions are significant and/or occupancy is high, it may be possible that the limits will be exceeded and that some form of protective measures will be required. The assessment procedure should be repeated after the application of protective measures.

Repetition of the measurement and assessment may be necessary if:

- The radiation source has changed (e.g. if another source has been installed or if the source is operated under different operating conditions).
- The nature of the work has changed.
- The duration of exposure has changed.
- Protective measures have been applied, discontinued, or changed.
- A long period of time has elapsed since the last measurement and assessment so that the results may no longer be valid.
- A different set of ELVs is to be applied.

6.1 Protection of eyes and skin

Reduction of unintended exposure to optical radiation should be included in the design specifications of the equipment. Exposure to optical radiation should be reduced, as far as reasonably practicable, by means of physical safeguards, such as engineering controls. Personal protective equipment should only be used when engineering and administrative controls are impracticable or incomplete.

For occupational exposure to optical radiation, the areas of the skin most usually at risk are the hands, the face, the head and the neck, as other areas are generally covered by working clothes. The hands can be protected by wearing gloves with low transmission to hazardous optical radiation. The face can be protected by an absorbing face shield or visor, which may also offer eye protection. Suitable headwear will protect the head and neck.

The eye is at risk of injury from optical radiation if exposures are in excess of the ELVs. If the other measures are inadequate to control the risk of eye exposure in excess of any applicable ELVs, eye protection recommended by the equipment manufacturer or optical radiation safety advisor and specifically designed for the wavelengths and output should be worn.

Protective eyewear should be clearly marked with the wavelength range and corresponding protection level. This is particularly important if there are multiple sources that require different types of protective eyewear, such as different wavelength lasers that require their own unique eyewear.

Additionally, it is recommended that an unambiguous and robust method of marking the safety eyewear should be employed to ensure that there is a clear link to the particular equipment for which PPE has been specified.

The level of attenuation of optical radiation provided by protective eyewear in the hazard spectral region should be, at least, sufficient to decrease the exposure level below applicable ELVs.

Luminous transmittance and the colour of the environment as seen through the protective filters are important characteristics of eyewear which may affect the operator's ability to perform the required operations without compromising non-optical radiation safety.

Personal protective equipment should be correctly stored, regularly cleaned, and subject to a defined inspection regime

6.2. Local Rules

Where the risk assessment identified a potential for exposure to hazardous level of optical radiation, it is appropriate to put in place a system of written safety instructions (or Local Rules) to regulate how work with optical radiation is carried out. These should include a description of the area, contact details for relevant personnel, details of who is authorised to use the equipment, details of any pre-use tests required, operating instructions, an outline of the hazards, and details of contingency arrangements.

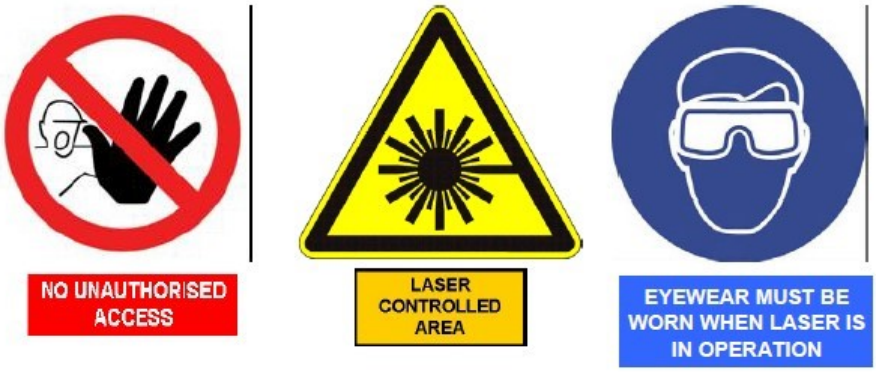
Local Rules should normally be available in the areas to which they relate and should be issued to all those affected by them

6.3. Demarcation

A controlled area may need to be designated where access to optical radiation in excess of the ELV is likely. A controlled area should be one to which access is restricted, except to authorised persons. This should preferably be by physical means, for example, using the walls and doors of the entire room. The area may be restricted by locks, number pads, or barriers. Arrangements should be put in place for the formal authorisation of users by management.

6.4. Signage

Safety signs are only effective if they are clear and unambiguous, and if they are displayed only when appropriate – otherwise they are often ignored.
Warning signs may include information about the type of equipment in use. If there is a requirement for personnel to use personal protective equipment, then this should also be indicated. Warning signs are more effective if they are displayed only when the equipment is in use. All safety signs should be placed at eye level to maximise their visibility.



