THE UNIVERSITY of EDINBURGH
Health & Safety Department

NON-IONISING RADIATION
Code of Practice

Contents

Introduction

The University of Edinburgh (the University) is committed to ensuring the health, safety and welfare of all staff, students and visitors. This document defines the organisation and arrangements at the University that demonstrate compliance with the applicable legislation and a commitment to a culture of safety when working with non-ionising radiation (NIR). This document has been divided into three parts. In Part One the roles and responsibilities of those involved in NIR safety are identified and some common elements that apply to NIR safety are described. Parts Two and Three individually consider the following, respectively:

- Artificial optical radiation (AOR), which includes lasers and broadband light sources, but excludes natural sources, such as the sun.
- Electromagnetic Fields (EMFs).

Table 1. Categories of Non-Ionising Radiation.

Non-ionising Radiation	
Artificial Optical	**Electromagnetic Fields**
UV, visible and infrared	Radiowaves (including microwaves), time varying electric and magnetic fields, static magnetic fields.

There is specific legislation covering safe work with both AOR and EMF, as well as more general health and safety legislation, which the University is required to comply with. This three-part document sets out how the University complies with applicable legislation with respect to NIR safety.

Part 1: Non-ionising Radiation Safety at the University

1. Organisational Structure

The University's health and safety organisational structure is detailed in the "Framework: Organisation" section of the Health and Safety Policy. This structure has been designed to effectively deal with management of health and safety at the University and certain considerations, such as that of radiation (including NIR), are devolved to specialist units. The Radiation Protection Committee, comprising of academic, research and technical staff oversees the implementation and operation of the University's policy and arrangements for radiation safety, including the preparation and dissemination of appropriate guidance and information to radiation users (including NIR). At a local level, NIR safety is managed by departmental supervisors (e.g. Departmental Laser Supervisors for work with hazardous AOR sources and Departmental EMF Supervisors for work with hazardous EMF sources). Figure 1 shows the health and safety structure as it applies to NIR safety.

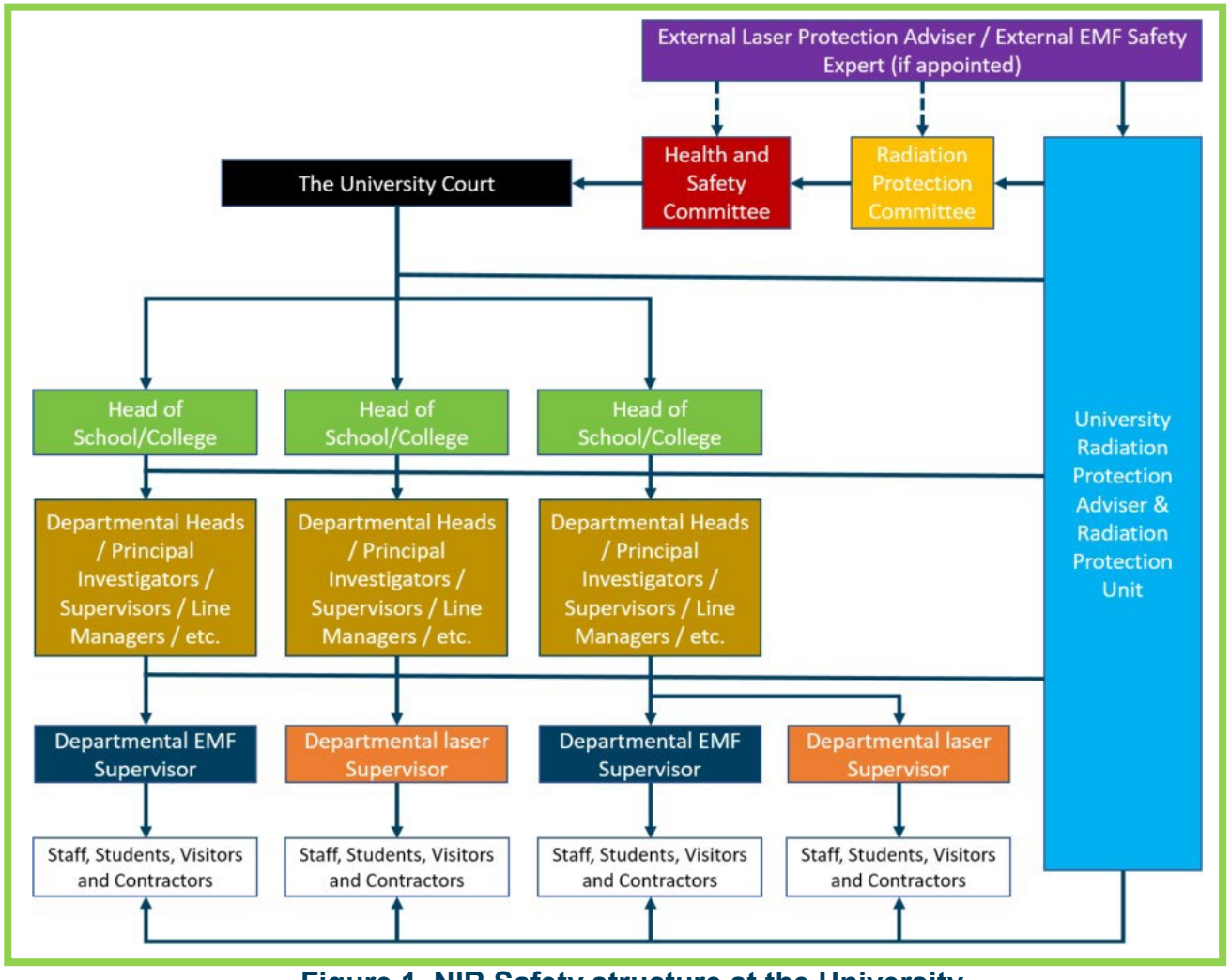

Figure 1. NIR Safety structure at the University

1.1 Roles and Duties

The University Court – the University takes very seriously the responsibility of providing a safe working environment for all staff, students, work partners and the general public. The University of Edinburgh Health and Safety Policy is authorised by the University Court and requires that staff adhere to it in order to maintain a safe working environment. This Non-Ionising Radiation Code of Practice forms part of the supporting framework to this Health and Safety Policy with the majority of the 'detail' regarding the safe management of NIR contained in Parts 1 to 3 of this Code of Practice.

Health and Safety Department – includes the Health and Safety Office, consisting of the Director and Deputy Director of Health and Safety, which oversees the management of health and safety within specialist units including the Radiation Protection Unit (RPU) for ionising and non- ionising radiation safety. The Health and Safety Office is responsible for managing the health and safety structure and practices at the University and reviews all accident reports submitted via the online Accident and Incident reporting system (AIR).

Health and Safety Committee – reports directly to the University Court and is responsible for the setting of policy in all areas of occupational safety and health within the University. Any local level health and safety committees bring forward items of particular significance to the main Health and Safety Committee. The committee is made up of the Director and Deputy Director of Health and Safety along with other management, Trade Union, legal and specialist area representatives. The Radiation Protection Committee provide a report to the Health and Safety Committee on an annual basis.

Radiation Protection Unit (RPU) – provides professional advice to the University on NIR safety and works with, and provides support to, departmental supervisors. The RPU is made up of the University Radiation Protection Adviser (URPA), the Deputy Radiation Protection Adviser and a Health and Safety Technician. The URPA acts as the secretariat for the Radiation Protection Committee. The RPU maintains an inventory of all hazardous NIR sources at the University, provides radiation safety training and maintains a register of trained users and training records. The NIR training course provided by the RPU covers essential knowledge in NIR safety, attendance at which is required before individuals can commence unsupervised work with hazardous NIR sources. The RPU performs audits of NIR safety across the University to the standards set in Radiation Policy, radiation safety codes of practice and also guidance notes to ensure compliance with legal requirements and best practice.

Radiation Protection Committee – Appointed by the University Court, the committee advises on all matters relating to the hazards arising from radiation, including NIR. The committee reports to the Health and Safety Committee on matters involving NIR such as incidents and near misses, new equipment, audits, training programmes, etc.

Laser Protection Officer/Adviser (LPO/LPA) – the UPRA acts as the University Laser Safety Officer who provides specialist in-depth knowledge and advice on AOR safety management at the University. In some cases, the University may appoint an external Laser Protection Adviser (LPA) or external EMF Safety Expert to assist the URPA in providing specialist in-depth knowledge and advice on AOR safety to the University.

Head of School (or equivalent) – The Heads of School (or equivalent) are responsible for the management of all aspects of health and safety (including NIR safety) in the work of their Schools. Approximately annually, they are required to report the implementation of the Health and Safety Policy to the Director of Corporate Services; this is facilitated by an annual questionnaire received by the Health and Safety Department and summarised at the Health and Safety Committee. The Heads of School are responsible for appointing departmental laser and EMF supervisors in writing and ensuring they have received adequate training.

Principal Investigators (PIs), supervisors or manager – A PI is normally a member of academic staff responsible for the planning, organisation and successful outcome of their particular research project and, as such, they bear the day to day responsibility for the health and safety management (including NIR safety) relating to the project. Supervisors and managers fulfil a similar role to PIs and may not be academic or research staff but will have supervisory or management responsibility over other staff or students. The PI, supervisor or manager must know and understand the requirements of the University Health and Safety Policy (including the NIR Safety policy).

