Health and Safety Services

UNIVERSITY OF GREENWICH

Guidance on Working with Electromagnetic Fields (EMF)

Contents

1. Overview

The Management of Health and Safety at Work Regulations requires all employers to control the risks in the workplace, by thinking about what might cause harm to people and taking reasonable steps to prevent harm. This includes considering any risks arising from exposure to Electromagnetic Fields (EMFs).

Electromagnetic Fields (EMFs) are produced whenever a piece of electrical or electronic equipment is used and are present in almost all workplaces. In the majority of cases, the levels produced are within safe levels.

The Control of Electromagnetic Fields Regulation (known as the CEMFAW Regulations) came into force 1st July 2016 and introduced additional controls for workplaces where certain devices pose a higher risk of Electromagnetic Fields (EMFs) to workers. This document is intended to provide guidance to help University staff / students to identify equipment / activities that might generate higher levels of EMFs and complete the associated risk assessment.

2. Definitions

"Action Levels (ALs)" - Defined quantities to help ensure that occupational exposures to electric or magnified fields are maintained below ELVs. The ALs can be found in Part 3 and Part 4 of Schedule 1 in CEMFAW16 regulations.

"Electromagnetic Field (EMF)" - Encompasses static electric fields, static magnetic fields, and time-varying electric and magnetic fields (radio wave fields) with frequencies up to 300 GHz. The generation of electromagnetic fields occurs in various scenarios, such as when a piece of electrical equipment is plugged in and operational. This aligns with the understanding that any device or equipment that uses or generates electrical power can produce associated electromagnetic fields.

"Exposure Limit Values (ELVs)" - Legal limitations set to regulate and limit the exposure of employees to Electromagnetic Fields (EMFs). These values define the **maximum** levels of electromagnetic field exposure that individuals in the workplace are allowed to experience without risking adverse health effects.

"Gigahertz (GHz)" - A unit of measurement used to quantify the frequency of electromagnetic waves. One gigahertz is equivalent to one billion hertz, where a hertz represents one cycle per second.

"Non-ionising Radiation" - Refers to the part of the electromagnetic spectrum that covers two main regions:

- Optical radiation, which includes ultraviolet (UV), visible, and infrared light.
- Electromagnetic Fields (EMFs), which encompass power frequencies, microwaves, and radio frequencies.

"Persons at Particular Risk" (from EMF exposure) - may include individuals who are more susceptible to the effects of electromagnetic radiation. The level of risk can vary based on factors such as health conditions, age, and other individual characteristics.

3. Roles and Responsibilities

3.1. Senior Management (e.g Faculty Operating Officer / Director of Service)

These individuals have overall management responsibility for the work undertaken by their staff / students, as part of their work or study, and must ensure that adequate arrangements have been made before any work with EMF commences. This includes ensuring:

- Adequate resources (time, budgets and personnel) are allocated for planning and carrying out the activity safely
- A 'responsible person' is nominated to oversee any work involving EMFs (see 3.2 below)
- Safe systems of work are established for the planned activities and foreseeable emergencies
- Suitable and sufficient risk assessment(s) are carried out, and necessary actions taken, for any practical work involving EMF.
- Health surveillance and medical examinations are arranged for employees who are exposed to EMFs in excess of the ELVs.

3.2. Staff – Responsible Person

The responsible person will be the person with day to day, operational control over the activity. They are required to carry out a suitable and sufficient risk assessment to ensure that control measures are in place to reduce hazardous EMF exposure so far as is reasonably practicable and to below ALs / ELVs. Where required, this will include producing a formal action plan to reduce exposure to below the relevant level and notifying the Senior Manager of any employees who may have been exposed to EMFs in excess of the ELVs.

3.3. Staff / Students - General

In accordance with the University's Health and Safety Policy, all staff and students are required to comply with the EMF policy and take care that their actions do not put themselves or other people at risk. This includes:

- Ensuring they are competent to undertake their allocated tasks, seeking additional information or training if necessary.
- Following instructions given within the risk assessment / safe system of work and / or by the responsible person and immediately report any concerns about the arrangements or procedures.
- Report accidents, injuries and ill health as they occur, particularly if they may present a risk to the safety of themselves or others. Report any illnesses that occur later but may be attributable to EMF exposure.

4. Guidance

4.1. Sources of Electromagnetic Fields - General

EMFs in the non-ionizing radiation range come from both natural and human-made sources. Examples of non-ionizing radiation sources include:

Natural Sources:

- **Radiation:** The sun emits a broad spectrum of electromagnetic radiation, including visible light, infrared radiation, and ultraviolet (UV) radiation. Visible light is essential for vision, while excessive UV radiation can have harmful effects on the skin.
- **Geomagnetic Field:** Earth's magnetic field is a natural source of non-ionizing radiation. It plays a crucial role in navigation and helps protect the Earth from solar wind.
- **Atmospheric Processes:** Certain atmospheric processes can generate non-ionizing radiation. For example, lightning produces electromagnetic radiation in various frequencies, including radio waves.