Typical signs used in the work environment to advise of hazards and recommend the use of personal protective equipment

7. Training

Users of AOR sources and other persons at-risk from exposure to artificial optical radiation must be provided with suitable and sufficient information and training relating to the outcome of the risk assessment, and this must include the following—

- The significant findings of the risk assessment, including any measurements taken, with an explanation of those findings.
- The technical and organisational measures in place to eliminate or reduce risks
- The ELVs.
- Why and how to detect and report adverse health effects to the eyes or skin.
- The circumstances in which employees are entitled to appropriate health surveillance.
- Safe working practices to minimise the risk of adverse health effects to the eyes or skin from exposure to artificial optical radiation; and
- The proper use and maintenance of personal protective equipment.

The responsible person must ensure that any person, whether or not that person is an employee, who carries out work in connection with the AOR task/activity/equipment has suitable and sufficient information and training.

8. Registration and records for AOR users

There should be a formal process for evaluating the suitability of personnel prior to authorisation and this should include an assessment of their training, competence, and knowledge of the Local Rules.

The results of this assessment should be recorded, and the names of all authorised users should be recorded in a formal register.

The responsible person will identify potential AOR users in the risk assessment and ensure that any person working with any high risk sources are registered with the department using the Laser User Authorisation – Training Record Form.

Records of AOR users must be retained by the School/Department in their shared safety drive or alternative documentation management and retention system.

9. Emergency procedure and incident reporting

If eyes or skin have been exposed to AOR please seek medical assistance immediately. Staff must know the emergency details which make up the departmental risk controls. Health and Safety incidents must be reported as soon as possible.

If the exposure limits are thought to have been exceeded or if the adverse health effect or identifiable disease is considered to have been caused by artificial optical radiation in the workplace then the following actions should be triggered:

- The person affected should be informed of the results
- The person affected should receive information and advice regarding follow-up health surveillance
- The manager/supervisor of the person affected should be informed, respecting any medical confidentiality
- The manager/supervisor of the person affected should review the risk assessment
- The manager/supervisor of the person affected should review the existing control measures (which may involve
- seeking specialist advice)
- The manager/supervisor of the person affected should arrange any necessary continued health surveillance

10 Health Surveillance

If the risk assessment indicates that there is a risk of adverse health effects to the eye/skin of staff as a result of exposure to artificial optical radiation, or that exposure limits have been exceeded, the relevant staff must be placed under suitable health surveillance. For more information please contact the Occupational Health Service.

11. References

- Health and Safety (Signs and Signals) Regulations 1996
- ICNIRP guidelines on limits of exposure to incoherent visible and infrared radiation
- Guidance for employers on the control of artificial optical radiation at work regulations 2010
- Control of Artificial Optical Radiation at Work Regulations 2010
- EU: Non-binding guide to good practice for implementing directive 2006/25/EC Artificial Optical Radiation
- HPA advice on radiation
- BS EN 62471:2008 Photobiological safety lamps and lamp systems

12. Part 2 – Electromagnetic Fields

13. Sources of Electromagnetic Fields

The extent and magnitude of electromagnetic fields produced will depend on the voltages, currents, and frequencies that the equipment operates at or generates, along with the design of the equipment. Some equipment may be designed to intentionally generate external electromagnetic fields.

In this case, small low-powered equipment may give rise to significant external electromagnetic fields. Generally, equipment that uses high currents, high voltages or that is designed to emit electromagnetic radiation will require further assessment.
Below is a summary of the health and sensory effects used to limit exposures in different frequency regions:

Table 1 - Summary of relevant health and sensory effects used to limit exposures in different frequency regions.

Field and frequency	Sensory effects	Health effects
Static magnetic field **0 - 1 Hz**	Vertigo, nausea, metallic taste	Altered blood flow in limbs, altered brain function. Altered heart function
Low frequency fields **1 Hz - 10 MHz**	Phosphenes (perceived as light flashes). (Minor change in brain function 1 - 400 Hz)	Tingling sensation or pain (nerve stimulation) Muscle twitches Disturbed heart rhythm
High frequency fields **100 kHz - 6 GHz**	Microwave hearing effect (200MHz - 6.5 GHz)	Excessive whole-body or localised heating or burns
High frequency fields **6 - 300 GHz**		Localised heat damage to eyes or skin
NB: The effects of intermediate frequency fields (100 kHz - 10 MHz) are a combination of the effects of low frequency fields and high frequency fields.		

The magnitude of an electromagnetic field will decrease rapidly with distance from its source. Worker exposure can be reduced if it is possible to restrict access to areas close to the equipment when the equipment is in operation. It is also worth remembering that electromagnetic fields, unless generated by a permanent magnet or superconducting magnet, will normally disappear when the power is removed from the equipment.

The first step towards the identification of EMF hazards is to identify activities and equipment giving rise to electromagnetic fields in the workplace (see Appendix A).