Departmental Laser and EMF Supervisors – the University (via the Heads of School) appoints staff at a local level to supervise and monitor the NIR safety aspects of work. Departmental supervisors assist users, PIs, managers and supervisors with drawing up suitable and sufficient risk assessments, and the implementation of appropriate control measures, in accordance with the hierarchy of controls. Prior to their appointment in writing they receive appropriate training so that they understand the role and are knowledgeable about NIR hazards and the regulatory requirements.

Staff and employed students (including research students) – those people at the University who may be working with or in the vicinity of hazardous NIR sources. Individuals are required to comply with any procedures or arrangements formulated under the authority of this Policy. Breaching this Policy may lead to disciplinary action under University procedures.

Undergraduates, visitors and contractors – this group of people, who may be present on the University premises, typically do not normally work in areas where there is a hazard due to NIR. When persons of this category require access to an area containing a hazardous NIR source, theRisk Assessment for the area must be checked by the PI, supervisor or manager to ensure it includes their access and that all safety issues have been adequately addressed. In particular, the Risk Assessment must take into account that visitors, undergraduates or contractors entering an area may be classed as '*persons at particular risk'.*

2. Legislation

The University is committed to meeting its legislative duty and to demonstrating compliance. Several sets of legislation apply to the University's work with NIR, including those specific to AOR and EMF, and also more general health and safety legislation.

The principle legislation specific to working with NIR are:

- *The Control of Artificial Optical Radiation at Work Regulations* 2010 (AOR10),
- *The Control of Electromagnetic Fields at Work Regulations* 2016 (CEMFWR16).

The University is committed to meeting the requirements of AOR10 and CEMFWR16, as well as more general health and safety legislation which applies to work with NIR.

The University is also committed to meeting the practical requirements and good practices that are defined in British Standards and guidance documents.

The regulations, standards and guidance for working with AOR and EMF are explained in greater detail in Parts Two and Three of this NIR Code of Practice.

3. Hierarchy of Controls

The University is committed to protecting those under its responsibility from the hazards associated with working with NIR. In order to best achieve the minimisation of risk, the University expects that the control measures put in place to minimise the risks are implemented in accordance with the Hierarchy of Control Measures (Figure 2), where the most effective or reliable controls, or the controls with the largest impact are implemented first, rather than choosing the easiest control measure to implement.

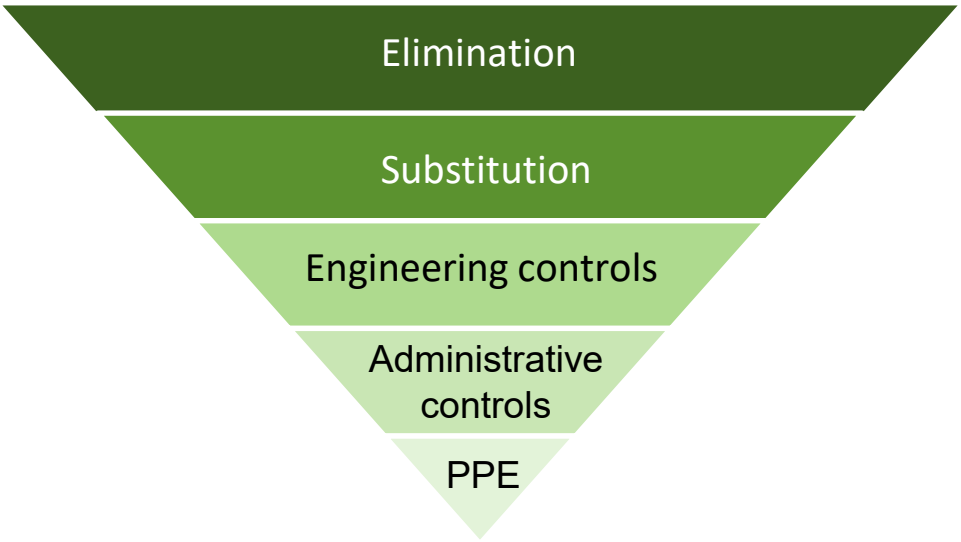

Figure 2. Hierarchy of Control Measures

It is appreciated that in some situations, control measures lower down the hierarchy are necessary (e.g. laser protective eyewear for some laser beam alignment procedures). While the University does not prohibit this work, it requires that when planning this work there is a strong emphasis on following the hierarchy of control measures. The University regards this type of work to be the exception rather than the norm and is only permitted if a robust justification has been made supporting the case against using control measures further up the Hierarchy (i.e. justifying why it is not reasonably practicable to enclose a laser beam). It is **never acceptable** for personal protective equipment (e.g.laser protective eyewear) to be chosen as a control measure before consideration is given to the hierarchy of control measures.

4. Service engineers

Service engineers and other contractors carrying out work on University premises have their own Health and Safety arrangements to comply with. The University must be aware of the potential risks and hazards from the work so that service engineers and contractors are provided with adequate information to enable them to conduct their work on University premises safely.

The University requires, therefore, that where work is to be carried out by service engineers or contractors that could give rise to an NIR hazard, safe working practices are to be assured in advance of the work commencing. For this, the service engineer must provide the University with risk assessments and method statements for the work, prior to the work commencing. The relevant departmental laser or EMF supervisor must be satisfied that these risk assessments and method statements are appropriate and comprehensive for the work to be carried out.

5. Incidents and Near-Misses

The procedural controls for each area must detail the steps that should be taken in the event of a foreseeable incident involving hazardous sources of NIR. Foreseeable accidents or incidents should be identified in the risk assessment. All incidents and near misses are to be reported via the online Accident and Incident Reporting system (AIR).

In the case of a known or suspected eye strike from a laser beam (either direct, reflected or scattered with the ability to cause injury – Class 3B and 4), the affected individual will need to be assessed by a trained ophthalmologist within 24 hours.

6. Auditing

The University expects that regular auditing is carried out by the RPU in areas where hazardous NIR sources are being used. An audit is carried out approximately annually for purpose of ensuring:

- The NIR safety Code of Practice and associated Guidance Notes are being implemented.
- Arrangements are appropriate and practical.
- Arrangements are implemented effectively.
- Non-compliances are promptly identified and rectified in a timely manner.

A summary of the results of the auditing process are raised as a standing item at the meeting of the Radiation Protection Committee. Where matters of concern exist that cannot be resolved by the committee, the chair will escalate them to a higher level, and the advice of an appointed Laser Protection Adviser or EMF Safety Expert, who may be an external consultant, may be sought where appropriate.

7. Review

This CoP will be reviewed by the University every two years. The Radiation Protection Unit will lead the review and report any significant changes to the Radiation Protection Committee for action and onward dissemination to the colleges and schools.

Part 2: Artificial Optical Radiation

1. Introduction

Artificial Optical Radiation (AOR) includes lasers and broadband sources, where the emitted radiation is ultraviolet radiation, visible light, or infrared radiation with a wavelength range of 100 nm to 1 mm. AOR excludes natural optical radiation sources, such as the Sun. AOR sources are ubiquitous in the University environment (e.g. general lighting), and most are not hazardous. However, the University is committed to ensuring that where there are hazardous AOR sources used on University premises, (or used by University staff on other employers' premises), the University fully complies with applicable health and safety legislation with respect to work involving these sources.

2. Applicable Legislation, Standards and Guidance for AOR

With regard to working safely with AOR, there is specific legislation as well as more general health and safety legislation, which sets out the legal requirements. The specific legislation is ***The Control of Artificial Optical Radiation at Work Regulations* 2010 (AOR10)**. Standards and Guidance also exist to describe practical requirements and good practice from working with AOR sources. The University is committed to demonstrating compliance with them. More information is contained in Appendix A.

3. Exposure Limit Values

Exposure Limit Values (ELVs) represent the maximum level to which employees can be exposed to AOR without suffering injury. AOR10 specifies ELVs for exposure to AOR and places a legal requirement on employers to ensure exposures do not exceed the ELVs. The health effects of AOR exposure are explained briefly in Appendix B.

4. AOR Sources and Hazards

The University considers two categories of AOR source:

Lasers: The word laser is an acronym for **L**ight **A**mplification by the **S**timulated **E**mission of **R**adiation. A laser will generally consist of a laser head (where the laser beam is produced), a power supply, a cooling unit (if required) and any other services such as gas supplies, fume extract, etc. A laser product may consist of a single laser (with or without a separate power supply) or may incorporate one or more lasers in a more complex system. Hazards associated with laser radiation depend on the wavelength, intensity and the duration of exposure. Potential risks from work with laser equipment will vary with each individual application but could foreseeably include photochemical and/or thermal effects to the eyes

or skin from direct exposure to a laser beam, fire from the interaction of a laser beam with flammable material, as well as injury from non-beam hazards such as chemicals, fume, mechanical, electrical etc.

Broadband sources (non-laser sources): These devices typically emit optical radiation with a range of different wavelengths and can produce radiation that spreads out over a large area. This means that AOR tends to have a high intensity at the point of origin, which decreases as the distance from the source increases. Examples of potentially hazardous broadband sources include high power LEDs, UV lamps (e.g. UV transilluminators and UV sterilisation lamps) and arc welding equipment. Potential risks from working with broadband AOR sources will vary with each individual application but could be photochemical and/or thermal effects to the eyes or skin, chemical hazards and fire hazards from the heating effect of the lamp.

Lasers under BS EN 60825-1:2014 and lamps under BS EN 62471:2008 should be classified by the manufacturer in terms of the ability of the AOR to cause harm; as indicated in Table 2 below.

