MR LOCAL RULES

Version 3.1

22 December 2023

This version replaces all previous versions

Previous Version [3.0, March 2022]

Magnetic Resonance Units at RDUK:

1. Siemens Avanto – R10
2. Siemens Avanto – R11
3. Siemens Aera – R12
4. Siemens Aera – R14
5. Siemens Aera – R15

Prepared by RA Quest (MR Safety Expert, MRSC™), Jessica Knifton-Smith (Supt Radiographer)

To be reviewed biennially: Review date March 2024

Ref no. MRI001

These MR Local Rules have been agreed and authorised by:

Signature:  ..... Date: 09/06/22

Emma Liddle
Operations Manager

Signature:  ..... Date: 10/06/22

Beverley Halfpenny
Clinical Lead – North

Signature:  ..... Date: 10/06/22

Rosalee Brissett
Clinical Lead – South

Signature:  Date:04/07/22

Rebecca QUEST
MR Safety Expert (MRSC™), Imperial College Healthcare NHS Trust

Declaration by the MR Responsible Person

As the MR Responsible Person who is responsible for the day-to-day MR safety of the following MR Units:

1. Siemens Avanto – R10
2. Siemens Avanto – R11
3. Siemens Aera – R12
4. Siemens Aera – R14
5. Siemens Aera – R15

I declare that I have read and understood the MR Local Rules (version 3.1, 22-Dec-2023) and will ensure that the department abides by them.

Signature:  ..... Date: 10/06/22

Beverley Halfpenny
MR Responsible Person

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Version	Date	Author/Editor	Comments
3.0	22-Dec-23	Jessica Knifton-Smith/Emma Liddle	Re-write of local rules to incorporate the MRI Safety policy (CR02)
4.0	22-Dec -23	Emma Liddle/Rosalee Brissett and Bev Halfpenny	Updated Operator list. Removed R7, R8 and R9 MRI scanners Updated to reflect new Risk system Radar.

1 Introduction

Magnetic Resonance Imaging (MRI) is a clinical diagnostic technique which does not use x-rays or ionising radiation. However, the presence of strong magnetic fields makes MRI a potentially hazardous working environment for staff, patients and visitors.

These Local Rules provide a framework for safe practice at

MR mobile scanning units at Ramsay Diagnostics UK (RDUK)

All staff working on the MRI scanners must read, be familiar with and comply with these Local Rules.

Sections 2-4 contain background and general information. Sections 5-12 cover local practice, with further information in the appendices.

Under the Health and Safety at Work etc. Act 1974, the principal duties are as follows: -

- Each person entering the MRI environment has a duty to themselves and others to be diligent in the observation of the safety rules, and also such verbal and written guidance as may be used to supplement these rules.
- All staff have a duty to inform the management of RDUK, of any additional hazard not covered by these local rules, or covered in a way which is found to be inadequate. Such reports should pass through the MR Responsible Person.
- There is a strict duty under the Health and Safety at Work etc. Act 1974 to demonstrate due regard for the condition of apparatus used within the MRI suite, and for its correct operation. Deficiencies in training or instruction should be drawn to the attention of the MR Responsible Person at the earliest convenient opportunity.
- Although operational duties are allocated to two specific officers within these rules, the executive safety responsibilities are with the Head of Diagnostic Services.

The Local Rules are consistent with the following:

1. **Protection of Patients and Volunteers Undergoing MRI Procedures**
   Health Protection Agency, Documents of the HPA, Radiation, Chemical and Environmental Hazards, Aug 2008.
2. **Safety Guidelines for Magnetic Resonance Imaging Equipment in Clinical Use.**
   Medicines and Healthcare Products Regulatory Agency (2021). London: MHRA.
3. **Medical Magnetic Resonance (MR) Procedures: Protection of Patients**
   ICNIRP (2004). Health Physics 87: 197-216, and Health Physics 2009; 97: 259-261.
4. **Pregnancy and Work in Diagnostic Imaging Departments 2nd Edition**
   British Institute of Radiology, College of Radiographers, Royal College of Radiology, 2009.

2 Brief functional description of MR equipment

2.1 System components

A MR system typically consists of:

- a magnet which produces a strong, constant magnetic field;
- a radio-frequency transmitter and receiver subsystem;
- a magnetic field gradient subsystem;
- a computer system for scanner control, image display and archiving;
- a patient handling subsystem;
- accessories.

2.2 The magnet

MR systems are described in terms of magnetic field strength, measured in Teslas (T). The earth's magnetic field is approximately 0.05 mT.

Clinical scanners generally use superconducting magnets with field strengths of 1.5 or 3T. **The magnetic field is always present**, even when the MR system is not in use and otherwise shut down.

Liquid helium is used as a cryogenic coolant. A loss of superconductivity results in a magnet quench where the field collapses in less than one minute and a large amount of helium boils off as gas. In certain *emergency* conditions a quench can be initiated by an *Authorised MR System Operator*.

2.3 Fringe field

The magnetic field extends beyond the confines of the scanner. The strength of this *fringe field* decreases rapidly with distance. To ensure safety an **MR Environment** is defined which contains the 0.5 mT field contour (see 2.9). The **MR Controlled Access Area** contains the MR Environment. Access of persons and equipment to the MR Controlled Access Area is restricted and suitable warning signs displayed at all entrances.

2.4 Radio frequency (RF) system

The MR signals which provide the diagnostic information are produced within the patient's tissue in response to radio-frequency (*RF*) pulses. These are generated by a transmitter coil which surrounds the whole body or a part of it.

The MR signals are detected using receiver coils. The MR signals are sensitive to electrical interference. A special shielded room (or *Faraday cage*) is used to minimise interference. **It is important to keep the Magnet Room door closed during scanning to avoid interference**.

2.5 Gradient system

The MR signals are manipulated to produce images using short term variations in magnetic field strength across the patient. These are known as the *gradients*.

The gradient fields are produced by three sets of gradient coils, one for each direction (*x,y,z*), through which a series of large electrical pulses are applied in a *pulse sequence*. The gradient coils are built in to the bore of the magnet.

The gradients generate a tapping sound during scanning, like a loudspeaker. The cumulative effect of all three gradients can be very loud. **Hearing protection is required**.

2.6 Computer system and console

The MR system is controlled via the operator's console in the control room. At the console the MR *System Operator* enters patient details, chooses the scan acquisition parameters, views and processes and archives images, or sends then to other workstations or PACS.

2.7 Patient handling system

The patient couch is integral to the magnet system. Accurate positioning is achieved using halogen or laser light markers. The motor drive has emergency stop buttons.

Communication between the patient and the system operator is achieved via an intercom system. The patient is provided with a hand-held alarm. Closed circuit TV may be used for additional visual monitoring of the patient.