14. Effects of exposure

The type of effect that electromagnetic fields have in people depends primarily on the frequency and intensity: other factors such as the shape of the waveform may also be important in some situations. Some fields cause stimulation of sensory organs, nerves, and muscle, while others cause heating. The effects caused by heating are termed *thermal effects*, while all other effects are termed *non-thermal effects.* The effects caused by exposure are transient being limited to the duration of exposure, and they will stop or decrease once exposure ceases. This means that there can be no further risk to health once exposure has ended.

EMF in the workplace may cause direct or indirect effects. Direct effects are those arising from an interaction of the fields with the body and may be either non-thermal or thermal in nature. Indirect effects result from the presence of an object in the field resulting in a safety or health hazard.

14.1. Direct effects

Direct effects are changes that occur in a person as a result of being exposed to an electromagnetic field. For example:

- Vertigo and nausea from static magnetic fields (typically associated with movement, but may also occur when stationary)
- Effects on sense organs, nerves, and muscles from low frequency fields (up to 100 kHz)
- Heating of the whole body or parts of it from high frequency fields (10 MHz and above); above a few GHz heating is increasingly limited to the surface of the body
- Effects on nerves, muscles, and heating from intermediate frequencies (100 kHz — 10 MHz)

14.2. Indirect effects

Undesirable effects may occur due to the presence of objects in the field resulting in a safety or health hazard. The indirect effects are:

- 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
- 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

15. Persons at particular risk

Table 2 lists groups of workers that are considered to be at particular risk from electromagnetic fields. These workers may not be adequately protected by the Action Levels (ALs) specified in the EMF Regulations and so it is necessary for Managers to consider their exposure separately to that of other workers

Table 2 - Examples of workers at particular risk

Workers at particular risk	Examples
Workers wearing active implanted medical devices (AIMD)	Cardiac pacemakers, cardiac defibrillators, cochlear implants, brainstem implants, inner ear prostheses, neurostimulators, retinal encoders, implanted drug infusion pumps
Workers wearing passive implanted medical devices containing metal	Artificial joints, pins, plates, screws, surgical clips, aneurism clips, stents, heart valve prostheses, annuloplasty rings, metallic contraceptive implants, and cases of AIMD
Workers wearing body-worn medical devices	External hormone infusion pumps
Pregnant workers	

Workers at particular risk will normally be adequately protected by compliance with the reference levels specified in *Council Recommendation 1999/519/EC.* However, for a very small minority even these reference levels may not provide adequate protection. These individuals will have received appropriate advice from the medical practitioner responsible for their care, and this should assist the responsible Line Manager to establish whether the individual is at risk in the workplace.

15.1. Active implanted medical devices (AIMDs)

Strong electromagnetic fields may interfere with the normal operation of AIMDs making workers wearing AIMDs at particular risk. There is a legal requirement for device manufacturers to ensure that their products have reasonable immunity to interference, and they are routinely tested for field strengths that might be encountered in the public environment.

As a result, field strengths up to the reference levels specified in *Council Recommendation 1999/519/EC* should not adversely affect the operation of these devices. However, field strengths above these reference levels ***at the position of the device or its sensing leads*** (when present) may result in a malfunction, which would present a risk to those wearing them. For example, the field produced by a mobile phone could interfere with a cardiac pacemaker if the phone were held close to the device. Nevertheless, people wearing cardiac pacemakers can still use mobile phones without being at risk. They simply must be careful to keep the phone away from the chest

Appendix A identifies those situations where a specific assessment is required for workers wearing active implants due to the possibility that strong fields could be generated in the immediate vicinity of the device or its sensing leads (when present). Often the outcome of this assessment will be that the worker should simply follow the instructions given to them by their medical team when the implant was fitted

Where workers or others fitted with active implants have access to a workplace, the responsible Manager will need to consider whether a more detailed assessment is required. In this context it should be noted that for several work situations listed in Appendix A, a distinction is made between someone personally carrying out an activity and the activity occurring in the workplace. The latter situation is unlikely to result in a strong field in the immediate vicinity of the implant and so an assessment is not normally required.

16. Risk Assessment

16.1. Requirements for a risk assessment

Managers must ensure they complete a risk assessment if they have the types of equipment of workplaces listed in Appendix A.
Managers must ensure they revisit this table in the event that their employees fall under the category of “persons at particular risk” (refer to Table 2 above).

So far as is reasonably practicable, the risks identified in the most recent risk assessment should be eliminated or reduced to an acceptable level. Measures taken must be based on the general principles of prevention, which are: **elimination, substitution, engineering; administration and PPE** (for more information see Risk Assessment Policy).

Take into account technical progress, the potential to restrict access to parts of the workplace, and the availability of measures to control the production of electromagnetic fields at source. The risk assessment must include consideration of, where relevant—

a) The ALs and ELVs.
b) The frequency range, level, duration, and type of exposure, including its distribution over the employee’s body and the workplace.
c) Direct biophysical effects.
d) Replacement equipment designed to reduce the level of exposure.
e) Information obtained from any health surveillance or medical examinations provided under regulation 11.
f) Information provided by the manufacturer or distributor of equipment.
g) multiple sources of exposure.
h) Simultaneous exposure to multiple frequency fields.
i) Indirect effects.
j) Any effects on employees at particular risk; and
k) Other health and safety related information.