Table 2. Classifications of Lasers and Lamps under BS EN 60825-1:2014 and BS EN 62471:2008 respectively

Laser Classification	1	1M	1C	2	2M	3R	3B	4
 Ability to cause harm								
Lamp Risk Group	Exempt		1		2		3	

Some Class 1 or 2 laser products contain higher class lasers (Class 3B or 4) embedded within them. Under conditions of normal use, the higher class laser beam is fully enclosed with the hazard being engineered out; these devices are therefore low risk. However, in some situations, e.g. servicing or maintenance, the beam may become accessible and further control measures will be necessary to prevent exposure. Where the beam is accessible, or where safety features are bypassed (e.g. interlock bypassed or fixed panels removed when the power is on), the product ceases to be treated as a 'Class 1 laser product' and the same levels of control are required for the class of the laser embedded within (likely to be Class 3B or 4).

The Health and Safety Executive (HSE) document, *Guidance for employers on the Control of Artificial Optical Radiation at Work Regulations* (AOR) 2010, provides non-exhaustive lists of safe and potentially hazardous sources of AOR (as per their ability to exceed the Exposure Limit Values). These lists have been reproduced in Appendix C and are divided into three categories: trivial, safe under normal operation and hazardous.

5. Employees at Particular Risk

Special consideration must be given to the safety of employees at particular risk, as they may not be protected by the ELVs. This includes persons who have informed the University of a health condition which means they are potentially more susceptible to effects from exposure to AOR sources. Employees at particular risk from AOR sources include those with enhanced skin photosensitivity which can be due to genetic or medical reasons, or due to the intake or use of certain medications. The University provides training to staff that work with potentially hazardous AOR sources on the risks to photosensitive individuals, and the importance of informing the University if an individual suspects they fall into this category.

6. Appointment of a Departmental Laser Supervisor

The Head of School (or equivalent) is responsible for appointing a Departmental Laser Supervisor (DLS) in writing for each department or area where there may be a risk associated with working with AOR. This will generally be for sources of AOR that are included in the 'Hazardous Sources of Optical Radiation' list in Appendix C. Therefore, a DLS is not normally required to be appointed where only Class 1/1M/1C/2/2M/3R and Class 1 laser products (including Class 1 laser products with embedded Class 3B or Class 4 lasers within them) **are used under normal conditions of use only**.

The Head of School (or equivalent) ensures that the DLS is provided with sufficient training to fulfil that role. The specific duties of the DLS will depend on the environment but are such that the DLS will facilitate compliance with this policy in the areas for which they are responsible. The University template DLS appointment letter has been included in Appendix D.

7. New Facilities or Equipment

Where new facilities are proposed that will involve AOR sources (e.g. a new laser laboratory), or areas which are to be significantly refurbished that involve AOR sources, the RPU must be informed so that expert AOR safety advice can be provided to ensure that the facility is safe and fully compliant with application legislation. This should be arranged by the relevant

Estates Department Project Management team overseeing the project.

In the case of the acquisition of new potentially hazardous AOR sources, either the relevant School or the Procurement Department must arrange consultation with the RPU. A potentially hazardous AOR source includes:

- Any Class 3B or 4 laser;
- A lower class laser product containing a Class 3B or 4 laser (which would be accessible in certain circumstances, for example servicing);
- Risk Group 3 lamps; or,
- Other hazardous sources as listed in Appendix C.

The DLS maintains an inventory of all hazardous AOR sources under their control, and provides details to the RPU annually so that it can maintain an overall inventory of all hazardous AOR sources at the University.

8. Registration of Hazardous AOR Sources

Upon purchasing hazardous AOR sources, they must be registered with the RPU. The responsibility for this lies with the PI, manager or supervisor. Registration forms are available in Appendix E.

It is not necessary to register low risk AOR sources with the RPU. This includes:

- Commercially available equipment such as Class 1, 2 and 3R laser products (where there is normally no access to higher class lasers); and,
- Risk Group 1 and 2 lamps.

9. Risk Assessments

The PI, Manager or Supervisor is responsible for assessing exposures to AOR by means of a suitable and sufficient risk assessment, which must be written prior to work commencing. The risk assessment is drawn up in consultation with the DLS. The class of a laser or risk group of a lamp will determine how detailed the risk assessment should be. If the risk assessment indicates that exposures could exceed the ELVs then the University will put control measures in place to eliminate or reduce the risk of exposure. Guidance for drawing up AOR risk assessments can be found in Radiation Protection Guidance Note RP GN 101 "*AOR Risk Assessment Guidance*". A link to the Guidance Notes area of the RPU website is shown below:

https://www.ed.ac.uk/health-safety/radiation-protection/codes-of-practice-and-guidance/guidance-notes

Templates are included in the Guidance Notes but also available as stand-alone documents to assist persons carrying out Risk Assessments. These can be found on the RPU website at:

https://www.edweb.ed.ac.uk/health-safety/radiation-protection/radiation-protection-management/risk-assessments-nir

When completing a risk assessment, the University expects that the author considers the following:

- ✓ The University is committed to the use of the Hierarchy of Controls when minimising the risk when working with sources of AOR.
- ✓ The level of detail in the risk assessment must be suitable and sufficient for the work practice being carried out, with all significant risks being assessed.
- ✓ Risk assessments must be completed at local levels by those individuals working with the hazardous AOR sources. It is the responsibility of the PI, Manager or Supervisor to ensure this is carried out.
- ✓ Strong justification must be provided in the risk assessment for any scenario where reliance is placed on administrative controls or personal protective equipment. The DLS must be consulted if this is the case. Should the DLS have any concerns, they will refer the assessment to the RPU.
- ✓ All relevant parts of the equipment 'life cycle' must be considered. This includes routine work and non-routine work such as beam alignment, servicing and maintenance.
- ✓ Any non-beam hazards must be considered (e.g. electrical, mechanical, chemical).
- ✓ Any indirect effects of exposure must be considered (e.g. fire, injury caused by dazzle ordistraction)
- ✓ The risks to photosensitive persons must be considered.

Risk assessments for Class 3B/4 lasers and Risk Group 3 lamps are reviewed and approved by the DLS.

10. Implementation of Control Measures

When implementing control measures, following the outcome of the risk assessment, the hierarchy of control measures **must** be followed (see Section 3 in Part One of this CoP). The University recognises that favouring the use of personal protective equipment (e.g. laser protective eyewear) over an engineering control (e.g. enclosures and guarding) is less

effective and may not satisfy the Health and Safety Executive that a suitable and sufficient risk assessment has been carried out. Schools/PIs must ensure that there are robust risk control measures in place to ensure that people will be suitably protected against exposure to safety as well as health.

11. Information, Instruction and Training

The University expects that staff, students and visitors are made suitably aware of the risks posed by AOR, through appropriate information, instruction, and training. Due to the diverse nature of work at the University, the training is tailored to the role a person is undertaking or the work they are involved with. A general programme for AOR safety training is included in Appendix F. This programme specifies what level of training is required for different categories of staff. For example, for users of AOR sources the training will focus on the key safety requirements for their work area whereas training for a DLS requires more in-depth training in laser safety management and how the AOR safety Code of Practice applies across the University.

Records of training are maintained by the University and by local management responsible for individual areas where AOR sources are used. This is required in order to demonstrate compliance during audits or visits by an enforcing authority. AOR safety training must be refreshed at routine intervals (approximately every three to five years) or when there have been major changes to legislation or the University's AOR safety framework.

12. Local Procedural Controls

Local Procedural controls (or Local Rules) are often an integral part of AOR safety. These procedural controls can be simple written instructions or detailed documents describing how to manage AOR safety in an area.

The risk assessment will determine whether procedural controls are required and how detailed they need to be. Local Procedural controls must be local to the area where the AOR source is used and the University avoids, where possible, implementing generic procedural controls for multiple locations.

The University has produced formal guidance on what elements should be included within a Local Procedural Controls document. This guidance can be found in Radiation Protection Guidance Note RP GN 102 "*Local Procedural Controls Guidance*". A link to the Guidance Notes area of the RPU website is shown below:

https://www.ed.ac.uk/health-safety/radiation-protection/codes-of-practice-and-guidance/guidance-notes

It is the PI, Manager or Supervisor's responsibility to ensure procedural controls are implemented and documented in Local Procedural Controls for the hazardous AOR in their area. The DLS for the relevant area approves the Local Procedural Controls once they have been produced.

13. Laser Alignment

Due to the highly hazardous nature of beam alignment, the University has decided to make a statement at Code of Practice level on the alignment procedures for Class 3B and Class 4 lasers.

It is clear that the avoidance of open beam alignment with Class 3B and 4 lasers will minimise the AOR risk, and the avoidance of such open beam alignment is encouraged. This may be achieved by considering the need for beam alignment at the laser design stage, and using remote adjustment tools, reducing the beam power down below the ELV if practicable, or the use of a Class 1 or 2 alignment laser for some of the coarse alignment work. Where open beam alignment is unavoidable, the following must be in place:

- ✓ The laser must be within laser controlled area (LCA) to which access is restricted.
- ✓ Removing all persons from the LCA except those directly involved in the alignment work (persons undergoing training in alignment are permitted to be in the room).
- ✓ The person performing the alignment must have received suitable training to do so safely and this additional training must be recorded on their training record.
- ✓ Detailed written procedures covering the alignment procedure must be drawn up.
- ✓ Use of beam paths at a safe height, below eye level when standing or sitting.
- ✓ The wearing of appropriate laser alignment protective eyewear that complies with BS EN208:2009.