2.8 Accessories

MR Conditional anaesthetic and physiological monitoring systems are required when the patient undergoes general anaesthesia or sedation. Physiological monitoring, e.g. peripheral pulse, ECG (electro-cardiogram) and respiration, may be used to control the timing of the scan to prevent motion (e.g. from breathing) degrading the images. Other patient handling accessories include non-magnetic wheelchairs, trolleys and drip stands. Only accessories labelled MR safe or MR Conditional are permitted to be taken into the MR Environment. Those labelled MR Conditional must be used according to the conditions for safe use. Accessories labelled MR Unsafe must never be taken into the MR Environment.

2.9 Scanner Layout

Within the MRI scanner, the following areas are defined; the magnet is located in the *Scanner* or *Magnet Room*. The electrical cabinets required to run the scanner are located either in the rear of the control room and/or to the rear of the scanner magnet. The *Control Room* houses the system console and archiving devices.

The **MR Environment** is defined as the three-dimensional volume of space surrounding the MR magnet that contains both the Faraday shielded volume and the 0.5 mT field contour (5 Gauss line). This volume is the region in which an item might pose a hazard from exposure to the electromagnetic fields produced by the MR equipment.

The **MR Controlled Access Area** is a locally defined area which contains the MR Environment. Access of persons and equipment to the MR Controlled Access Area is restricted and suitable warning signs must be displayed at all entrances.

3 Risks of MRI

3.1 Magnetic field exposures to staff and patients

MRI does not use x-rays or ionising radiation. Patients are exposed to static, extremely low frequency (ELF) and voice frequency (VF) time varying (from the gradients) and radio frequency (RF) magnetic fields. Staff are usually only exposed to the static magnetic fringe field.

3.2 Sources of potential hazard include

- attractive and twisting forces (torque) on ferromagnetic objects within the static magnetic field and its fringe field;
- interference with or damage to active implanted medical devices;
- heating and displacement of active or passive implanted medical devices (implants and prostheses);
- skin burns and induced current burns;
- acoustic noise;
- adverse reactions to MR contrast agents;
- cryogen hazards.

Other acute sensory effects may occur, but are not hazardous.

3.3 Projectile or missile effect and torque

The magnetic fringe field causes a *strong force of attraction* on ferromagnetic objects. **The magnetic force upon these objects increases very rapidly close to the magnet**. A loose ferromagnetic object will accelerate as a projectile towards the magnet and may seriously injure any person in its path. Damage may also be inflicted on the MR equipment itself.

Additionally, a strong torque or twisting force is exerted on ferromagnetic objects, aligning them with the field. **The torque is strongest within the magnet bore.**

Metals such as iron, steel (including types of stainless steel) and nickel are ferromagnetic. Some coins are ferromagnetic. Aluminium, brass, copper, titanium, and some alloys (e.g. nitinol, epigloy, CrCoMo ASTM) are not ferromagnetic. 316 Stainless steel is weakly ferromagnetic.

Some active implants may contain ferromagnetic components.

An accident resulting from the forces on a ferromagnetic object could be fatal.

3.4 Interference with active implanted medical devices

Electrically or magnetically activated implants may be subject to electro-magnetic interference, heating and a mechanical force within or close to the MR system. The static magnetic field may interfere with the operation devices, e.g. neural stimulators or pacemakers, either by unwanted activation, inhibition or programming changes. Additionally, integral components such as relay switches may be damaged.

For cardiac pacemakers, induced signals resulting from the RF or gradients can interfere with the pacing function. Changes in the operating modes of standard pacemakers have been observed in field strengths as low as 1mT. **Persons with standard cardiac pacemakers are excluded from 0.5mT fringe field boundary**.

3.5 Heating and displacement of active or passive implanted medical devices

Ferromagnetic prostheses and implants may experience displacement when introduced to the static magnetic field. All metallic implants may undergo heating during a scan as a result of the RF exposure.

Items requiring a cautious approach include aneurysm or occlusive clips, interstitial radiotherapy implants, intra-uterine contraceptive devices (IUDs), false eyes and indwelling catheters. Subjects with metallic implants other than those in the brain, are usually not excluded from scanning, as there is little risk of movement due to fibrosis around the implant. The possibility for shrapnel wounds or the presence of metallic foreign bodies, particularly in the eyes, can be excluded by plain film x-ray.

The presence of any metal within or close to the area being examined will degrade the quality of the information obtained and may impair the diagnosis.

3.6 Skin burns

Skin burns can occur occasionally if the patient's legs are touching or if their hands are clasped, particularly if they are sweaty, or if they are in close contact with the bore of the magnet. Padding should be used to alleviate this risk. The use of inappropriate leads for physiological monitoring can result in burns. Only high impedance leads suitable for use with the MR equipment should be used for the monitoring of electrophysiological signals (e.g. ECG) during scanning.

3.7 Acoustic Noise

The scanner can generate high levels of acoustic noise due to the switching gradient fields. At the location of the patient, acoustic noise exposure could result in discomfort or temporary hearing loss. Hearing protection is compulsory when acoustic noise levels exceed 99dB(A) (IEC 60601-2-33, ref **Error! Reference source not found.**) and advisable if greater than 85 dB(A) (refs 2,3). Hearing p rotection must be available for staff if the sound pressure level exceeds 85 dB(A).

Increased acoustic noise levels generated in a 3T system and the higher gradient performance causes higher sound pressure levels.

See section 7.16 for further information.

Hearing protection is required for all patients, staff and visitors in the Magnet Room during scanning.

Both ear plugs and ear defenders are required to be worn by patients within the MRI scanner whilst being scanned

3.8 Adverse reaction to MR contrast agents

MR contrast agents are sometimes injected into the patient to provide better diagnostic information. Serious or life-threatening reactions are extremely rare. Nephrogenic systemic fibrosis (NSF) has been associated with some contrast agents (linear Gadolinium chelates) in patients with severe renal impairment.

There is currently no evidence that gadolinium deposition in the brain has caused any harm to patients; however European Medicine Agency (EMA) has recommended restrictions for some intravenous linear agents in order to prevent any risks that could potentially be associated with gadolinium brain deposition.

Restrictions on the use of contrast agents may also apply in children, during pregnancy and for nursing mothers.

See Ramsay Policy CR-012 "Administration of Gadolinium based contrast agents for MRI examinations" for further information.

3.9 Cryogen hazards

Potential hazards of working with cryogens (liquid/gaseous helium) include:

- asphyxiation in oxygen deficient atmospheres;
- cold burns, frostbite and hypothermia;
- asthma attacks in susceptible persons if cold gas is inhaled.

Handling of cryogens should be restricted to fully trained MR engineering staff.

3.10 Effect of the magnet on other equipment

The MR system may adversely affect other objects and equipment in its vicinity. Examples include mechanical watches and magnetic media (e.g. credit cards, tickets with a magnetic strip). Mobile phones and pagers contain batteries which are usually ferromagnetic.