16.2. Compliance Assessments

16.3 ELVs and ALs

Exposure to electromagnetic fields can produce different effects depending on the frequency. As a result the EMF Regulations provide exposure limit values (ELVs) for:

- Non-thermal effects (0 — 10MHz)
- Thermal effects (100kHz — 300GHz)

It follows from this that it is generally necessary to know the frequency (or frequencies) of the electromagnetic field before the correct ELV can be selected. It can be seen that the two ranges overlap. Hence in the intermediate frequency range (100 kHz — 10 MHz) both thermal and non-thermal effects can occur and so both ELVs need to be considered.

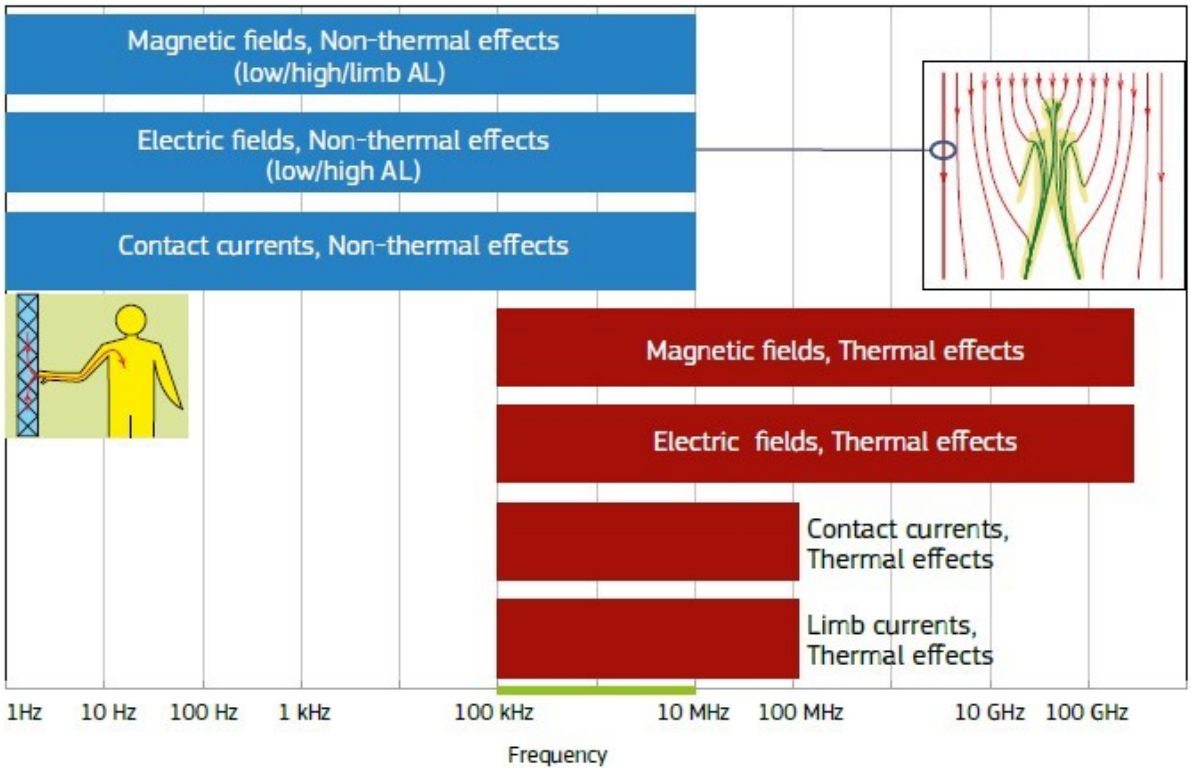


Figure 1 - Range of frequencies over which different ALs are applicable (Non-binding guide to good practice for implementing Directive 2013/35/EU)

The EMF Regulations provides actions levels (ALs) that are set in terms of external field quantities that can be measured or calculated relatively simply. These ALs are derived from the ELVs using conservative assumptions and **so compliance with the relevant AL will always ensure compliance with the corresponding ELV.** However, it is possible to exceed an AL and yet still comply with the ELV.

The comparison with ALs or ELVs forms an input into the risk assessment process. If compliance with ALs cannot be demonstrated, then Managers may decide to assess against the ELVs instead. For most Managers it will be simpler to demonstrate compliance with action levels than exposure limit values, although compliance distances may well be larger for the former than the latter. Action levels are also provided for some, but not all, indirect effects. Action levels and exposure limit values will not normally provide sufficient protection for workers at particular risk.

