

EU Physical Agents (EMF) Directive

The potential impact of EU PAD (EMF) on MRI research practice in the UK: a survey of Cancer Research UK, EPSRC, MRC and Wellcome Trust grant-holders

The EU Physical Agents (Electromagnetic Fields) Directive 2004/40/EC [EU PAD] is intended to protect the health and safety of workers exposed to electromagnetic fields (EMF). The Directive defines maximum exposure levels for electromagnetic fields (EMF), with frequencies from 0-300 GHz; these limits will apply to all operating staff and those maintaining equipment.

Concerns have been raised that the Directive could seriously limit the use of magnetic resonance imaging (MRI), for research, diagnosis and treatment. The Wellcome Trust and the Medical Research Council (MRC) conducted a survey to examine the potential impact of the EU PAD on research practice. The results suggest the Directive could have a very prohibitive impact on research: more than three quarters of researchers who are present in the scanner room during operation need to work within one metre of a scanner.

Methodology

The survey was conducted between November 2006 and January 2007. E-mail invitations were sent to every current grant-holder funded by Cancer Research UK, the Engineering and Physical Sciences Research Council (EPSRC), the MRC and the Wellcome Trust that use MRI technology. Questions explored the amount of time that researchers spent in a scanner room while the scanner was operating and the reasons why, to assess how often researchers might exceed the limits in the Directive.

Responses were received from researchers at 54 different MRI units throughout the UK.¹ Out of 189 researchers who were sent invitations to the survey, 81 provided complete responses – a response rate of 43%. Respondents used mainly 1.5T, 3T, 7T and 9T scanners.²

Results

Presence in scanner room: The results reveal that a majority of researchers need to spend time near to the scanner during operation: 70% of survey respondents spend time in the scanner room while the scanner was operational. The reasons given depend on the field strength of the scanner. At low strengths, researchers are most frequently present to meet patient need or to conduct interventional MRI; for higher strength scanners, researchers need to be present to monitor animal physiology. The need for researchers to provide technical support is cited across all strengths, becoming increasingly important with higher field strength magnets.

The reason for using the scanners, and the levels of exposure of researchers, can be seen to vary according to the field strength of the scanner. The survey report analysed the results according to scanner strength, and by types of exposure across all researchers.

¹ It should be noted that the survey was not conducted as a comprehensive audit. The selection method – using current grantholders from four funding bodies – meant that not every unit in the country was approached. In addition, not all of those units that were approached submitted responses.

² Researchers were asked to provide information about the scanner they used most frequently (the 'main' scanner), the second most commonly used scanner (the 'second' scanner) and any other scanners used in the unit. The results described include both 'main' and 'second' scanners.

Distance from magnet: Of those researchers who spend time in the scanner room during operation, nearly half (46%) need to reach into the magnet, mainly for technical support, patient need and interventional MRI. A further third (32%) are within one metre of the scanner. Therefore, the survey found that more than three quarters (77%) of researchers are within one metre of the scanner, for all strengths of scanner, and could exceed the limits in the Directive.

Number of scans per week: The survey found that a small cohort of researchers conduct over ten scans per week, mainly using high strength scanners. The majority of researchers (75%) conduct less than three scans per week during which they are present in the scanner room.

Average time spent in scanner room: The majority of researchers (62%) spend less than 30 minutes, on average per scan, in the scanner room while the scanner is operating. However, nearly a quarter of researchers spend over an hour in the scanner room. Overall, the survey also revealed that approximately one in ten researchers (of those who are present in the scanner room) conduct many scans per week and spend over an hour in the scanner room for each scan.

Other people present in the scanner room: The majority of respondents reported instances of another person, or people, being present in the scanner room during the scan, other than those being scanned during the experiment. For any scanner strength, two to four other members of staff may be in the room at any one time, including technicians, carers, researchers, or anaesthetists. The distance these other users stand from the scanner varies according to the purpose. Technicians and anaesthetists are most likely to be standing very close to the magnet, or reaching inside, and can therefore be expected to have the highest levels of exposure.

Safety awareness: awareness of safety and risk assessment appears to be good among all the respondents. All units have either local safety rules for their facility or a local magnetic safety advisor or both, and the vast majority carry out a risk assessment for every research project.

Discussion

The results of this survey suggest the EU PAD could have a very prohibitive impact on research practice. New research commissioned by the UK's Health and Safety Executive (HSE) demonstrates that workers standing within one metre of the scanner during operation, or moving more quickly than 1m/s through static fields, would exceed the limits set by the Directive.³ Our results reveal that, of those researchers in the scanner room during operation, more than three quarters are within one metre of the scanner, for any scanner strength. These researchers would therefore all be in breach of the Directive. Moreover, nearly half (46%) of all researchers in the scanner room need to reach into the scanner.

The current exposure limits for gradient fields would prevent workers from standing close to the bore during imaging. This would prohibit interventional MRI, limit the provision of patient care, and restrict researchers from reaching into the magnet bore, for example for positioning and checking equipment, or providing technical support. Paediatric and neonatal work would be particularly threatened, because expert nursing care is often required during imaging.

The EU Physical Agents (EMF) Directive could seriously limit the use of MRI for research purposes, prohibiting research that has clinical and public benefit. The use of new, more powerful high-field scanners in research will be particularly restricted and the Directive threatens the development of new MR methodologies and improvements in technology.

³'Assessment of electromagnetic fields around MRI equipment', HSE Research Report (2007), available to download at: <http://hse.gov.uk/research/rrhtm/rr570.htm>. See also S Crozier et al, Proc. Intl. Soc. Mag. Reson. Med. (2007) 15, 1089.