Human-Made Sources:

- **Power Lines and Electrical Wiring:** The generation, transmission, and use of electricity produces electromagnetic fields, especially around power lines, electrical wiring, and household appliances. Extremely Low-Frequency (ELF) radiation is associated with these sources.
- **Wireless Communication**: Devices such as mobile phones, Wi-Fi routers, Bluetooth devices, and other wireless communication technologies emit non-ionizing radiation in the radiofrequency range.
- **Microwave Ovens:** Microwave ovens use microwaves (a type of radiofrequency radiation) to heat food. While these microwaves are designed to be contained within the oven, leakage can occur if the oven is damaged.
- **Infrared Devices:** Infrared radiation is used in various technologies, including remote controls, heat lamps, and infrared imaging devices.
- **Medical Equipment:** Certain medical devices, such as magnetic resonance imaging (MRI) machines, use strong magnetic fields and radiofrequency radiation for diagnostic purposes.
- **Visible Light:** Light emitted by artificial sources, such as light bulbs and electronic displays, is part of the non-ionizing electromagnetic spectrum.

4.2. Common Types of Equipment

Common types of equipment found in universities and that may produce EMF include:

4.2.1. Laboratories

- **MRI Machines:** Magnetic Resonance Imaging machines used in medical and scientific research generate strong magnetic fields.
- **NMR Spectrometers:** Nuclear Magnetic Resonance spectrometers used in chemistry and biochemistry labs produce strong magnetic fields.
- **Electron Microscopes:** Transmission and scanning electron microscopes can produce electromagnetic fields
- **Particle Accelerators:** High-energy physics research may involve particle accelerators, which can produce strong magnetic fields.
- **Cyclotrons and Synchrotrons:** Particle accelerators used in nuclear and particle physics research.

4.2.2. Medical and Healthcare environments

- **X-ray Machines**: Some types of X-ray machines can generate electromagnetic radiation.
- **Electroconvulsive Therapy (ECT) Machines**: Used in psychology and psychiatry, ECT machines produce electrical currents that generate EMF.

4.2.3. Power Lines / Distribution Systems

- **Transformers and Substations:** Electrical power distribution systems on university campuses involve transformers and substations that can produce EMF
- **The power distribution infrastructure** within buildings and on university campuses, including power lines and electrical wiring, can produce EMF

4.2.4. Information Technology / Electronic Devices

- **Microwave Ovens:** Used in common areas and research facilities, microwave ovens emit electromagnetic radiation.
- **Radiofrequency (RF) Equipment:** Communication equipment, radar systems, and wireless networks generate RF fields
- **Computers and Servers:** Electronic devices emit low levels of electromagnetic radiation.
- **Electric Motors:** Various types of electric motors found in labs, offices, or workshops can generate EMF.

4.2.5. Industrial:

- **Welding Equipment:** Electric arc welding generates electromagnetic radiation.
- **Induction Heaters:** Used in material science and industrial processes, induction heaters produce strong magnetic fields.

The strength of the electromagnetic fields produced by these types of equipment can vary, and exposure levels depend on factors such as the proximity of individuals to the equipment, the duration of exposure, and the specific characteristics of the equipment**.**

4.3. Consequences of EMF exposure

There are two main categories of consequences from EMF exposure: indirect effects and direct effects.

It is important to note that the consequences described below, particularly in the direct effects category, are associated with exposure to elevated levels of EMFs. In everyday scenarios and with typical exposure levels, such effects are not commonly experienced.

4.3.1. Indirect Effects:

Uncontrolled Attraction of Ferromagnetic Metals - EMFs may induce magnetic fields that attract ferromagnetic metals, which can lead to uncontrolled movement of metal objects in the vicinity of strong EMFs.

Interference with Medical Devices - EMFs can interfere with the operation of active or passive medical devices, which may affect the proper functioning of that equipment, potentially compromising patient safety.

Electric Shocks and Sparks - EMFs can induce electric currents, leading to shocks and sparks, which can trigger a fire or explosion in certain environments.

4.3.2. Direct Effects:

Sensory Effects – this may include**:**

- Nausea: A feeling of sickness or discomfort.
- Vertigo: Dizziness or a spinning sensation.
- Metallic Taste: Perception of a metallic taste in the mouth.
- Flashes to the Eyes: Visual disturbances such as flashes.