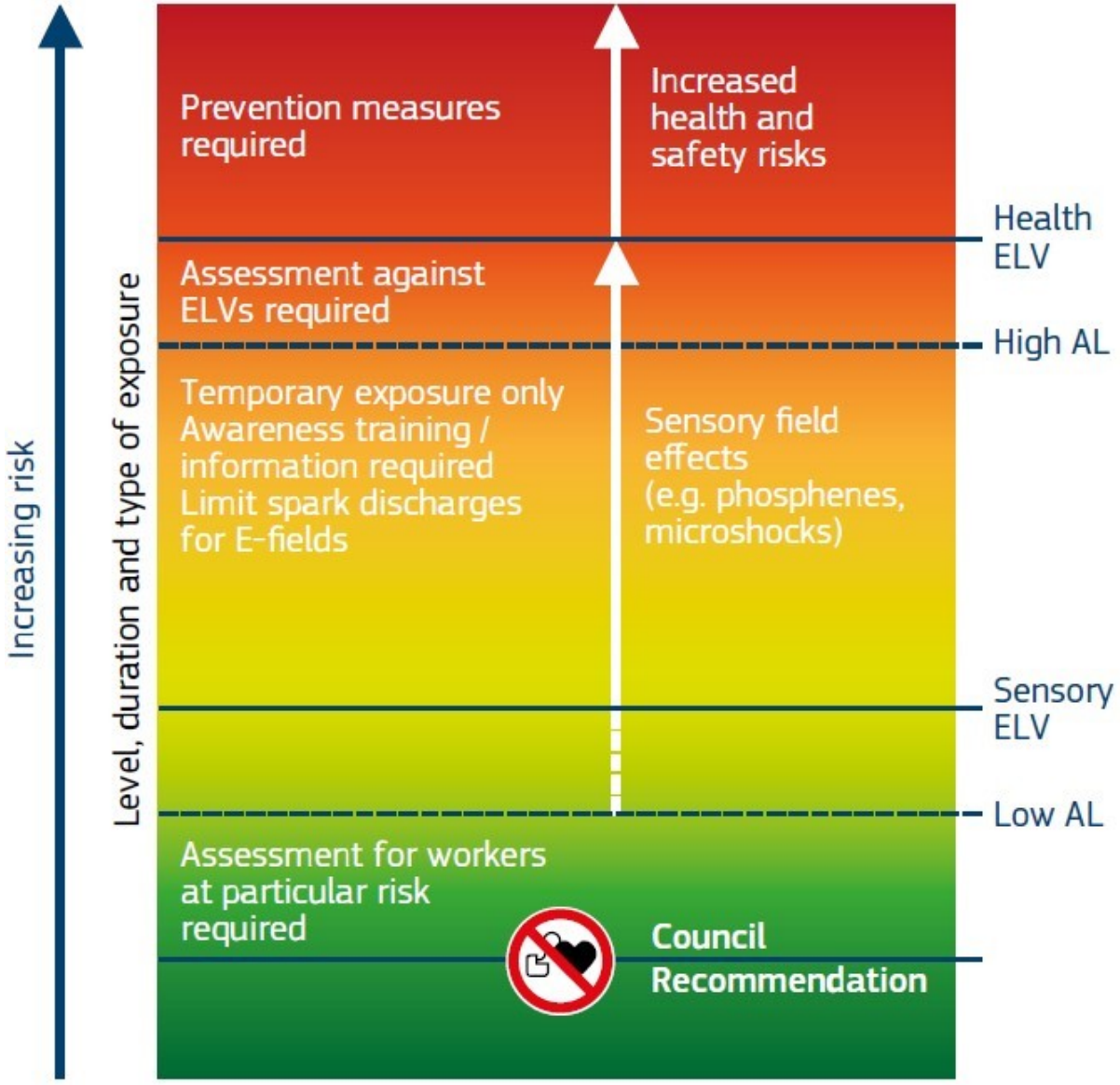


Figure 2 - Schematic showing relationship between ELVs and ALs (Non-binding guide to good practice for implementing Directive 2013/35/EU)

16.4. Protective and preventative measures

16.5 Action Plan

Relevant managers must develop and implement a suitable and sufficient action plan to ensure that employees are not exposed to electromagnetic field levels in excess of the ELVs.

The action plan must include consideration of, where relevant:

a) Other working methods that entail lower exposure to electromagnetic fields.
b) Replacement equipment designed to reduce the level of exposure.
c) Technical measures to reduce the emission of electromagnetic fields, including, where necessary, the use of interlocks, screening, or similar health protection mechanisms.
d) Demarcation and access control measures.
e) Maintenance programmes for work equipment, workplaces, and workstation systems.
f) The design and layout of workplaces and workstations.
g) Limitations on the duration and intensity of exposure; and
h) The availability of suitable personal protective equipment.