4 Biological effects of exposure

The following is a brief summary of the possible acute (short term) effects of exposure to magnetic fields. For more information see Protection of Patients and Volunteers Undergoing MRI Procedures (Ref 1 on Pg 1 of this document). There is no evidence of any long term effects, e.g. causing cancer.

4.1 Static field

Some people may experience sensations of vertigo (dizziness), nausea (feeling sick), metallic taste, or a faint flashing light (phosphenes) in or around high field magnets. Moving the head slowly tends to reduce these sensations.

4.2 Time-varying gradient fields

The pulsing of the gradients induces small electric fields in tissues which, in extreme conditions, can cause *peripheral nerve stimulation* (PNS) resulting in mild twitching sensations during the scan. These rarely occur in routine clinical scanning. The scanner has built-in safety limits to prevent the possibility of cardiac stimulation.

The effect of PNS is increased at 3T. Methods to reduce this include patient positioning, sequence selection and parameter manipulation.

4.3 Radio-frequency field

Radio-frequency exposures may lead to tissue heating. Possible physiological effects include changes in cardiac output and decreased mental function. The presence of metallic implants may result in greater localised heating. The scanner monitors the amount of RF power absorbed by the patient (*SAR)* and has built-in protection to limit the exposure to safe levels.

SAR increases with field strength so SAR limits when using RF-intensive pulse sequences (e.g. FSE, EPI, FLAIR) can be reached more quickly at 3T than at 1.5T.

4.4 Pregnancy

There is no evidence that MRI has any adverse effect during pregnancy. ICNIRP and the HPA, now Public Health England (PHE) advise the use of a critical risk/benefit analysis, particularly during the first trimester and if contrast agents are required, and that exposures are restricted to the normal operating mode. Acoustic noise levels should be kept to a minimum. The MHRA (ref 2) advises that pregnant staff should not remain in the Magnet Room during scanning.

Under the Management of Health and Safety at Work Regulations, employers are obliged to undertake a risk assessment for expectant mothers relating to hazards caused by physical agents.

Further information is available in the SCoR publication, "*Health & Safety and Pregnancy in Clinical Imaging and Radiotherapy Departments: A Guide for pregnant and breast feeding women*."
https://www.sor.org/learning-advice/professional-body-guidance-and-publications/documents-and-publications/policy-guidance-document-library/health-safety-and-pregnancy-in-clinical-imaging-an

An example risk assessment template is available to view on the British Institute of Radiology's website:
https://www.bir.org.uk/media/351905/ra_7__pregnant_staff_update2017.pdf

The MHRA recommends that throughout their pregnancy, staff should not remain in the scan room while scanning is under way due to the concerns of acoustic noise exposure and risks to the foetus.

4.5 Exposure limits

The Health Protection Agency (HPA) and ICNIRP publish guideline limits on exposure. These limits are not legally enforced at present.

a) **Patients and volunteers.** The HPA defines a three-level approach to exposure limits for patients and volunteers:

   routine operating mode - suitable for all general clinical MR examinations,

   controlled operating mode - which may be used subject to suitable medical supervision,

   experimental operating mode - for which research ethics approval is required.

These are implemented on the scanner as "*normal*" and "*1st level controlled*" operating modes. The 2nd level or experimental modes are not accessible on clinical scanners. The limits are given in Appendix I.

b) **Staff.** The present occupational exposure limit guidelines are contained in Appendix I. A suitable risk assessment should be carried out to the satisfaction of the MR Safety Expert for situations where staff may exceed a limit.

c) Limits for the **general public** are one fifth of the occupational values.

5 Responsibilities

5.1 The Employer

The Employer has overall responsibility for the safety of all patients, volunteers, staff and visitors in its premises and members of the public who may be affected by the work. The Employer is

- **Ramsay Health Care UK**

The Head of Diagnostic Services (as the service registered manager) is ultimately responsible for the safe operation of all MRI facilities within the control of the UK business. They are responsible for ensuring that local rules are in place prior to the operation of any MRI unit. The daily responsibility for MRI safety is delegated to the Responsible Person named on the cover of this document.

5.2 The MR Responsible Person

The Responsible Person has delegated responsibility for the safe working of the MR unit, including updating of operational and safety policies, ensuring adequate training, maintenance of safety facilities. *The Responsible Persons are listed in Appendix II.*

5.3 Clinical Lead Radiographer

The MR Clinical Leads provide day-to-day supervision of the Unit and ensures that safety and operational polices are adhered to. *The Clinical Leads are listed in Appendix II.*

5.4 Magnetic Resonance Safety Expert

A Magnetic Resonance Safety Expert is appointed by the Employer to provide advice on the scientific and technical issues relating to MR safety and on relevant training requirements for staff. *The MR Safety Experts are listed in Appendix II.*

5.5 MR System Operator

The System Operator is the MR Authorised Person who is in immediate control of the MR system at any given time. A System Operator must possess appropriate and sufficient professional skills for the tasks they undertake, particularly with respect to patient care. System Operators must complete the MRI Training Checklist for Operators and the subsequent annual Competency Checklist (see Appendix VI).

A list of MR System Operators including records of their training should be kept by the Clinical Leads (stored on the G drive)

5.6 MR Authorised Persons

MR Authorised Persons are members of staff who have undergone an MR safety induction specified by the Magnetic Resonance Safety Expert to the satisfaction of the Clinical Lead and Responsible Person. There are three categories of MR Authorised Personnel:

- An **MR Authorised Person (Supervisor)** is authorised to have free access to and to supervise others in the MR Controlled Access Area and the MR Environment (Magnet Room). They need to perform MR safety screening of other people and take responsibility for the safety of themselves and others within the MR Environment. Radiographers, Clinical Scientists and some Radiology Department Assistants (RDAs) will be in this category.
- An **MR Authorised Person (MR Environment)** is authorised to have free access to the MR Controlled Access Area and the MR Environment but is not authorised to supervise other people in there. They take responsibility for the safety of themselves within the MR Environment. Radiographers and RDAs in training will usually be in this category.

- **MR Authorised Persons (Non-MR Environment)** who can go into the MR Controlled Access Area but not the Magnet Room. Management, clerical staff and radiologists without MR safety training are usually in this category.

Additional professional training and experience is required in order to perform scans and become an MR System Operator.

A list of MR Authorised Persons with free access to the MR Environment (i.e. those in the Supervisor and MR Environment categories) and MR System Operators can be found in Appendix II. Training records (see section 10) must be kept by the Clinical Leads (also found on the G drive).

5.7 Other Staff

All staff have responsibility under the Health and Safety at Work Act 1974, to work according to safe practices and in accordance in local safety policies.