14. Laser Pointers

The University has made a COP level statement on laser pointers, namely lasers used for the use of indicating and signalling during presentations or teaching. Only Class 1 or Class 2 lasers are to be used for this purpose. Such pointers must never be directed towards the eyes of either the user or the audience. The laser pointer must also display the labelling as required by BS EN 60825-1. See Radiation Protection Guidance Note RP GN 110 "*Safe Use of Laser Pointers and Similar Devices*" for further information.

15. Personal Protective Equipment (PPE)

PPE may be needed to protect the skin and eyes of workers from AOR hazards. PPE must only be used as a last resort if the AOR source cannot be enclosed or there is a risk of a worker being exposed to the beam (for Class 3B and 4 lasers and Risk Group 3 lamps).

The most common type of PPE for AOR sources is laser protective eyewear. Protective eyewear uses filters to absorb, and hence reduce, the intensity of incoming AOR.

Laser protective eyewear must comply with the relevant British Standard (BS EN 207 or 208). The DLS must be contacted prior to any new purchase of laser protective eyewear so that it can be ensured that the correct eyewear is purchased (new for old replacement of the same type does not require DLS approval).

Further guidance on the selection and use of Laser Protective Eyewear can be found in Radiation Protection Guidance Note RP GN 104 "*Laser Safety Eyewear*". A link to the Guidance Notes area of the RPU website is shown below:

https://www.ed.ac.uk/health-safety/radiation-protection/codes-of-practice-and-guidance/guidance-notes

PPE must be suitable for the work activity, properly maintained, cleaned and stored. Damaged PPE must be reported to the PI, supervisor or manager and replaced. Information on PPE, instructions on use and training are made available in the procedural controls (or local rules) document.

16. Health Surveillance

AOR10 requires that health surveillance is provided if the risk assessment indicates that there is a risk of adverse health effects to the skin of employees as a result of exposure to AOR. The University aims to ensure that risks to the skin will be reduced to far as reasonably practicable such that health surveillance will not be required. If a risk assessment indicates that there is a risk of adverse health effects to the skin, this must be discussed with the RPU before work commences.

Part 3: Electromagnetic Fields

1. Introduction

The University utilises sources of electromagnetic fields (EMF) across its sites. The electric and magnetic field ranges considered in this document include static (0 Hz) magnetic fields, to time varying electric and magnetic fields with frequencies up to 300 GHz. EMFs are generated whenever electricity is used and so there are a large number of EMF sources across the University. The University recognises that most of the EMF sources on its premises will emit low levels of EMF that will not present a hazard. However, it is important that the University is able to identify sources that could present a risk to workers so that appropriate control measures can be put in place. The University has duties under applicable legislation, in particular the *Control of Electromagnetic Fields at Work Regulations* 2016 (CEMFWR16), to ensure the health and safety of workers with respect to EMFs in the workplace.

2. Applicable Legislation

With regard to working safely with EMF, there is specific legislation as well as more general health and safety legislation that sets out the legal requirements. The specific legislation is ***The Control of Electromagnetic Fields at Work Regulations* 2016 (CEMFWR16)**. The University is committed to demonstrating compliance with the legislation. More information about relevant legislation is contained in Appendix G.

3. EMF Sources and Hazards

There are established direct and indirect effects caused by EMF exposure. The type of effect depends primarily on the frequency and intensity of the EMF. Direct effects are changes that occur in a person as a result of being exposed to EMFs and are separated into non-thermal effects, which dominate at lower frequencies, and thermal effects, which dominate at higher frequencies. Indirect effects occur where the presence of an object within an EMF may become the cause of a safety or health hazard e.g. initiation of electro-explosive devices, ferromagnetic projectiles in a static magnetic field or shocks caused by contact with an object within an EMF.

There are also risks to ‘employees at particular risk’ of exposure, which include pregnant workers, workers fitted with passive or active medical implants and those fitted with body worn medical devices, such as insulin pumps.

A number of lists of potentially hazardous sources of EMF have been tabled in the Health and Safety Executive guide: *Electromagnetic fields at work. A guide to the Control of Electromagnetic Fields atWork Regulations* 2016. HSG281. 2016. These lists have been reproduced in Appendix H.

4. Exposure Limit Values

CEMFWR16 specifies exposure limit values (ELVs), which are levels of EMF exposure that must not be exceeded. The regulations specify 'health effects' ELVs, which are set to prevent a worker experiencing an adverse health effect, and 'sensory effects' ELVs, which are set to prevent a worker 'perceiving' the field. Sensory effects do not cause harm but can be annoying. It is acceptable to exceed a sensory effects ELV if:

- It is only exceeded temporarily.
- Adequate information is provided to the employee on the possibility of sensory effects occurring.
- Hazardous spark discharges, and contact currents are prevented through the provision of information and training and the use of suitable technical and personal protection measures.
- Where any sensory effects are reported to the employer, the risk assessment is updated where necessary.

The University puts appropriate measures in place to ensure that workers are not exposed to levels of EMF in excess of the 'health effects' ELVs (however see Section 5: Exemptions below). If workers could be exposed to levels of EMFs in excess of the 'sensory effects' ELVs, the above requirements are adhered to by the University.

5. Exemptions

There are two exemptions given in CEMFWR16: one for Magnetic Resonance Imaging (MRI) relating to patients in the health sector (see Section 5.1 below for further details) and one for the military. There are also a number of exempt activities given in a HSE exemption certificate, including the use of MRI other than for patients in the health sector. The current version of the certificate can be found on the HSE website.

Where CEMFWR16 refers to exempt activities, the exemption is only applicable to the restrictions imposed by the ELVs and the requirement to implement an action plan. All other requirements of the Regulations apply.

When an exemption does apply, it is still subject to certain conditions being met. The University does not expect the need to routinely use an exemption and will aim to ensure

compliance with the ELVs in all circumstances where this is possible and practicable. The PI, supervisor or manager will contact the RPU for advice if it is determined that an exemption needs to be used, as the fact that the exemption is being used needs to be recorded to ensure that the exemption conditions are being met.

It is known that there are a number of MRI machines used by the University for medical and other uses, and so details regarding the exemptions covering this work are included in Section 5.1 below.

5.1 Use of MRI

The exemption in CEMFWR16 for MRI relating to patients in the health sector includes the development, testing, installation, use and maintenance of, or research related to, MRI equipment for patients in the health sector. The exemption in the HSE certificate relates to all other uses of MRI (e.g. veterinary). The exemptions mean that compliance with the ELVs in not required, where:

- The exposure of employees to EMFs is as low as is reasonably practicable; and
- Employees are protected against the health effects and safety risks related to that exposure.

All other requirements of CEMFWR16 must be complied with, except the requirement to develop an action plan.

Every effort will be made by the University to comply with the ELVs with respect to work with MRI equipment, however, where the nature of the work does not allow this, the exemptions can be used. The RPU will be contacted so that it can be ensured that the risk assessment for the work is suitable and sufficient and that the exemption conditions above are met.

6. Direct Effect Action Levels

Most ELVs are specified in terms of internal body quantities, which are difficult to assess. Therefore, direct effect Action Levels (ALs) have been derived from the ELVs using conservative assumptions and are included in CEMFWR16.

The ALs are given in quantities that can be measured and so the direct effect ALs offer a simple route to demonstrating compliance with the ELVs by either in-field exposure measurement or calculation using appropriate data. For some frequencies high ALs, low ALs and limb ALs are specified. It is acceptable to exceed a low AL if the conditions listed in Section 4 are adhered to.

7. Indirect Effect Actions Levels

Indirect effect ALs are specified for various indirect effects, including contact currents, interference with active implanted medical devices in a static magnetic field and projectile risk in a static magnetic field. The University ensures areas in which the indirect effects ALs could be exceeded are identified and appropriate control measures implemented.

8. Employees at Particular Risk

Employees at particular risk include pregnant workers, workers fitted with passive or active medical implants and those fitted with body worn medical devices, such as insulin pumps.

Hiring Managers check whether new staff plan to work with, or may come into contact with, hazardous EMF sources through the Key Job hazards evaluation form. This aims to identify any new staff who may be classed as employees at particular risk.

School safety advisors ensure that contractors coming to work on University premises have carried out a suitable and sufficient assessment of the risk prior to carrying out their work. This Risk Assessment would identify if there were persons at particular risk from hazardous EMF sources.

Visitors are generally accompanied by staff or other persons when accessing University buildings. Staff or other persons who are escorting visitors are responsible for informing them about potential risks during their visit.

Employees are encouraged to inform their Line Manager if they are, or believe they are, pregnant. The line manager of the individual is then responsible for reviewing their risk assessment for the remainder of their pregnancy and may choose to contact the RPU as part of that review.

Once the University has been informed of an employee at particular risk, a risk assessment is carried out covering the individual in question. The risk assessment also considers accidental exposure of such personnel from work carried out in close proximity to them by others.

For exposure of employees at particular risk, where an AL is not specified in CEMFWR16, it is acceptable to use the reference levels specified for protection of the public, given in the Council Recommendation 1999/519/EC, as exposure limits. Those working in close proximity electro-explosive devices, explosive materials or flammable atmospheres must also be considered. The EMF risk must be considered in the risk assessment for any such work.

9. Appointment of a Departmental EMF Supervisor

The Head of School (or equivalent) is responsible for appointing a Departmental EMF Supervisor (DES) in writing for each department or area where there may be a risk associated with working with EMF. The Head of School (or equivalent) also ensures that the DES is given sufficient training to fulfil that role. The specific duties of the DES will depend on the environment but are such that the DES facilitates the implementation of this policy in the areas for which they are responsible. The University template appointment letter for DESs has been included in Appendix I.