If the exposure of employees exceeds any ELV the Relevant Manager must, as soon as is reasonably practicable, identify and implement any changes to the action plan which are necessary to ensure exposure levels do not exceed the ELVs

17. Information and training

Relevant information and training must be provided to any employees who is likely to be subjected to the risks identified in the most recent risk assessment including in relation to:

a) The control measures undertaken.
b) The concepts and values of the ALs and ELVs and the possible risks associated with them.
c) The possible indirect effects of exposure.
d) The results of the most recent exposure assessment.
e) How to detect and report sensory and health effects.
f) The circumstances in which employees are entitled to health surveillance and medical examinations.
g) Safe working practices; and
h) Any additional measures taken in respect of employees at particular risk.
i) The level and extent of training must be commensurate with the level of risk assessed and identified in the risk assessment.

18. Maintenance

Equipment producing EMF should be subject to a regular programme of preventative maintenance and, where appropriate, inspection to ensure that it continues to function efficiently. Adequate maintenance is a requirement of the PUWER and will serve to minimise any increase in emissions due to degradation of the equipment.

Technical measures to limit emissions or restrict access to strong fields should similarly be subject to ongoing maintenance, inspection and testing to ensure that they remain fully effective.

The frequency of such maintenance and inspection activities will depend on the nature of the equipment, how it is used and the environment in which it is located. In general manufacturers of equipment will recommend appropriate maintenance intervals and this will provide a satisfactory guide in most cases. However, unusually harsh environments or heavy use of equipment may accelerate the rate of deterioration and in these cases more frequent maintenance and inspection will normally be warranted. Maintenance Managers must ensure that staff undertaking maintenance and servicing work are not exposed to EMF levels which exceed the ELVs and must risk assess these tasks separately (i.e. apart from routine operation)

.

19. Review and Health surveillance

Responsible Managers and Supervisors are responsible for ensuring that risk assessments are reviewed when there:

- Is reason to suspect it is no longer valid; or
- Has been a significant change in the matters to which it relates, and make such changes to it as are necessary to ensure it remains suitable and sufficient

Managers must ensure that health surveillance and medical examinations are provided as appropriate to any employee who:

a) Is exposed to electromagnetic field levels in excess of the health effect ELVs; and
b) Reports experiencing a health effect to that employer.

The Occupational Health Service will provide health surveillance or medical examinations.

20. Record keeping

The Occupational Health Service shall keep suitable records of any health surveillance and medical examinations provided. Managers are expected to retain copies of maintenance records locally or on a shared safety drive.

21. References

The Control of Electromagnetic Fields at Work Regulations 2016

1999/519/EC Council Recommendation on the limitation of exposure of the general public to electromagnetic fields (0Hz to 300GHz)

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22. Appendix A – Activities with hazardous levels of AOR

Use hazardous sources of intense light	What are the hazardous activities?	How might workers be harmed by the intense light?	What key measures do you need to consider?
Industry, research, and education	• Class 3B and 4 lasers	• Damage to eyes, including blindness • Laser beam burns to skin • Potential fire risk	• Specialist advice may be needed • Engineered measures – enclosure, controlled areas, interlocks, remote controls, screening, clamps to hold material • Designated laboratories with restricted access • Provide face shields, goggles or other protective eyewear and coveralls/lab coat • Provide gloves where appropriate (it is recognised that thin nitrile gloves may be needed for dexterity and that these will offer limited protection against laser burns) • Include laser sources as part of fire risk assessment • Provide information and training • Display appropriate warning signs • Monitor and enforce use of control measures • If any workers are over-exposed, provide medical examination and consider whether follow-up health surveillance is appropriate
Metal working	• Welding (arc and oxyfuel) • Plasma cutting	• Damage to eyes – photokeratitis and photconjunctivitis (‘arc eye’), photochemical damage to the retina (blue light hazard) • Damage to skin – UV burn (erythema)	• Provide face shields, coveralls, and gloves • Protect others using screens/curtains/restricted access • Provide information and training • Display appropriate warning signs • Monitor and enforce use of control measures • If any workers are over-exposed, provide medical examination and consider whether follow-up health surveillance is appropriate

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Hot work	• Proximity to furnaces, burners, and hot metals/glass	• Damage to eyes and skin – mainly early onset of cataract risk • Thermal discomfort	• Engineered measures – remote controls, screening, interlocks, clamps to hold material • Provide face shields, goggles or other protective eyewear, coveralls, and gloves • Enforced maximum working periods – routine change of activity • Protect others using screens/curtains/restricted access • Provide information and training • Display appropriate warning signs • Monitor and enforce use of control measures • If any workers are over-exposed, provide medical examination and consider whether follow-up health surveillance is appropriate
Use hazardous sources of intense light	**What are the hazardous activities?**	**How might workers be harmed by the intense light?**	**What key measures do you need to consider?**
Pharmaceuticals and research	• Ultraviolet sterilisation and induced fluorescence	• Damage to eyes – photokeratitis and photoconjunctivitis (‘arc eye’), photochemical damage to the retina (blue light hazard) • Damage to skin – UV burn (erythema)	• Provide protective eyewear and make sure other areas of skin are not exposed (i.e. provide lab coats and gloves) • Protect others using screens/curtains/restricted access • Provide information and training • Display appropriate warning signs • Monitor and enforce use of control measures • If any workers are over-exposed, provide medical examination and consider whether follow-up health surveillance is appropriate

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23. Appendix B: Requirements for specific EMF assessments in respect of common work activities, equipment, and workplaces.