5.8 Clinical responsibility

Patient care within the MR Unit is the responsibility of all attendant staff. Where a multi-disciplinary approach is required, each professional has responsibility for patient care as required by their discipline, e.g. life-support care of a patient undergoing general anaesthesia will be the responsibility of the anaesthetist. Overall responsibility for safety with respect to the particular constraints of the MR environment (i.e. "magnet safety") for all patients' rests with the consultant radiologist or registered medical practitioner taking responsibility for the examination.

6 The MR Controlled Access Area

6.1 Definition

The **MR Controlled Access Area** includes is a locally defined area of such a size to contain the MR environment. Access shall be restricted and all entrances must have prominently displayed suitable warning signs.

The **MR Environment** is defined as the three-dimensional volume of space surrounding the MR magnet that contains both the Faraday shielded volume and the 0.5 mT field contour (5 Gauss line). This volume is the region in which an item might pose a hazard from exposure to the electromagnetic fields produced by the MR equipment

The MR Environments for each system are defined in Appendix III.

6.2 Access to the MR Controlled Access Area

Access to the MR Controlled Access Area shall be controlled by suitable control methods.

Free access to the MR Controlled Access Area should be given only to MR Authorised Personnel. All other personnel including unauthorised staff and visitors must be appropriately screened and seek authority to enter the MR Controlled Access Area.

Screening for entry into the MR Controlled Access Area should include at least verbal questioning (for emergencies) however, a paper screening form for all other situations.

6.3 Access to the MR Environment

Access to the MR Environment is restricted to:

- MR Authorised Persons who have completed the appropriate MR safety induction and local training programme;
- screened patients and their escorts (also screened) under the supervision of an MR Authorised Person;
- other screened staff and screened visitors supervised by an MR Authorised Person;
- service and maintenance engineers with due authorisation from the Operations Manager or MR Responsible Person;
- consenting and appropriately screened volunteers for e.g. applications training.

For all of the above persons, a written MR safety screening form must be completed and verified and provision of information about potential hazards must be given before authorisation to enter the MR Environment can be given.

The door to the exam room should remain closed, except during patient/staff entry and exit. MRI personnel should monitor the doorway at all times when the door is open.

Persons with cardiac pacemakers must not enter the MR Controlled Access Area.

6.3.1 Access to MRI Environment Out of Normal Working Hours

Any access of the MR Environment outside of normal working hours must comply with these local rules. Anyone requiring emergency access out of normal scanning hours must obtain permission from an MR Authorised Person. The mobile scanner driver should be contacted in the first instance (if they are available on site), then the RDUK on-call Clinical Lead, Mobile Operations Manager or Head driver if the unit is left unattended.

6.4 Safety for Third Parties

There will be situations where it is necessary for designated individuals, who are not Ramsay Healthcare employees, to enter the MRI scan room unsupervised (e.g. cleaning contractors).

Where this occurs Ramsay Healthcare will:

- Provide training (or oversee that correct training is provided)
- Advise on correct procedures to be used
- Advise on items of equipment to be taken into the scan room

Monitoring of all staff safety questionnaires (checking that they are completed and held by the third party) will be performed by the MR responsible person.

6.5 Comforters and carers

Comforters or carers required to be with the patient during scans must also undergo the patient safety screening procedure. Hearing protection is also required.

6.6 Volunteers

In all instances volunteers must have completed the MR Safety Screening Form before entering the MR Environment. Volunteers must be informed that they are free to terminate the examination at any time.

6.7 Pregnant staff

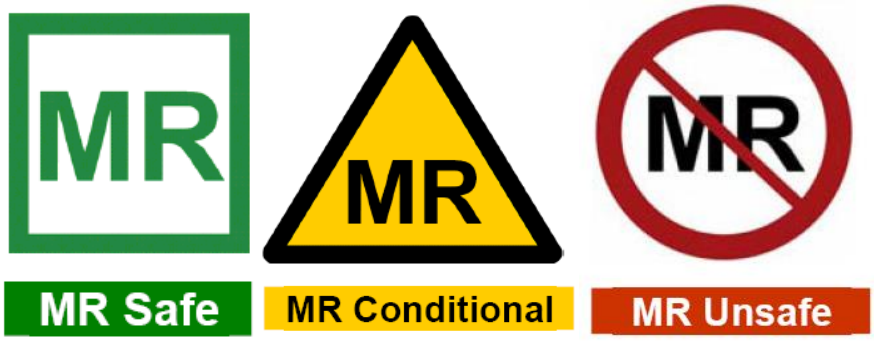
Staff who are pregnant are advised to inform the relevant Clinical Lead Radiographer. Current guidance recommends that pregnant staff should not be within the MR scanner bore nor remain within the scanner room during scan acquisition. Staff can continue to work in the rest of the MR environment carrying out their usual duties such as positioning patients, coil selection and injecting contrast agents provided the scan is not in progress. Entering the Magnet Room in response to an emergency is also acceptable.

6.8 Occupational exposure

Staff carrying out their normal duties are unlikely to exceed current occupational exposure guideline limits (see Appendix I). For staff who remain close to the bore entrance *during scanning* a risk assessment must be carried out to the satisfaction of the MR Safety Expert and recorded.

6.9 Ancillary Equipment and the MR Environment

All equipment which is used in and around the MRI Environment is required to be labelled using one of the following labels



No additional equipment may be brought into the MR Environment unless it is *essential* for patient care *and* one of the following applies:

a) it is clearly labelled as MR safe at the appropriate field strength,
b) it has been declared MR safe by the Clinical Lead or MR Safety Expert;
c) it has been marked MR Conditional and is used only under the conditions for which it is intended.
d) it is used only under the direct supervision of the MR Safety Expert.

If new equipment is to be brought into the department it should first be checked for labelling and if necessary referred to the MR Safety Expert.

MR Conditional – an item that can be used in the MR environment with specific conditions that may relate to position in relation to the magnetic field or the exposure to the Radio Frequencies or the Time Varying Magnetic Fields. The item must be clearly labelled with its constraints. The following items are identified as being MR Conditional:

- Mop
- Brush

MR Unsafe – An item that is known to be unsafe and must not be taken into the MR Environment. The following items are considered unsafe:

- All chairs
- Suction unit
- Oxygen cylinder
- AED
- Emergency/Resuscitation bag
- Pulse Oximeter

Any unmarked item must be assumed to be MR Unsafe.

7 Patient Management

7.1 MR requests (clinical scans)

Patients may only be scanned with the approval of a registered medical practitioner who should be satisfied that the exposure is likely to result in a net benefit to the patient.

Only patients with a fully completed and authorised request will be scanned. All requests will be vetted by an appropriately qualified practitioner to assess the suitability of the patient for scanning and to identify any additional risks from the MR environment.

7.2 Screening procedures

The ultimate responsibility for determining the patient is safe to be referred for an MRI examination lies with the referring clinician who, by signing the request card, has deemed the patient free of contraindications for the MRI examination to the best of their knowledge.