10. New Facilities or Equipment

Where new facilities are proposed that will involve potentially hazardous EMF sources (e.g. MRI scanners, NMR equipment), the RPU must be informed so that expert safety advice can be provided to ensure that the equipment is appropriate and a suitable space is available for it. Either the relevant School or the Procurement Department must arrange consultation with the RPU during the procurement/purchasing phase.

The Departmental EMF Supervisor maintains an inventory of all hazardous EMF sources under their control, and the RPU maintains an inventory of all hazardous EMF sources at the University.

11. Exposure Assessment

The University expects that an exposure assessment is performed for any equipment that generates EMF; note an Exposure Assessment and a Risk Assessment are not the same. The exposure assessment reveals if additional action needs to take place in order for the equipment to be safe to work with. The University uses the flow chart in Figure 3 below for the exposure assessment process. A record of the event must be made when an exposure assessment is performed.

The PI, manager or Supervisor is normally responsible for the planning, organisation and successful outcome of their particular research project, and as such, they bear the day to day responsibility for the health and safety management (including NIR safety) relating to the project.

The PI, manager or Supervisor must therefore check if an Exposure Assessment has already been carried out or if a new one is required.

Exposure Assessments already carried out can be found on the University webpage at the link below:
https://www.ed.ac.uk/health-safety/radiation-protection/radiation-protection-management

It is important to recognise that, in the majority of cases, EMF measurements should not be required. The exposure assessment can be performed by:

- ✓ Reviewing the lists in the guide: *Electromagnetic fields at work. A guide to the Control of Electromagnetic Fields at Work Regulations* 2016. HSG281. 2016. (These lists are reproduced in Appendix H); and,
- ✓ By reviewing manufacturer's information.

If the University cannot determine whether additional action is required after reviewing the lists in HSG281 and the manufacturer's information then it may consider carrying out measurements of EMF.

The following flow chart describes the process for completing an exposure assessment for EMF sources. It should be used in conjunction with the lists/tables in Appendix H.

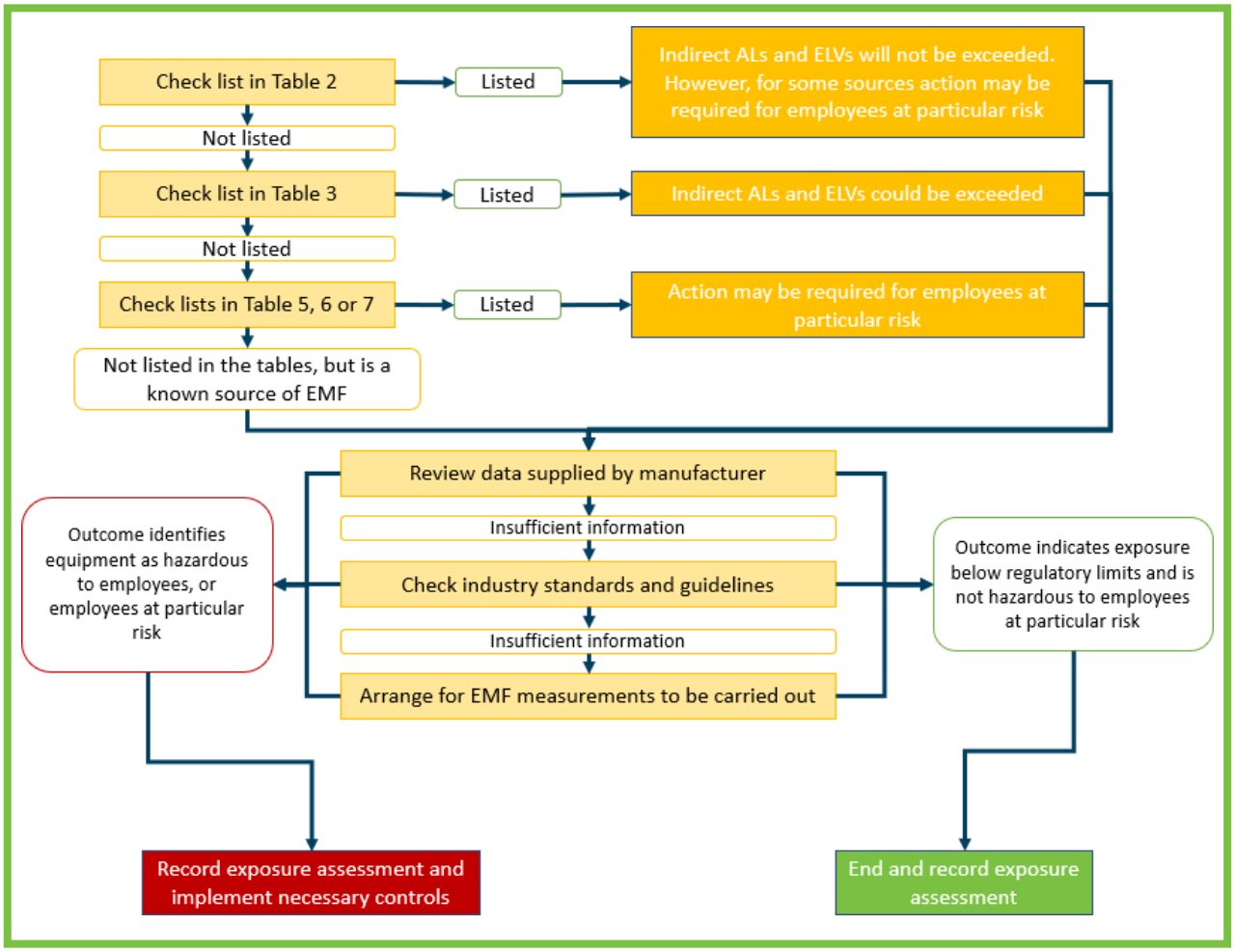

Figure 3. Flow Chart of the Exposure Assessment Process for EMF Sources

In situations where the University is required to use measurement or calculation to carry out an exposure assessment, compliance with the relevant direct effects AL is used to determine compliance with the relevant ELV. The exception to this is static magnetic fields, where the ELV is used.

If it is deemed from the above exposure assessment that the 'health effects' ELVs could be exceeded, the University shall implement an action plan, considering the points listed in Section 12, to ensure exposures are reduced to levels lower than the ELV. A Risk Assessment is then carried out by the University to ensure that the risks of exposure are considered, and appropriate control measures are implemented.

If it is deemed that the low ALs, indirect ALs or the EMF levels specified for protection of the public, given in the Council Recommendation 1999/519/EC could be exceeded, the University ensures that a risk assessment is carried out such that the risks of exposure are considered and appropriate control measures are implemented.

12. Action Plan

Where an exposure assessment has deemed that the ELVs could be exceed, the University implements an action plan to ensure exposures are reduced to levels that are lower than the ELVs. The Action Plan must consider the following points:

- Other working methods that would result in lower levels of exposure to EMFs
- Replacement equipment designed to reduce the level of EMF exposure
- Technical measures to reduce exposure to EMF, including, where necessary, the use of interlocks, screening or similar protection mechanisms
- Demarcation and access control measures
- Maintenance programmes
- The design and layout of workplaces and workstations
- Limitations on the duration and intensity of exposure
- The availability of suitable personal protective equipment

13. Risk Assessments

Any equipment that has been identified as a hazardous EMF source by the exposure assessment is considered in the risk assessments associated with work practices linked to the equipment. The University expects the PI, Supervisor or Manager to ensure the risk assessment is carried out, with guidance from the DES where necessary. The risk

assessment shall include the follow details, where they are relevant:

- The ALs and ELVs
- A description of the source (frequency, level, duration, etc.)
- A description of the exposure (length, part of body, etc.)
- Potential direct and indirect effects
- Any effects on persons at particular risk
- If there are multiple sources of exposure
- Any pertinent information from the manufacturer
- Any pertinent information from any health surveillance undertaken
- Any pertinent additional health and safety related information

Risk assessment templates and guidance for drawing up EMF risk assessments can be found at:
https://www.edweb.ed.ac.uk/health-safety/radiation-protection/radiation-protection-management/risk-assessments-nir

14. Implementation of Control measures

When implementing control measures, following the outcome of the risk assessment, the hierarchy of control measures **must** be followed (see Section 3 in Part One of this CoP). The University recognises that favouring the use of personal protective equipment and procedural controls over an engineering control (e.g. enclosures and guarding), is less effective and may not satisfy the Health and Safety Executive that a suitable and sufficient risk assessment has been carried out. Schools/PIs must ensure that there are robust risk control measures in place to ensure that people will be suitably protected against exposure to safety as well as health.

15. Information, Instruction and Training

The University ensures the provision of information, instruction and training for those involved with sources of EMF that have been identified as hazardous. Staff are given enough information such that they are able to recognise if they fall into the category of 'employee at particular risk', the potential risks and the importance of notifying the University if they fall into this category. Training in EMF includes the following topics, where they are appropriate:

- ALs, ELVs and potential risks
- The results of the exposure assessment
- The measures taken by the University to eliminate or reduce the risks of exposure

- Safe working practices
- The possible indirect effects of exposure
- How to detect and report health effects
- The circumstances in which employees are entitled to health surveillance and examinations
- Any additional measures taken in respect of employees at particular risk

A programme of training has been included in Appendix J.

16. Local procedural controls

Procedural controls can be simple written instructions or detailed documents describing how to manage EMF safety in an area. The level of detail is determined by the risk assessment.