Source: Non-binding guide to good practice for implementing Directive 2013/35/EU

Type of equipment or workplace	Assessment required for		
	Workers not at particular risk[3] (1)	Workers at particular risk (excluding those with active implants)[4] (2)	Workers with active implants[5] (3)
Wireless communications			
Phones, cordless (including base stations for DECT cordless phones) — use of	No	No	Yes
Phones, cordless (including base stations for DECT cordless phones) — workplaces containing	No	No	No
Phones, mobile — use of	No	No	Yes
Phones, mobile — workplaces containing	No	No	No
Wireless Communication Devices (e.g. Wi-Fi or Bluetooth) including access points for WLAN — use of	No	No	Yes
Wireless Communication Devices (e.g. Wi-Fi or Bluetooth) including access points for WLAN — workplaces containing	No	No	No
Office			
Audio-visual equipment (e.g. televisions, DVD players)	No	No	No
Audio-visual equipment containing radiofrequency transmitters	No	No	Yes
Communication equipment and networks, wired	No	No	No
Computer and IT equipment	No	No	No
Fan heaters, electric	No	No	No
Fans, electric	No	No	No
Office equipment (e.g. photocopiers, paper shredders, electrically operated staplers)	No	No	No
Phones (landline) and fax machines	No	No	No
Infrastructure (buildings and grounds)			

[3] Assessment required against applicable ALs or ELVs

[4] Assess against Council Recommendation reference levels

[5] Localised personal exposure may exceed reference levels in Council Recommendation — this will need to be considered in the risk assessment, which should be informed by information supplied by the healthcare team responsible for implanting device and/or subsequent care.

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Alarm systems	No	No	No
Base station antennas, inside operator's designated exclusion zone	Yes	Yes	Yes
Base station antennas, outside operator's designated exclusion zone	No	No	No
Garden appliances (electric operated) — use of	No	No	Yes
Garden appliances (electric) — workplaces containing	No	No	No
Heating equipment (electrical) for room heating	No	No	No
Household and professional appliances, e.g. refrigerator, washing machine, dryer, dishwasher, oven, toaster, microwave oven, iron, provided it does not contain transmission equipment such as WLAN, Bluetooth or mobile phones	No	No	No

Type of equipment or workplace	**Assessment required for**		
	Workers not at particular risk[1] **(1)**	**Workers at particular risk (excluding those with active implants)[2] (2)**	**Workers with active implants[3] (3)**
Lighting equipment, e.g. area lighting and desk lamps	No	No	No
Lighting equipment, RF or microwave energised	Yes	Yes	Yes
Workplaces accessible to the general public which meet the reference levels specified in Council Recommendation 1999/519/EC	No	No	No
Security			
Article surveillance systems and RFID (radio frequency identification)	No	No	Yes
Erasers, Tape or Hard Drive	No	No	Yes
Metal detectors	No	No	Yes
Electrical supply			
Electrical circuit where the conductors are close together and having a net current of 100 A or less — includes wiring, switchgear, transformers, etc. — exposure to magnetic fields	No	No	No
Electrical circuit where the conductors are close together and having a net current of greater than 100 A — includes wiring, switchgear, transformers, etc. — exposure to magnetic fields	Yes	Yes	Yes
Electrical circuits within an installation, with a phase current rating of 100 A or less for the individual circuit — includes wiring, switchgear, transformers, etc. — exposure to magnetic fields	No	No	No
Electrical circuits within an installation, with a phase current rating of greater than 100 A for the individual circuit — includes wiring, switchgear, transformers, etc. — exposure to magnetic fields	Yes	Yes	Yes

Electrical installations with a phase current rating of greater than 100A — includes wiring, switchgear, transformers, etc. — exposure to magnetic fields	Yes	Yes	Yes
Electrical installations with a phase current rating of 100A or less — includes wiring, switchgear, transformers, etc. — exposure to magnetic fields	No	No	No
Generators and emergency generators — work on	No	No	Yes
Inverters, including those on photovoltaic systems	No	No	Yes
Overhead bare conductor rated at a voltage up to 100 kV, or overhead line up to 150 kV, above the workplace — exposure to electric fields	No	No	No
Overhead bare conductor rated at a voltage greater than 100 kV, or overhead line greater than 150 kV ([6]), above the workplace — exposure to electric fields	Yes	Yes	Yes
Overhead bare conductors of any voltage — exposure to magnetic fields	No	No	No