At appointment booking, the patient will be asked the MRI safety questions on the screening form, ensuring that patients with contra-indications are identified or further information can be gathered before the appointment.

Screening of a patient will take place prior to entering the MRI scan room, by RDUK staff using the MRI safety screening questionnaire. Links to the forms are in Appendix IV.
Patients will be asked the safety questions at least once prior to entering the MRI scan room by the Radiographer or MRI Health Care Assistant. The patient is therefore questioned at least twice prior to their scan – both at appointment booking and prior to entering the MR Environment.

All patients undergoing MRI will be given a copy of the MRI patient information leaflet to ensure that they understand the procedure, any risks, contra-indications to MRI and how to get their results.

In order to ascertain that it is safe for an individual to enter the MRI scan room, the responses to the questions must be clarified. If any responses are a “Yes”, these should be discussed further with the patient and the decision to scan should be made in conjunction with the local rules and the Clinical Lead, if required. All further information must be recorded with in the MRI Safety questionnaire and subsequently scanned into the patient’s RIS record. Any doubt about patient status with regard to MR safety should be rigorously pursued; this may involve, for example, plain film radiography to detect a metallic intraorbital foreign body (IOFB).

Where patients ‘lack capacity’ and are unable to answer the questions (e.g. suffering from dementia, unconscious) then the referring clinician must take responsibility and complete the separate MRI safety questionnaire (Lacks Capacity). Further guidance is also available in Ramsay policy CN-024 - Mental Capacity policy.

Patients who do not speak English as a first language should be accorded the same information and confidentiality as any other patient.
Ideally, an approved Ramsay translator should be utilised to ensure that the questions put to the patient, and the answers received, are accurate and not changed. A face to face translator should be booked in advance, if the communication difficulty has been identified at an early stage.
Please refer to Ramsay policy CN-018 - Patients who Require Additional Support to Access Information and Services.

If a translator is present for an examination, they should sign the safety questionnaire form to confirm that they asked the patient all the questions listed, and that the answers noted are a true record of those received. If the translator is not present, a note of their name or identification code should be made on the form.

The safety questionnaire must be signed and dated by the patient/visitor/clinician before entering the MR Environment.

In the case of implanted or external active medical devices, the device make and model should be determined and recorded on the form. Some guidance is contained in sections 7.3 to 7.7 and Appendix V.

The MR System Operator who countersigns a Patient's MRI Safety Questionnaire assumes MRI safety responsibility for that individual. For this reason, in accordance with policy, they are at liberty to refuse to scan a patient if it would compromise patient, staff or equipment safety.

7.3 Designation of medical implants and devices

The following definitions are used:

MR Safe	The device has been demonstrated as being safe in the MR Environment or comprises non-magnetic, non-metallic, non-conducting components.
MR Conditional	In all instances the patient may only be scanned in accordance with the specific conditions attached. These may relate to maximum field strength, maximum static field, spatial gradient and maximum SAR. Consideration should be given to potential heating.
MR Unsafe	The device poses a hazard or potential hazard in the MR environment.

Implanted medical devices fall into two main categories:

- **Active implantable medical devices** where functionality is dependent upon an energy source. This includes pacemakers, defibrillators, neuro stimulators, cochlear implants and drug pumps.
- **Passive implantable medical devices** which require no power source. This includes hip/knee joint replacements, heart valves, aneurysm clips, coronary stents and breast implants.

Both active and passive devices can contain metallic components which may render the device incompatible with MR or may cause artefacts which degrade image quality. Information about any implantable medical devices should be available before the patient attends for the examination to allow for time to ascertain compatibility.

Note that implants that are MR Safe or MR Conditional at 1.5T may have different safety conditions, or may be MR Unsafe at 3T.

Under no circumstances, where there is a risk to patient safety, can an unidentified potentially metallic object or implanted medical device be exposed to a magnetic field strength >5G (gauss). (0.5mT).

Whenever a patient attending for an MRI examination is re-booked on the day of the patient's appointment, or the examination cancelled on the day due to implementation of these local rules, **an incident report (RADAR) must be completed**. The exception to this is delay due to IOFB X-ray following further questioning by the MRI Radiographer.

7.5 Active implanted medical devices

For all active devices, the *make and model* must be determined and scans may only proceed following the device manufacturer's recommendations. The decision to scan will be made by the radiologist in conjunction with the appropriate clinical team. The patient must be warned of the possibility of localised heating. Explicit patient consent is required. The examination must be stopped immediately if discomfort or heating is experienced by the patient.

It should also be remembered that even non-ferromagnetic metallic implants may affect the diagnostic quality of the scan.

Refer to the MR Safety Expert for further advice.

7.5.1 Cardiac pacemakers, cardioverter defibrillators and monitors.

A pacemaker helps control abnormal heart rhythms by using electrical pulses to prompt the heart to beat at a normal rate. An implantable cardioverter defibrillator (ICD) monitors heart rhythm and delivers shocks if it senses dangerous rhythms. It can also monitor the heart's electrical patterns when there is an abnormal heartbeat. Most new ICDs can act as both pacemaker and defibrillator.

The static magnetic field, the time-varying magnetic gradient fields and the radio-frequency fields required for MR all create a hostile environment thought to cause severe disruption of pacemaker and ICD function.

Patients with MR conditional pacemakers or implanted cardiac monitors may be scanned in certain centres, subject to strict adherence to the manufacturer's recommendations, with the appropriate clinical support in attendance, and in accordance with local protocol.

Current policy at RDUK is that patients with a cardiac pacemaker, including those described as MR safe or MR conditional will NOT be scanned.

Scanning may not be carried out if the patient has remaining leads from a previous implantation.

7.5.2 Neuro stimulators

Neuro stimulators may be implanted in the abdomen, the upper chest region or within or adjacent to limbs, with leads and electrodes running subcutaneously to the target site, such as the spinal cord or the appropriate nerve or muscle requiring stimulation.

Some neuro stimulators are MR Conditional and can be scanned under certain conditions for safe operation in some centres, however:

Current policy at RDUK is that patients with a neuro stimulator will NOT be scanned.

7.5.3 Implantable drug infusion pumps

Certain drug infusion pumps are MR Conditional and can be scanned under certain conditions. It is essential that the device is properly identified. Please contact the MR Safety Expert for further advice.

Current policy at RDUK is that patients with drug infusion pumps will NOT be scanned.

7.5.4 Programmable hydrocephalus shunts

A programmable hydrocephalus shunt is a type of ventriculoperitoneal (VP) shunt used for treatment of hydrocephalus. A tube drains excess CSF from the ventricles of the brain to the abdomen where it is reabsorbed. The programmable shunt prevents fluid from moving in the wrong direction and only lets fluid drain when the pressure is too high.

Certain programmable hydrocephalus shunts are MR Conditional and can be scanned under certain conditions. A programmer and trained clinician are required immediately following an MR procedure to verify and reprogram the device if required. This level of support is not available at RDUK.