Local Procedural controls (or Local Rules) must be local to the area where the EMF source is used and the University expects the author of the Local Procedural Controls document to avoid, where possible, implementing generic procedural controls for multiple locations.

The Local Procedural Controls document may include the following (depending on the findings of the risk assessment):

- Description of any areas with specific restrictions on access or activities
- Details of any conditions for entering an area or carrying out a particular activity
- Specific training requirements for workers (such as training required to temporarily exceed the low AL, and requirements for employees at particular risk)
- Names of those persons authorised to enter areas
- Names of staff responsible for supervising work or enforcing access restrictions
- Identification of any groups specifically excluded from areas, such as workers at particular risk
- Details of emergency arrangements if appropriate

It is the PI, Manager or Supervisor's responsibility to ensure local procedural controls are implemented and documented.

17. Health surveillance

There are no established risks of direct effects from exposures to EMFs below the ELVs, and so there is no basis for regular medical examinations for University staff.

In the case where it is confirmed that a worker is exposed to levels of EMFs in excess of the ELVs and reports experiencing a health effect, the University ensures that a medical examination is provided to the individual and a record of this will be kept.

Appendix A **Legislation**

Legislation contains legal requirements which must be complied with by the University. For the use of AOR sources, the University must comply with both specific optical safety legislation, as well as general health and safety legislation.

Specific optical safety legislation

The Control of Artificial Optical Radiation at Work Regulations 2010 (AOR10) requires employers to assess the risks posed to staff and others by exposure to artificial optical radiation. AOR10 applies to both lasers and broadband optical sources and utilises a set of Exposure Limit Values (ELVs). Exposures to staff and others below these ELVs will not cause harm.

The University is required to assess whether any sources of AOR have the potential to exceed an ELV. Where optical radiation exposures can exceed the ELVs, the University is required to implement adequate control measures, provide information and training and ensure that health surveillance in available.

General health and safety legislation

Although AOR10 specifically covers AOR radiation sources in the workplace, the University is still required to comply with the requirements of general health & safety legislation such as the:

- *Management of Health & Safety at Work Regulations* 1999;
- *Provision and Use of Work Equipment Regulations* 1998;
- *Personal Protective Equipment Regulations* 2002;
- *Control of Substances Hazardous to Health Regulations* 2002; and
- *Reporting of Injuries, Diseases and Dangerous Occurrences Regulations* 2013.

Please note, this list is not exhaustive.

Laser safety standards

There are a large number of standards that relate to laser safety. The main standards belong to the BS EN 60825 series, which are produced by the British Standards Institute (BSI). Part 1 relates to laser classification, engineering specifications, labelling and supplier/ manufacturer information; while part 14 acts as a user guide for Part 1. There is also BS EN 207, which relates to laser protective eyewear. A list of key laser safety standards that may be applicable to the University's work with AOR sources are shown below:

- BS EN 60825-1 – Safety of laser products. Part 1: Equipment classification and requirements;
- BS EN 60825-2 – Safety of laser products. Part 2: Safety of optical fibre communication systems (OFCS);
- BS EN 60825-4 – Safety of laser products. Part 4: Laser guards;
- PD TR IEC 60825-8 – Safety of laser products. Part 8: Guidelines for the safe use of laser beams on humans;
- PD TR IEC 60825-14 – Safety of laser products. Part 14: A user's guide;
- BS EN 207 Personal eye protection – filters and eye protectors against laser radiation (laser eye protectors); and
- BS EN 208 – Personal eye protection – eye protectors for adjustment work on lasers and laser systems (laser adjustment eye protectors).

Broadband optical standards

There are also a number of Standards that relate to broadband optical radiation. The most pertinent is:

- BS EN 62471 – Photobiological safety of lamps and lamp systems.

The standard provides a lamp classification system (similar to that for lasers in BS EN 60825-1) so that the risks posed by optical sources can be quantified.

Guidance

There are a number of guidance documents that University uses to help it comply with AOR10 and more general health and safety legislation as it applies to work with AOR:

- Health and Safety Executive, *Guidance for employers on the Control of Artificial OpticalRadiation at Work Regulations* (AOR) 2010
- European Union Non-binding guide to good practice for implementing Directive 2006/25/EC 'Artificial Optical Radiation'
- Association of University Radiation Protection Officers, *Guidance on the safe use of lasers in education and research*. Guidance Note No. 7 (2018)

Appendix B Biological Effects from AOR

Artificial optical radiation (AOR) can only elicit a biological effect when it is incident upon tissue and interacts directly with it. Since AOR is rapidly absorbed by body tissue, and only travels through the outer layers of the body, the eyes and the skin are the organs most at risk of damage.

There are two main types of biological effects that can occur in the eyes and skin:

- **Thermal**, whether the energy deposition leads to heating of the target tissue. Excessive heating can lead to a burning of the tissue.
- **Photochemical**, where the energy in the artificial optical radiation excites the electrons in atoms leading to chemical reactions in the tissue.

The wavelengths of artificial optical radiation are categorised further:

Table 3. Bands of AOR

Category	Infrared			Visible Light	Ultraviolet		
Optical band	IRC	IRB	IRA		UVA	UVB	UVC
Wavelength (nm)	1,000,000 – 3,000	3,000 – 1,400	1,400 – 700	700 – 400	400 – 315	315 – 280	280 – 100
			Retinal Hazard Region				
Increasing Energy							

The Eye

Biological effects in the eye are heavily dependent of the wavelength of the AOR, as different wavelengths can penetrate to different tissues within the eye as illustrated in Figure 4.

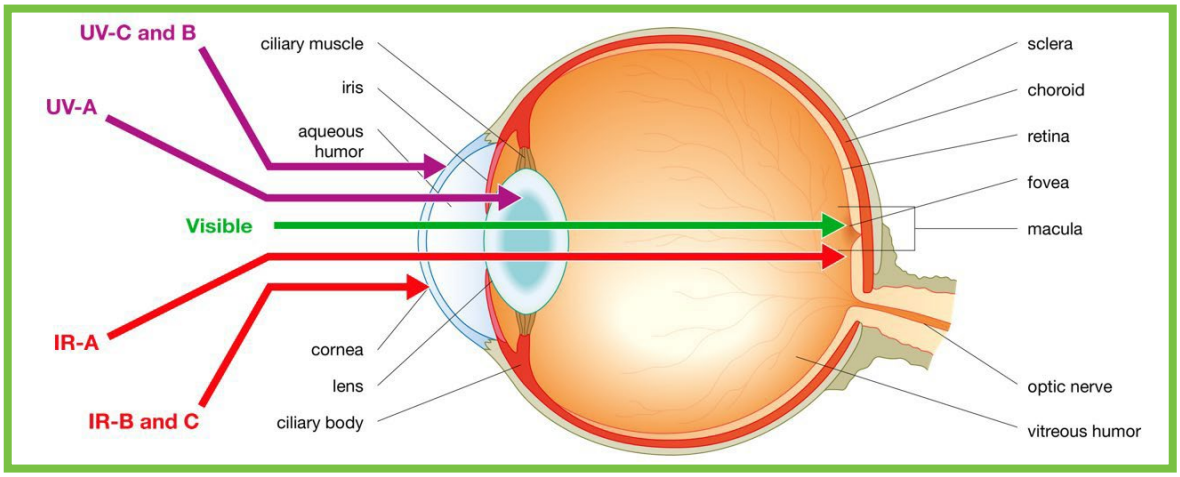

Figure 4. Basic structure of the eye with penetration depths of different wavelengths

Once the radiation has reached the target tissue, several effects can take place (Table 3). The severity of the injury is largely dependent on the wavelength, the duration of the exposure, and the irradiance or radiant exposure for pulsed lasers.

Table 4. Examples of biological effects in the eye

Ultraviolet	Visible Light	Infrared
Photo-keratitis Photo-conjunctivitis Photochemical cataract Retinal photochemical damage	Retinal photochemical damage Retinal thermal damage	Retinal thermal damage Thermal cataract Corneal burn

The Skin

Similar to the eye, different wavelength will penetrate to different layers of the skin.

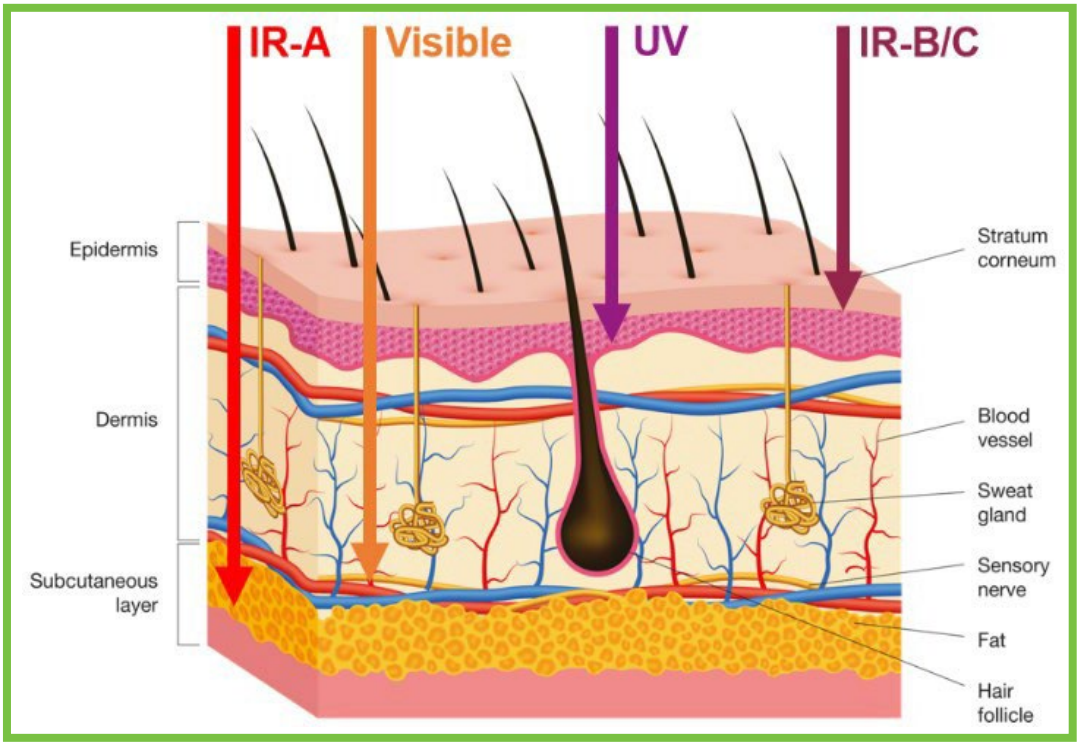

Figure 5. Basic structure of the skin with penetration depths of different wavelengths