Type of equipment or workplace	**Assessment required for**		
	Workers not at particular risk[1] **(1)**	**Workers at particular risk (excluding those with active implants)[2] (2)**	**Workers with active implants[3] (3)**
Underground or insulated cable circuit, rated at any voltage — exposure to electric fields	No	No	No
Wind turbines, work on	No	Yes	Yes
Light industry			
Arc welding processes, manual (including MIG, MAG, TIG) when following good practice and not supporting cable on body	No	No	Yes
Battery chargers, industrial	No	No	Yes
Battery chargers, large professional	No	No	Yes
Coating and painting equipment	No	No	No
Control equipment not containing radio transmitters	No	No	No
Corona surface treatment equipment	No	No	Yes
Dielectric heating	Yes	Yes	Yes
Dielectric welding	Yes	Yes	Yes
Electrostatic painting equipment	No	Yes	Yes
Furnaces, resistively heated	No	No	Yes
Glue guns (portable) — workplaces containing	No	No	No
Glue guns — use of	No	No	Yes
Heat guns (portable) — workplaces containing	No	No	No
Heat guns — use of	No	No	Yes
Hydraulic ramps	No	No	No
Induction heating	Yes	Yes	Yes

[6] For overhead lines above 150kV the electric field strength will usually, but not always, be lower than the reference level specified in Council Recommendation 1999/519/EC.

Induction heating systems, automated, fault-finding and repair involving close proximity to the EMF source	No	Yes	Yes
Induction sealing equipment	No	No	Yes
Induction soldering	Yes	Yes	Yes
Machine tools (for example pedestal drills, grinders, lathes, milling machines, saws)	No	No	Yes
Magnetic particle inspection (crack detection)	Yes	Yes	Yes
Magnetizer/demagnetizers, industrial (including tape erasers)	Yes	Yes	Yes
Measuring equipment and instrumentation not containing radio transmitters	No	No	No
Microwave heating and drying, in woodworking industries (wood drying, wood forming, wood gluing)	Yes	Yes	Yes
RF plasma devices including vacuum deposition and sputtering	Yes	Yes	Yes
Tools (electric handheld and transportable e.g. drills, sanders, circular saws, and angle grinders) — use of	No	No	Yes
Tools (electric handheld and transportable) — workplaces containing	No	No	No
Welding systems, automated, fault-finding, repair and teaching involving close proximity to the EMF source	No	Yes	Yes
Welding, manual resistance (spot welding, seam welding)	Yes	Yes	Yes
Heavy industry			
Electrolysis, industrial	Yes	Yes	Yes
Furnaces, arc melting	Yes	Yes	Yes
Furnaces, induction melting (smaller furnaces normally have higher accessible fields than larger furnaces)	Yes	Yes	Yes
Type of equipment or workplace	**Assessment required for**		
	Workers not at particular risk[1] **(1)**	**Workers at particular risk (excluding those with active implants)[2] (2)**	**Workers with active implants[3] (3)**
Construction			
Construction equipment (e.g. concrete mixers, vibrators, cranes, etc.) — work in close proximity	No	No	Yes
Microwave drying, in construction industry	Yes	Yes	Yes
Medical			
Medical equipment not employing EMF for diagnosis or treatment	No	No	No
Medical equipment using EMF for diagnosis and treatment (for example, short wave diathermy, transcranial magnetic stimulation)	Yes	Yes	Yes
Transport			

Motor vehicles and plant — work in close proximity to starter, alternator, ignition systems	No	No	Yes
Radar, air traffic control, military, weather, and long range	Yes	Yes	Yes
Trains and trams, electrically driven	Yes	Yes	Yes
Miscellaneous			
Battery chargers, inductive or proximity coupling	No	No	Yes
Battery chargers, non-inductive coupling designed for household use	No	No	No
Broadcasting systems and devices (radio and TV: LF, MF, HF, VHF, UHF)	Yes	Yes	Yes
Equipment generating static magnetic fields > 0.5 millitesla, whether generated electrically or from permanent magnets (for example, magnetic chucks, tables, and conveyors, lifting magnets, magnetic brackets, nameplates, badges)	No	No	Yes
Equipment placed on the European market as compliant with Council Recommendation 1999/519/EC or harmonised EMF standards	No	No	No
Headphones producing strong magnetic fields	No	No	Yes
Inductive cooking equipment, professional	No	No	Yes
Non-electrical equipment of all types except those containing permanent magnets	No	No	No
Portable equipment (battery powered) not containing radiofrequency transmitters	No	No	No
Radios, two-way (for example walkie-talkies, vehicle radios)	No	No	Yes
Transmitters, battery driven	No	No	Yes