Current policy at RDUK is that patients with a programmable shunt will NOT be scanned.

7.5.5 Cochlear implants

Certain cochlear implants are MR Conditional and can be scanned under certain conditions, however:

Current policy at RDUK is that patients with a cochlear implant will NOT be scanned.

7.5.6 Ingested capsule endoscopy devices (VCE)

If a patient has had a Pill Cam™ or Bravo™ capsule (an ingestible device for use in the gastrointestinal tract), the date of ingestion and the date of excretion should be stated in the MRI Checklist. Patients who have ingested capsule endoscopy devices inside their body must not undergo an MRI scan. If the patient cannot positively verify the excretion of the capsule, an abdominal X-ray is required before undergoing an MRI examination. Please refer to CR-002 SOP-001.

Patients with ingested capsule endoscopy devices *in situ* will NOT be scanned.

7.6 Passive implanted medical devices

Passive implanted medical devices which are MR Safe for the appropriate field conditions may be scanned at any time after implantation.

This includes coronary stents. However, where there are multiple overlapping stents, consideration must be given to the potential for RF heating and exposure must be restricted to the Normal Mode.

Other MR Conditional passive devices which may be *weakly* ferro-magnetic should not usually be scanned in the 6 weeks post implantation, except in the case of a clinical emergency. In this instance the decision to scan will be made by a consultant radiologist in conjunction with the referring clinical team. Patients must be warned of the possibility of heating, and the scans must be restricted to the Normal Mode of exposure.

It should be remembered that even non-ferromagnetic metallic implants may adversely affect the diagnostic quality of the scan.

Refer to the MR Safety Expert for further advice.

7.6.1 Coronary artery stents & heart valves

All commercially available coronary stents (including drug-eluting, non-drug eluting and two or more overlapped stents) can be scanned immediately post placement. Stay in Normal Mode; Maximum imaging time per sequence <15 min.

Note this only applies to coronary artery (cardiac) stents.

All commercially available heart valve prostheses and annuloplasty rings can be scanned immediately post placement. Stay in Normal Mode; Maximum imaging time per sequence <15 min.

7.6.2 Aneurysm clips

Certain types of intracranial aneurysm clips (e.g., those made from martensitic stainless steels such as 17-7PH or 405 stainless steel) are a contraindication to the use of MR procedures because excessive, magnetically induced forces can displace these implants and cause serious injury or death.

By comparison, aneurysm clips classified as "non-ferromagnetic" or weakly ferromagnetic (e.g., those made from Phynox, Elgiloy, austentitic stainless steels, titanium alloy, or commercially pure titanium) are acceptable for patients undergoing MR procedures.

Specific information (i.e. manufacturer, type or model, and material) about the aneurysm clip must be known, especially with respect to the material used to make the aneurysm clip, so that only patients or individuals with non-ferromagnetic or weakly ferromagnetic clips are allowed into the MR environment. The manufacturer provides this information in the labelling of the aneurysm clip.

Careful observation of the patient is required at all times. Not all aneurysm clips have been tested at 3T.

Current policy at RDUK is that patients with aneurysm clips will NOT be scanned.

7.6.3 Other clips and staples

Scanning must not proceed unless there is positive documented evidence that the clip or staple is non-ferromagnetic. For example, titanium, tantalum and vanadium are non-ferromagnetic, whereas stainless steel has varying degrees of para- and ferromagnetism.

7.6.4 Hip/knee joint replacements

Patients with hip or knee implants, where heat generation may occur, should be monitored carefully, both in the approach to the magnetic field and during the MR examination. If discomfort is experienced, MR exposure should be discontinued.

The presence of large metallic implants may degrade image quality if near to the imaging volume.

7.6.5 Ocular implants and intraocular metallic fragments

Ocular implants can be dislodged causing tissue damage, or the magnets used to locate false eyes can be demagnetised. Patients with detached retina repairs may have ferromagnetic retinal tacks or scleral buckles which are a contraindication to MRI. Manufacturer's MR safety advice for the implant should be followed.

Adequate screening of patients with suspected intraocular ferromagnetic objects is necessary before entering into the MR Environment. Where the presence of metal fragments in the eye is suspected but unproven, an ocular X-ray must be performed to confirm or negate the presence of penetrating metal foreign bodies. This should be recorded on the patient's RIS event.

7.6.6 MRI of spinal rods (Harrington rods)

Harrington rods have not been tested and labelled for MRI scanning. The patient should undergo a risk vs benefit assessment prior to scanning, performed by a Radiologist in conjunction with a senior Radiographer or MRSE. If the scan goes ahead, the scan should be performed in **Normal Mode** and the minimum number of sequences should be performed appropriate to answer the clinical question. Artefacts will be seen if scanning over the rods. If there are broken parts of the rods, this will increase the risk. Please always make the patient aware to alert the Radiographer if any heating felt.

7.6.7 Medicated Trans-dermal Patches (Medicated Skin patches)

All medicated patches must be removed prior to MRI scanning and replaced following the examination using a dressing or surgical tape.

Any medicated patch with an aluminium element to the coating could potentially cause a burn to the patient's skin following exposure to the changing RF field. There is also a potential to medicines overdose caused by a general rise in temperature of any medicated patch, regardless of whether there is a metallic element to it or not.

7.7 Intra-orbital Foreign Bodies

7.7.1 Identifying Patients at Risk

Patients who have a history of previous penetrating injury to the eye should undergo further screening. A penetrating eye injury is described as one where a fragment of metal has pierced into the eyeball. Previous occupational exposure to metallic dust fragments does not justify further investigation.

Patients that have received medical attention from a doctor and have been told that all the metal has been removed or that the examination was normal, will be safe to undergo MRI without further investigation.

Where there is doubt that all of the metallic fragment was removed, then an orbits X-ray must be undertaken and reported as normal before continuing with MRI.

7.7.2 Referral for Orbits X-ray

Only IR(ME)R entitled MRI Radiographers (or Radiologists) can request an x-ray of the orbits prior to MRI.

A list of IR(ME)R entitled RDUK Referrers will be made available to Ramsay static sites.

MRI referring Radiographers must ensure that there is no recent imaging (plain film or CT) which may negate the need for an IOFB film.

The MRI Radiographer can only request **one view**: Orbits IOFB X-ray

Where an MRI Radiographer is not available to question the patient and request the X-ray; then a Radiographer that has read and understood this policy can request a site Radiologist to act as Referrer.

7.7.3 Staff or carers accompanying a patient

Staff or carers accompanying a patient should not enter the MR environment or undergo an X-ray if they have a history of an IOFB. In such cases, the static site department should make alternative arrangements if the patient requires a carer within the scan room.

7.8 Discrepancy in Information

Where two routes of investigation have produced conflicting evidence, regarding the MR safety of a device or implant, then the 'unsafe' advisory statement will overrule any other and the examination must be cancelled until clarification can be obtained.