Table 5. Examples of biological effects in the skin

Ultraviolet	Visible Light	Infrared
Erythema Photosensitisation	Thermal damage	Thermal damage

Appendix C **Sources of AOR**

Table 6. Sources of AOR

Trivial Sources
A summary of trivial sources identified by the HSE & not likely to exceed an ELV: • All forms of ceiling-mounted lighting used in offices etc. that have diffusers over bulbs or lamps. • All forms of task lighting including desk lamps and tungsten-halogen lamps fitted with appropriate glass filters to remove unwanted ultraviolet light. • Photocopiers. • Computer or similar display equipment, including personal digital assistants (PDAs). • Light emitting diode (LED) remote control devices. • Photographic flashlamps – when used singly. • Gas-fired overhead heaters. • Vehicle indicator, brake, reversing and fog lamps. • Any exempt or Risk Group 1 lamp or lamp system (including LEDs), as defined in British Standard BS EN 62471: 2008 • Any Class 1 laser light product, as defined in British Standard BS EN 60825-1: 2007, for example laser printers and bar code scanners

Safe under normal circumstances
Sources that should not exceed an ELV provided that they are used normally: • Ceiling-mounted fluorescent lighting without diffusers over bulbs or lamps • High-pressure mercury floodlighting • Desktop projectors • Vehicle headlights • Non-laser medical applications such as: operating theatre and task lighting; diagnostic lighting such as foetal/neonatal transilluminators and X-ray light/viewing boxes • UV insect traps • Art and entertainment applications such as illumination by spotlights, effect lights and flashlamps (provided that any ultraviolet emissions have been filtered out) • Multiple photographic flashlamps, for example in a studio • Any Risk Group 2 lamp or lamp system (including LEDs), as defined in British Standard BS EN 62471: 2008

Safe under normal circumstances

- Class 1 laser light products with embedded lasers of Class 3B or Class 4 (i.e. safe when used under reasonably foreseeable conditions of operation).
- Class 1M, 2 or 2M lasers, as defined in British Standard BS EN 60825-1: 2007, for example low-power laser pointers.

Hazardous sources of optical radiation

These sources have the clear potential to exceed ELVs and must be managed:

- Metal working - welding (both arc and oxy-fuel) and plasma cutting
- Pharmaceutical and research - UV fluorescence and sterilisation systems
- Hot industries – furnaces
- Printing - UV curing of inks
- Motor vehicle repairs - UV curing of paints and welding
- Medical and cosmetic treatments - laser surgery, blue light and UV therapies, Intense Pulsed Light sources (IPLs)
- Industry, research and education, for example, **all use of Class 3B and Class 4 lasers, as defined in British Standard BS EN 60825-1: 2007**
- **Any Risk Group 3 lamp or lamp system (including LEDs)**, as defined in British Standard BS EN 62471: 2008, for example search lights, professional projections systems

Appendix D **Template DLS Appointment Letter**

Dear [Appointee Name]

Appointment for Departmental Laser Supervisor (DLS)

Please accept this letter of appointment as a Departmental Laser Supervisor (DLS) for [Department].

Your appointment to this position will assist the University in carrying out its duties under the relevant legislation, standards and guidance and will assist in implementing the requirements of the University's Non-Ionising Radiation Safety Code of Practice. The appointment will take effect from [Date].

You will report directly to [details of management with responsibility in the relevant Department] and will liaise with them as appropriate to appraise management as to the effectiveness of the arrangements for implementing Artificial Optical Radiation (AOR) safety practices. Meetings may be scheduled or initiated by yourself if you feel it necessary to bring any matter to the attention of management.

The duties that are assigned to the DLS include:

- To liaise with and bring to the attention of management any inadequacies identified in working practice or failures in AOR safety procedures
- To act as a responsible person for the purposes of securing compliance with the requirements of the relevant AOR safety legislation, standards and guidance and Parts One and Two of the University's Non-Ionising Radiation Safety CoP.
- To be aware of the scope of the departments AOR risk assessments and assist in drawing up and approving risk assessments for hazardous AOR sources.
- To supervise the implementation of the Local Procedural Controls Document.
- Keep an inventory of hazardous AOR sources and submit an annual summary to the Radiation Protection Unit (RPU).
- Check that those working with hazardous AOR sources have undertaken appropriate training.
- Notify management where a member of staff deliberately disregards procedures or where the working practice is inadequate or likely to place the University in breach of its legal requirements.
- Ensure that suitable records relating to AOR safety are being kept (as described in the Local Procedural Controls Document).

- Liaise with the RPU, Laser Protection Officer (LPO) or Laser Protection Adviser (LPA) as necessary (where appointed). The LPO is the University Radiation Protection Adviser but the LPA may be an externally appointed consultant.
- Implement the recommendations of the LPO or LPA as discussed with management from time to time.
- Seek the advice and consult with the RPU as necessary where circumstances are out of your area of knowledge or confidence.

If you choose to accept this appointment, then please sign this letter, and return it to [Head of School's Name].

Yours sincerely,

[Head of School's Name] [Head of School's Title]

I accept my appointment as DLS for [Department] at the University of Edinburgh:

Name of Appointee:		Date:	

Appendix E **Registration of Hazardous AOR Sources**

Hazardous AOR Sources Registration Form

A laser inventory must be maintained by the Departmental Laser Supervisor (DLS) for hazardous laser and other Artificial Optical Radiation (AOR) sources. To ensure the DLS and the Radiation Protection Unit (RPU) are aware of all hazardous lasers in use at the University, the Principal Investigator (PI), manager or supervisor must register a new hazardous laser and other AOR sources with the DLS and RPU. Existing laser and other AOR systems must also be registered with the DLS and RPU (i.e. all hazardous AOR sources in use must be listed on the DLSs local inventory template). It is not necessary to register low risk AOR sources with the DLS/RPU. For example,

Table 7. AOR Sources which do and don't require registration

Does not require registration	Does require registration
• Risk Group 1 and 2 lamps • Inherently safe Class 1 consumer lasers/laser products such as laser printers, CD/DVD players, Fax machines, etc. • Class 1 or 2 laser pointers	• Risk Group 3 lamps • Class 3B and 4 lasers • Class 1 laser products that have embedded Class 3B or 4 lasers inside them and whose beams might be exposed during routine service and maintenance.

PART 1: General Information

General:	
School or Institute etc:	
Building:	
Lab/Room No.:	
Departmental Laser Supervisor*: *if no DLS appointed, note the School Safety Advisor	
Date of first use (approx.):	

PART 2: Specific Information about the AOR Source

Specific information about the AOR source:	
Unique identifier for your laser/AOR source:	
Manufacturer:	
Make/Model number:	
Lasing medium [e.g. CO2]:	
Laser Class or Risk Group:	
Responsible Person for laser:	
Purpose of laser / AOR Source:	
Waveform:	Continuous Wave ☐ Pulsed ☐
Wavelength or wavelength range:	
For CW Lasers:	
Max. Power output:	
For Pulsed Lasers:	
Radiant Energy per Pulse:	
Pulse Duration:	
Pulse Repetition Frequency:	
For Risk Group 3 lamps:	
Output of source (e.g. W/m^2 at 20cm):	

Appendix F **AOR Safety Training Programme**

There are key components that must be covered during any AOR related safety training although the detail of the components and the training provided can be varied for each work area. Should there be shortfalls in the training provided, staff should seek the advice of the RPU to ensure that the University provides this training.

Staff and Users

Typical AOR safety training for staff and users should cover:

- The hazards posed by the sources of AOR in the workplace, including biological effects and non-beam hazards
- An introduction to the legislative requirements and how the University manages AOR safety
- Content of risk assessments and the implementation of control measures.
- Dealing with incidents involving AOR sources

Departmental Laser Supervisors (DLS)

Typical AOR safety training for DLSs should cover:

- The hazards posed by the sources of AOR in their workplace, including biological effects and non-beam hazards
- Assessment of hazards posed by beams including the determination of key safety parameters such as the Exposure Limit Values, Nominal Ocular Hazard Distance and Hazard Distance
- The legislative requirements of AOR10
- The requirements of the safety standards for lasers and AOR sources
- Guidance on the safe use of lasers
- How the University manages AOR safety, including elements of AOR safety management and the reporting of issues relating to AOR safety
- Carrying out risk assessments and the implementation of control measures
- Carrying out audits of AOR safety
- The role of the DLS
- Dealing with incidents involving AOR sources

Heads of Schools (or equivalent)

Typical AOR safety training should cover:

- The hazards posed by the sources of AOR in the workplace
- An introduction to the legislative requirements and how the University manages AOR safety

Appendix G **EMF Legislation and Guidance**

Legislation

The University is subject to the provisions of general Health and Safety legislation and specific EMF safety legislation. The University has a responsibility to protect its employees and others from the hazards posed by the direct and indirect effects of EMF exposure.

