

# Electromagnetic fields directive Using EU and HSE guidance documents to assess compliance

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# Background

- Physical Agents directive in EU
  - Noise, vibration and artificial optical radiation already in place
- Directive 2013/35/EU 26<sup>th</sup> June 2013
  - Control of Electromagnetic fields at work regulations (UK implementation)
  - UK regulation to be in place 1<sup>st</sup> July 2016
    - Associated EU and HSE guidance
- EN 50499:2008 (Procedure for the assessment of the exposure of workers to electromagnetic fields)
  - Based on 2004 version of the directive with stricter levels for magnetic fields and the same for electric fields (both at 50Hz)
    - Therefore compliance with the EN will afford compliance with 2013 directive

# Effects of EMF on people

- Direct Health effects of EMF on the body:
  - Phosphenes “flashes of light” when exposed to electric fields within the body
  - Nerves can respond to electric fields within the body
  - Muscles can be stimulated from EMF fields
- Indirect Health effects of EMF on the body:
  - Contact currents, voltages and currents induced by EMFs in objects and people. Touching objects in EMF can cause currents to flow, resulting in electric shocks, burns or sparks
  - Effects on medical devices:
    - E.g. Cardiac pacemakers (implanted) and insulin pumps (non-implanted)
    - Local heating of passive metallic implants

# Exposure Limit values and Action Levels

- Currently guidance only from ICNIRP with reference values
- New regulations will put into place exposure limit values which are enforceable in law
- Sensory and Health effect Exposure Limit Values
  - Directive defines separate exposure limit values for sensory and health effects
    - Sensory effects 0 -400Hz and 0.3 – 6GHz
    - Health effects all frequencies
  - ELV up to 1 Hz – (Sensory) related to vertigo and other perceptual effects
  - ELV 1Hz – 10MHz (Sensory) – retinal phosphenes, health stimulation of peripheral and central nerves
  - ELV 100KHz – 6GHz (Health) heating of tissues specific energy absorption rate (SAR)
- The ELVs for time varying fields are set in terms of internal body quantities that are not easily measurable in people.
- Action levels for electric and magnetic field strength derived

# Action values and ELVs

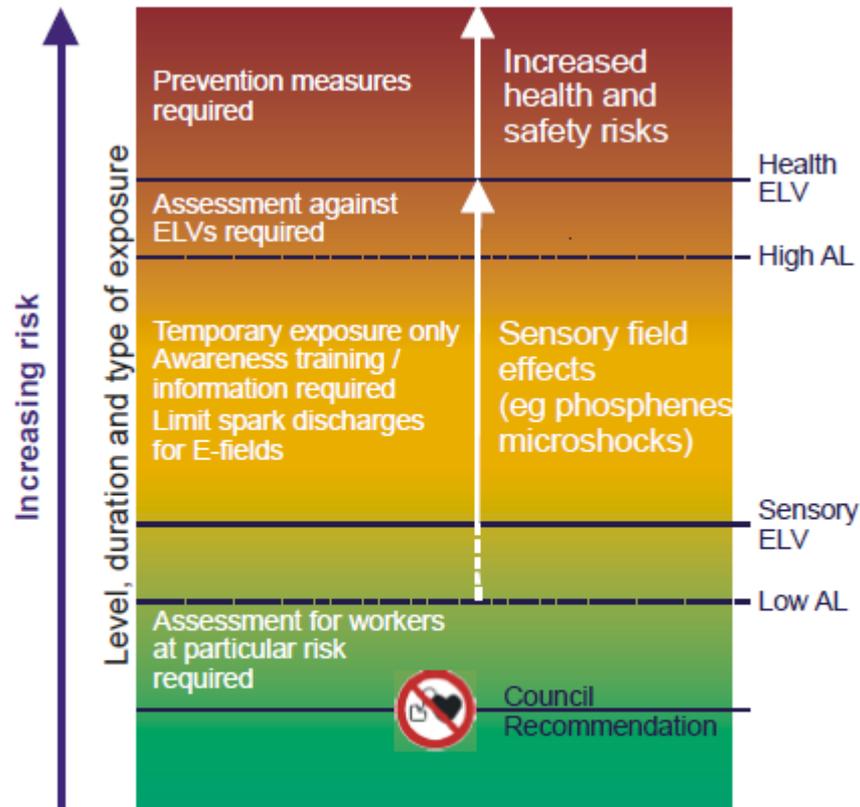


Figure A2 Schematic showing relationship between exposure limit values and action levels

Comparison of measurements with the action values can be used to demonstrate compliance.