7.9 Escalation Procedure

When a case exists where it is clear that a device or implant is deemed unsafe to scan, but the referring clinician is in disagreement, Radiology staff must refer to a Radiologist for further discussion with the referring clinician.

Where Radiologist authorisation to proceed with examination is given this must be discussed with all relevant parties, including the patient, and documented in the patients notes using the Device Risk & Benefit documentation.

7.10 Pregnancy

The decision to scan a patient who is pregnant is to be made on the grounds of clinical necessity. If possible, for example for an elective non-urgent procedure, the examination should be postponed until the conclusion of the pregnancy or restricted to the 2nd and 3rd trimesters. Advice on the relative risks of MR versus other examinations may be sought from the MR Safety Expert and Radiation Protection Adviser.

All patients above the age of 18, with internal reproductive organs, will be asked if there is any chance that they may be pregnant prior to examination. Where pregnancy cannot be excluded, and the date of the first day of the last period was > 10 days ago – the patient will be cancelled and referred back to the site for a pregnancy test or re-booking after the first day of the start of their next period.

Informed written consent is required from the pregnant patient. This is saved on the patient's record along with the standard MR Safety Screening Form onto RIS

To scan pregnant patients, a written request must be received from both the referring clinician and the radiologist outlining that a risk benefit analysis has been undertaken. The Ramsay pregnancy authorisation form must be completed and scanned into the patients RIS record.

The MRI scan will only be carried out if the consultant Radiologist or referring Clinician has discussed all of the implications of scanning with the patient, and the patient has understood and accepted the discussion. The patient must be formally consented to the procedure by the Radiologist before proceeding.

When a clinical decision is made for the scan to proceed, low acoustic noise sequences should be used with SAR restricted to the Normal Mode.

Gadolinium-based contrast agents will not be given to pregnant women except under exceptional circumstances. The responsible radiologist must record the justification in the patient record.

Any pregnant patient who is scanned must have a Pregnancy MRI Scan History Form completed. This details the scan procedures and sequence parameters used. This form is given to the mother to be put with the child's medical records after birth.

7.11 Breast feeding

A very small percentage of gadolinium-based contrast medium is excreted into the breast milk and absorbed by the infant's gut and current available data suggest that it is safe for the mother and infant to continue breast-feeding after receiving such an agent.

Ultimately, an informed decision to temporarily stop breast-feeding should be left up to the mother after these facts are communicated. If the mother remains concerned about any potential ill effects to the infant, she may abstain from breast-feeding from the time of contrast administration for a period of 12 to 24 hours. There is no value to stop breast feeding beyond 24 hours. The mother should be told to express and discard breast milk form both breasts after contrast administration until breast feeding resumes. In anticipation of this, she may wish to use a breast pump to obtain milk before the contrast-enhanced study to feed the infant during the 24-hour period following the examination.

7.12 Jewellery, Piercings and Tattoos

Due to the inherent dangers caused by the magnet and the heating effects of the electro-magnetic fields, all metallic objects including jewellery and body piercings will be removed by anyone undergoing MRI examination.

7.12.1 Precautions Taken

If it is not possible for the patient to remove metallic jewellery or piercings, then the piercing must be checked with a handheld magnet to ascertain if it contains ferromagnetic components. The patient or individual will be informed regarding the potential risks, namely heating or movement of the object.

To prevent potential heating/burns from any non-ferromagnetic body piercing , gauze, tape, or other similar material should be used to wrap the piercing in such a manner as to insulate it (i.e. prevent contact) from the underlying skin. The patient will be instructed to immediately inform the MR team if any heating or other unusual sensation occurs in association with the body piercing jewellery during the MR examination as the 'internal' part of the jewellery cannot be insulated by any means.
All patients who consent to the MRI scan with jewellery in situ must complete and sign the Ramsay "Patient consent to MRI with Jewellery" form and this will need to be scanned onto RIS along with the other MRI paperwork. The patient must be monitored continuously during the MR examination to ensure safety.

Any ferromagnetic piercing that cannot be removed should not be scanned. The RDUK Radiographer may ask for the patient to visit the place where they received the piercing for it to be temporarily removed. Patients will never be asked to have jewellery cut off.

Consideration should also be given to patients who have hair extensions as there are certain types that are bonded or tied to the hair using metal components.

7.12.2 Micro-dermal Piercing

Micro-dermal piercing involves sub-cutaneous placement of part of the piercing. This cannot be removed or insulated from the skin. The risks related to MRI must be explained to the patient and a comment added to the safety questionnaire by the Radiographer confirming that the patient understands the risks and wishes to proceed with the examination. This must be signed by the patient and scanned onto the patient's record on RIS. Please refer to section 7.12.1 regarding ferromagnetic piercings.

The patient must be monitored verbally throughout the scan.

Where there is a risk of artefact and image degradation from the piercing, the Radiographer will make a decision as to whether to continue with the examination or not. This may be in consultation with the Radiologist if they think this is necessary.

7.12.3 Tattoos

There are risks associated, particularly with decorative tattoos, regarding heating during MRI. These are rare but possible. Patients will be questioned as to whether they have any tattoos and warned that if they experience any tingling, heating or other unusual sensation in that area to alert the Radiographer using the call buzzer immediately.

If a patient does report heating, the scan should be stopped immediately and cold compress applied to the area.

The RMO must then assess the patient and record their findings before the patient is discharged from the department. The patient will be given follow up information as appropriate

7.13 Patient preparation

If deemed necessary by the radiographer patients will be changed into MR safe apparel (hospital gown or scrubs) prior to entry into the MR Environment, wherever this is possible and reasonable to do so.

This avoids general heating and potential burns from labelling or metallic sport stitching as well as reducing the possibility of image artefact.

Patients in wheelchairs will be transferred to an MR Safe wheelchair prior to being introduced into the MR Environment. Trolley patients will be transferred to the MR safe trolley outside the MR Environment.

Due care must be given to patients using walking sticks as these should never enter the MR scan room. Please use the MR Conditional wheelchair provided if necessary.

All persons entering the scan room are required to remove mechanical watches, credit cards, ferromagnetic objects (hairpins etc.), magnetic storage media, and store these in an appropriate locker.

Persons accompanying the patient into the scan room must also remove all extraneous metal, and any electronic devices, but may be allowed to remain in street clothes after careful screening of these.

Prisoners: removal and replacement of handcuffs, RF tracking devices, etc., is the responsibility of the custodial agency. These activities must occur outside the scan room.

7.13 Monitoring

The MRI Radiographer should use the following points to monitor patients during an MRI examination:

- Routine (minimum): Visual (CCTV) and verbal, plus patient-activated alarm ('panic button').
- Patient at risk (including those given IV contrast agents): with audible alarm and 'panic button'.
- Patients at risk who are unable to communicate must be appropriately risk assessed by an MDT as to suitability for a mobile scanner.