The University's work with EMFs is subject to the provisions of the *Health and Safety at Work etc. Act* 1974 and Regulations made under the Act. There are a number of regulations made under the Act which are pertinent to the University's work, such as:

- *Control of Electromagnetic Fields at Work Regulations* 2016
- *Management of Health and Safety at Work Regulations* 1999
- *Supply of Machinery Safety Regulations* 1992
- *Provision and Use of Work Equipment Regulations* 1998
- *Personal Protective Equipment Regulations* 2002

Please note, this list is not exhaustive.

Guidance

In addition to the legislation mentioned above, there are a number of guidance documents available:

- *Electromagnetic fields at work. A guide to the Control of Electromagnetic Fields at WorkRegulations* 2016. HSG281. 2016
- Non-binding guide to good practice for implementing Directive 2013/35/EU *ElectromagneticFields. Volume 1: Practical Guide*
- Non-binding guide to good practice for implementing Directive 2013/35/EU *ElectromagneticFields. Volume 2: Case Studies*
- Non-binding guide to good practice for implementing Directive 2013/35/EU *ElectromagneticFields. Guide for SMEs*

Appendix H Hazardous Sources of EMF Radiation

Examples of Hazardous Sources

The five tables in this section reproduce the information from the HSE guide *'Electromagnetic Fields at Work. A guide to the Control of Electromagnetic Fields at Work Regulations 2016. HSG281. 2016'.* Each of the tables from HSG281 lists equipment that pose a different level of risk, as described below:

- **Table 2** – sources of EMF emit EMF at levels below the ELVs and which will not exceed the indirect effect action levels. However, employees at particular risk still need to be considered.
- **Table 3** – sources of EMF that may emit exceed the ELVs and/or the indirect effect action levels.
- **Table 5** – sources of EMF that may pose a risk to expectant mothers.
- **Table 6** – sources of EMF that may pose a risk to workers with passive implanted medical devices.
- **Table 7** – source of EMF that may pose a risk to workers with active implanted and active body-worn medical devices.

HSG281 Table 2. Sources of EMF emit EMF at levels below the ELVs and which will not exceed the indirect effect action levels

Wireless communications
• Phones (landlines, mobile phones, cordless, digital enhanced cordless telephone (DECT) base stations) and fax machines in workplaces
• Wireless communications devices (e.g. 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 equipment
• Audio-visual equipment: TVs, DVDs etc.
• Communication equipment and wired networks
• Computer and IT equipment
• Electric fans, fan heaters and room heaters
• Office equipment, e.g. 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/EC2
• Alarm systems
• Electrical room heating equipment

HSG281 Table 2. Sources of EMF emit EMF at levels below the ELVs and which will not exceed the indirect effect action levels

• Base station antennas outside operator's designated exclusion zone
• Electric garden appliances
• Electric handheld and transportable tools
• Household and professional appliances, e.g. 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

HSG281 Table 3. Sources of EMF that may emit exceed the ELVs or the indirect effect action levels

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, e.g. 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

HSG281 Table 3. Sources of EMF that may emit exceed the ELVs or the indirect effect action levels

• Medical diagnostic and treatment equipment using EMFs, e.g. 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

HSG281 Table 5. Sources of EMF that may pose a risk to expectant mothers

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
• Automated welding systems, fault-finding: repair and teaching involving close proximity to the EMF source
Medical
• MRI equipment

HSG281 Table 6. Sources of EMF that 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
• Automated welding systems, fault-finding: repair and teaching involving close proximity to the EMF source

HSG281 Table 6. Sources of EMF that may pose a risk to workers with passive implanted medical devices

• Hand-held induction heating coils
Medical
• MRI equipment

HSG281 Table 7. Source of EMF that may pose a risk to workers with active implanted and active body-worn medical devices

Wireless communications
• Wireless communications devices (e.g. Wi-Fi or Bluetooth), including access points for WLAN
• Use of cordless phones, DECT base stations and fax machines
• Use of mobile phones
Office equipment
• Audio-visual equipment containing radio-frequency transmitters
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
• Where workers need to be in close proximity to cables carrying high currents
• Inverters, including photovoltaic systems
Light industry
• 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
• Arc welding processes including MIG, MAG and TIG
• Industrial and large professional battery chargers
• Corona discharge surface-treating equipment

HSG281 Table 7. Source of EMF that may pose a risk to workers with active implanted and active body-worn medical devices

• Electrostatic painting equipment
• Use of heat guns
• Use of glue guns
• Use of hand-held and portable tools, e.g. drills, sanders, circular saws and angle grinders
• Furnaces resistively heated
• Welding systems – working close to the EMF source, fault-finding and teaching
• Radio-frequency heater/sealer equipment
• Machine tools, e.g. pedestal drills, grinders, lathes, milling machines, saws
Construction
• Construction equipment, e.g. working close to concrete mixers, cranes etc
Medical
• MRI equipment
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
Military Activities
• Maintenance of radar or high-powered communications systems
Miscellaneous
• Battery chargers inductive or proximity-coupling
• Equipment generating static magnetic fields greater than 0.5 mT, e.g. by magnetic
• chucks, tables and conveyors, lifting magnets, magnetic brackets, nameplates, badges
• Headphones producing strong magnetic fields
• Professional inductive cooking equipment
• Two-way radios, e.g. walkie-talkies, vehicle radios
• Battery-powered transmitters

Appendix I **Template DES Appointment Letter**

Dear [Appointee Name]

Appointment for Departmental EMF Supervisor (DES)

Please accept this letter of appointment as a Departmental EMF Supervisor (DES) for [Department].

Your appointment to this position will assist the University in carrying out its duties under the relevant legislation and will assist in implementing the requirements of the University's Non-Ionising Radiation Safety Code of Practice. The appointment will take effect from [Date].

You will report directly to [details of management with responsibility in the relevant Department] and will liaise with them as appropriate to appraise management as to the effectiveness of the arrangements for implementing EMF safety practices. Meetings may be scheduled or initiated by yourself if you feel it necessary to bring any matter to the attention of management.

The duties that are assigned to the DES include:

- Ensure that an exposure assessment has taken place for equipment producing EMF
- To liaise with and bring to the attention of management any inadequacies identified in working practice or failures in EMF safety procedures
- To act as a responsible person for the purposes of securing compliance with the requirements of the relevant EMF safety legislation and Parts One and Three of the University Non-Ionising Radiation Safety Code of Practice.
- To be aware of the scope of EMF risk assessments and assist in drawing up and approving risk assessments for hazardous EMF sources.
- To supervise the implementation of the Local Procedural Controls Document.
- Keep an inventory of hazardous EMF sources in their area.
- Check that those working with hazardous EMF sources have undertaken appropriate training.
- Notify management where a member of staff deliberately disregards procedures or where the working practice is inadequate or likely to place the University in breach of its legal requirements
- Check that arrangements are in place to ensure that all EMF sources are maintained in good working order via the approved maintenance provider, ensure that records are kept and notify management if this is not the case.
- Ensure that suitable records relating to EMF safety are being kept.
- To seek the advice and consult with the RPU as necessary where circumstances are out of your area of knowledge or confidence.

If you choose to accept this appointment, then please sign this letter, and return it to [Head of School's Name].

Yours sincerely

[Head of School's Name]

[Head of School's Title]

I accept my appointment as DES for [Department] at the University of Edinburgh:

Name of Appointee:		Date:	

Appendix J **EMF Safety Training Programme**

There are key components that should be covered during any EMF safety awareness training although the detail of the components and the training provided can be varied for each work area.

- The terms frequency & wavelength and their relationship
- Direct biophysical effects & indirect effects associated with different frequencies
- Causes of transient symptoms and sensations related to effects in the central or peripheral nervous system and how to prevent them
- Health and safety of workers at particular risk e.g. workers who have active or passive implanted medical devices, such as cardiac pacemakers or workers with medical devices worn on the body, such as insulin pumps, and pregnant workers
- Values and concepts of basic restrictions and reference levels listed in the Annex to the EC Recommendation on limitation of the general public to exposures to EMFs (EC/519/1999)
- Values and concepts of the Exposure Limit Values and Action Levels listed in Control of Electromagnetic Fields at Work Regulations 2016 (transposing Directive 2013-35-EU into UK law), the associated possible risks and the preventive measures that may be taken
- How to detect sensory or adverse health effects of exposure, how to deal with an adverse event or apparent over exposure and how to report them
- Where relevant the employer's EMF safety Code of Practice
- Safe working practices to minimise risks resulting from exposure e.g. personal risk assessment and personal protection measures
- Incidental hazards, including electrical, fire and explosion
- Typical hazards and associated system power levels of both intentional and unintentional emitters.

Document version

Version number	Summary of change	Date and by whom
V1.0	New version	April 2021 Mark Green
V1.1	Minor updates	August 2023 Mark Green

If you require this document in an alternative format please contact The Health and Safety Department on health.safety@ed.ac.uk or call (0131) 651 4255