# Workers at particular risk – council recommendation

- The Directive defines action limits for workers at particular risk (equivalent to the general public (council recommendation))
- Workers at particular risk (council recommendation) include those with:
  - Pacemakers (potential increased risk if exposure localised to chest)
  - Defibrillators
  - Cochlear implants
  - Insulin pumps
  - Electric or electronic devices implanted or worn on body
  - Metallic prosthesis (pins, screws, and plates, including replacement knees and hips)
  - And those who have declared their pregnancy

# Process for assessment of compliance – A priori

- Refer to EN 50499:2008 for “a priori” equipment
  - Equipment producing levels of EMF below council recommendations
  - Equipment not priori compliant but compliant with low action values
    - Identified in EN 50499
  - Equipment not compliant with low action values but complaint with Exposure limit values
    - Contact currents to be considered for further risk assessment/ measurement
  - Magnetic fields:
    - Less than 500A total current or current per phase
    - The conductor is an overhead bare conductor
  - Electric fields:
    - EN 50499 assumes all cables greater than 1KV have an earthed shield and are compliant
    - Single core cables with spiral armouring, not expected to have significant fields even at bends

# Process for assessment of compliance

1. Identify where electric or magnetic field may exceed the low action value
  - Where EN 50499 suggests the action value may be exceeded
  - Equipment has air-cored inductive devices, including air-cored power transformers and reactors (inductors)
  - Close to the end of windings of high power generators
2. Detailed review of equipment on site that was not “a priori” and required further assessment
3. Identified areas where more information was required
  - Public Health England contracted to conduct measurement using the low action values and council recommendation as reference points

# Results of Assessment of EMF

- Power generation and distribution
  - Electricity generation
    - Low action values not exceeded (including limb for live changing of exciter brushes)
    - Council recommendation exceeded around power generators, bus bars and cables.
  - Electricity generation
    - Magnetic flux densities could exceed low action level under high load
      - Low occupancy – qualify as lower risk activity
    - Switch rooms and transformer compounds do not exceed low action value but do exceed council recommendation
- Motors and Drives
  - High power consumption motors and drives do not exceed low action value but do exceed council recommendation
  - Magnetically- coupled pumps do not exceed low action value or council recommendation

# Results of Assessment of EMF

- Workshop tools
  - Installed tools do not exceed low action value or council recommendation
  - Hand held tools do not exceed low action value but do exceed council recommendation close to the tool
- Induction heating equipment
  - Workshop induction heater
    - High action value exceeded in very close proximity (unlikely to be whole body)
    - Low action value exceeded at operator position (low risk work activity)
  - Induction hob (kitchens) (pans not positioned on hob correctly)
    - Action value exceeded at surface of hob
    - Council recommendation exceeded

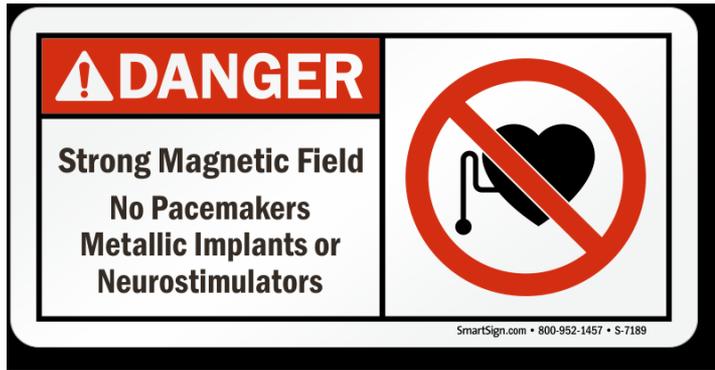
# Results of Assessment of EMF

- Security equipment
  - Electric fence controllers, limb exposure exceeds action value. Council recommendations exceeded inside the cabinet
  - Electric fence, do not exceed low action value or council recommendation
  - Access control pads, do not exceed low action value or council recommendation
  - Portable metal detectors, do not exceed low action value or council recommendation
- Radiofrequency Communications equipment
  - Communications antennae, do not exceed low action value or council recommendation

# Actions to meet the requirements in the draft directive

- Include information in site induction regarding the hazard of EMF and inform existing workers.
  - Strong fields in some areas may present a risk
  - Such areas will be demarcated and signed appropriately
  - Explanation why entry not permitted when high or limb action values may be exceeded
  - Explanation that only authorised persons permitted to enter where low action values may be exceeded
  - Any worker at particular risk should identify themselves to supervisor
  - Any worker at particular risk should observe warning signs and other instructions

# Signs, or equivalent, to be used



No hand access  
within 5 cm



No hand access  
within 5 cm



Risk of interference  
with active implanted  
medical devices



No access for  
personnel with  
passive implants

# Next steps

- Document risk assessment
- Develop training / information packages for existing workers
- Review and edit site induction information
- Sign and demarcate identified areas
- Put in place a management of change process for new equipment or changes to existing equipment that could impact EMF risk assessment

# Acknowledgements

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Questions?

Thank you