Health Effects – this may include:

- Thermal Stress in Body Tissue: Elevated temperatures in tissues due to absorption of EMF energy.
- Sensations of tingling and Muscle Contractions
- Heart Arrhythmia: Irregular heartbeats or disturbances in the normal heart rhythm.

4.4. Risk Assessment

The responsible person must carry out a suitable and sufficient risk assessment to ensure that hazardous EMF exposure is below ALs and does not exceed ELVs. The risk assessment must cover the lifecycle of the work and include indirect and direct effects and people at particular risk.

Workers and students should be informed about safety measures and follow recommended practices when working with or around equipment that produces EMF.

It's important to refer to the specific text of Directive 2013/35/EU and any associated regulations to get detailed and accurate information regarding the steps and requirements for conducting electromagnetic risk assessment in the workplace.

4.4.1. Workers at Particular Risk

Some workers are considered to be at particular risk from EMF. These workers may not be adequately protected by the ALs specified in the directive, and therefore the University are required to consider their exposure separately. This includes:

- **Workers wearing active implanted medical devices (AIMD**), including cardiac pacemakers, cardiac defibrillators, cochlear implants, brainstem implants, inner ear prostheses, neurostimulators, retinal encoders, and implanted drug infusion pumps.
- **Workers wearing passive implanted medical devices containing metal**, including artificial joints, pins, plates, screws, surgical clips, aneurysm clips, stents, heart valve prostheses, annuloplasty rings, metallic contraceptive implants, and cases of AIMD
- **Workers wearing body-worn medical devices**, including external hormone infusion pumps
- **Pregnant workers** (see also New & Expectant Mothers at Work arrangements)

Note: In assessing whether workers may be at particular risk, consideration must be given to the frequency, level and duration of exposure. The University may additionally obtain input from qualified medical practitioners for advice about whether an individual is at particular risk.

4.4.2. Considerations for Assessing Risk

Understanding the potential hazards associated with EMF sources is a critical aspect of ensuring the safety of individuals in the university. Developing comprehensive strategies for assessing and controlling EMF exposure involves a systematic and informed approach.

Electromagnetic risk assessments must follow the guidelines of the Framework Directive 2013/35/EU, and include consideration of:

- **Source Characteristics** - the frequency, level, duration, and type of exposure from the EMF source. This includes evaluating the field distribution over an individual's body and variations between different areas of place of work and assessing whether exposure levels comply with relevant safety standards and guidelines
- **Multiple Sources and Simultaneous Exposure** - the presence of multiple EMF sources in the place of work and the potential for simultaneous exposure to multiple frequency fields. Evaluate the combined effects of exposure from different sources, taking into account the cumulative impact on individuals.
- **Direct Biophysical Effects** - This involves understanding how electromagnetic fields interact with biological tissues and potential health implications. Referring to scientific literature and research studies will help you to stay informed about the current understanding of direct effects.
- **Indirect Effects** - such as induced currents in conductive objects or interference with electronic devices.
- **Manufacturer or Distributor Information -** emission information and other safety-related data provided by the manufacturer or distributor of equipment. Manufacturers often provide guidelines on safe usage, maintenance, and potential hazards associated with their equipment
- **Sector or Industry Standards** - For example, guidance notes on the use of non-ionizing radiations in research and teaching may provide specific recommendations for academic and research environments.
- **EU (Non-Binding) EMF Practical Guidance** - CEMFAW Regulations, the EMF Directive 2013/35/EU, International Commission on Non-Ionizing Radiation Protection or European Union's (non-binding) EMF Practical Guide to Good Practice offer practical recommendations and best practices for managing EMF exposure in various settings.
- **Health and Safety Executive (HSE) guidance HSG 281**, "A Guide to the Control of Electromagnetic Fields at Work Regulations 2016." provides guidance specific to the UK regulations on controlling EMF exposure at work.

5. Further information

5.1. Related HSE Guidance:

Further general guidance on Electromagnetic Fields can be found on Health and Safety Executive (HSE) web pages;

- A guide to the Control of Electromagnetic Fields at Work Regulations 2016, http://www.hse.gov.uk/pubns/priced/hsg281.pdf
- HSE Information Page on EMFs: http://www.hse.gov.uk/radiation/nonionising/emf.htm
- Control of Electromagnetic Fields at Work Regulations 2016: http://www.legislation.gov.uk/uksi/2016/588/pdfs/uksi_20160588_en.pdf

5.2. Related University documents:

- Electromagnetic Fields Policy
- H&S Risk Assessment arrangements

6. Document History

Details of previous reviews are as follows:

Review Date	Reviewer	Summary of Review
13-Jun-2025	Isabelle Sangregorio Biological & Scientific Safety Advisor	First revision (V.25.1)

This document will be reviewed at least annually.