7.14 Claustrophobia

Non-pharmaceutical management may include:

- Patient education
- Allowing a patient companion to accompany the patient into the scan room
- Continuous verbal contact with the patient
- Patient headphones equipped with audio/music
- Use of prone and/or feet first positioning
- Use of a blindfold, fan, or bright lights

The patient must have immediate access to a "panic button", or other alarm system, at all times. If examination without sedation is not feasible, the patient must be assessed for any risk factors relevant to sedation and, in the case of outpatients, arrangements made for a responsible adult to accompany the patient after discharge.

7.15 Acoustic Noise

Ear plugs and ear defenders (headphones/muffs) must be given. Where headphones won't fit e.g. in the head or neck coils, foam pads should be used over the ear plugs.

An explanation of the noise level must be given to patients and anyone remaining in the scan room. Patients must be advised to alert the Radiographer immediately if they feel the noise is too uncomfortable. Patients must be shown how to correctly insert ear plugs and the MRI Radiographer must check that they have done so.

All patients will be provided with both ear plugs and ear defenders.

In all cases the MR Operator should ensure that the patient can hear them over the MRI intercom system before starting the scan.

All staff members and any members of the public who need to remain within the Magnet Room during scanning must wear hearing protection. Exposure to acoustic noise should be kept to a minimum.

Hearing protection is required for all patients, staff and visitors in the Magnet Room during scanning. Patients who refuse mandatory ear protection should not be scanned unless only examined with pulse sequences with documented SPL less than 80 dB(A).

7.16 Contrast media

Contrast agents may only be administered in accordance with written protocols according to local policy CR-012 Administration of Gadolinium based Contrast Agents for MRI Examination and risk of NSF (see Appendix VII). The radiologist or suitably trained radiographer is responsible for all decisions concerning contrast agent administration, including dosage, and is responsible for the health and safety of the subject throughout the scans. Details (type, batch and dosage) of contrast agent administration must be recorded on the MR Safety Screening Form (see Appendix IV).

The decision on prescribing contrast will be the responsibility of the supervising consultant radiologist. The cumulative dose of contrast medium should be kept as low as possible and non-enhanced protocols should be substituted if appropriate.

Suitably-trained radiographers may administer contrast medium according to protocol under the direction of the MR Responsible Person.

Gadolinium-containing contrast agents are associated with a varying degree of risk of nephrogenic systemic fibrosis (NSF). Vulnerable groups are: patients with renal impairment; patients in the perioperative liver transplantation period; infants, neonates, and the elderly; and women who are pregnant or breastfeeding. High-risk gadolinium-containing contrast agents are contraindicated in patients with severe renal impairment, patients in the perioperative liver-transplantation period and in neonates.

Risk Classification, on the basis of current evidence is as follows:

Brand name	Risk	Name	Chelate/ionicity	Organ specific?
Magnevist	High	Gadopentate dimeglumine	Linear/ionic	No
Omniscan	High	Gadodiamide	Linear/non-ionic	No
Optimark	High	Gadoversetamide	Linear/non-ionic	No
Multihance	Medium	Gadobenate dimeglumine	Linear/ionic	Yes (liver)
Primovist	Medium	Gadoxetate disodium	Linear/ionic	Yes (liver)
Dotarem	Low	Gadoterate meglumine	Macrocyclic/ionic	No
Gadovist	Low	Gadobutrol	Macrocyclic/non-ionic	No
Prohance	Low	Gadoteridol	Macrocyclic/non-ionic	No

Recent (2017) studies have been done into gadolinium deposition in brain tissues following use of gadolinium contrast agents during MRI scans. There is currently no evidence that gadolinium deposition in the brain has caused any harm to patients; however,

EMA has recommended suspension or restrictions for some intravenous linear agents in order to prevent any risks that could potentially be associated with gadolinium brain deposition.

Suspended: Intravenous use of:
- Magnevist
- Omniscan
- Optimark

Restricted: For liver scans only, intravenous use of:
- Primovist
- Multihance

For intra-articular (into the joint) use only:
- Magnevist

Maintained:
- Dotarem
- Gadovist
- Prohance

The contrast agents currently in use at RDUK are:

- Dotarem
- Primovist for liver scans only
- Magnevist for intra-articular use only, and for administration by radiologists only

7.17 Physiological monitoring and patient support equipment

Only equipment certified for use in MRI may be used. The use of appropriate high impedance leads is essential. Care must be taken to avoid excessive lead length or loops being formed within the magnet and unnecessary contact with the skin except through the appropriate electrodes. Scanning must be stopped immediately if discomfort or heating is experienced by the patient.

For the purposes of scan gating, only the equipment appropriate for this purpose provided by the MR manufacturer should be used.

Power supplies are MR unsafe and should be used to charge the monitor then disconnected prior to taking the monitor into the MR Environment.

7.18 Sedation

At-risk groups (major organ disease, respiratory, cardiac, liver disease, diabetes, medications, allergies, previous adverse reactions, and children) need special consideration and may need anaesthetist supervision.

Current practice at RDUK is that a Sedation service is not offered

7.18.1 Patient preparation:

- Patient to have fasted 6 hrs from solids, 2 hrs from liquids.
- Sites should define a standard regime of appropriate sedative agents and doses.
- Supervision of the administration of sedation, and subsequent monitoring of the sedated patient, must be by appropriately trained personnel
- Sedated outpatients must be discharged in the care of a responsible adult, and warned of the risks of driving or operating heavy machinery following sedation.

Attendant staff entering the MR Environment for the first time must complete an appropriate MR Safety Screening form. At all times access to the MR Environment is at the discretion of the MR System Operator.

Life-support care of the patient and responsibility for monitoring will be undertaken by the attendant staff (e.g. nurse, anaesthetist, paediatrician). Hearing protection must be provided for anaesthetised or unconscious patients.

RDUK does not prescribe or administer sedation to patients, if patients require oral sedation this is to be arranged with their GP prior to their scan.

7.19 Records

An 'End-of-Day' report must be completed and sent to the site at the completion of every list.

MR Safety Screening forms (Appendix IV), including details of contrast agent administration where relevant, must be scanned into the patient's record on the radiology information system.

Informed consent forms for pregnant patients must be scanned into the patient's record on the radiology information system.

Patient records are to be kept for a period commensurate with the requirement for medical records.

8 Equipment Management

8.1 Maintenance

All MR and related equipment must be properly maintained only by appropriately qualified service personnel at intervals commensurate with the manufacturer's recommendations. It is the Employer's duty to ensure that adequate maintenance programmes, consistent with the safe operation of the MR equipment, are carried out.

8.2 Quality assurance

Daily quality assurance procedures supervised by the Operations Manager, carried out by RDUK trained staff as Authorised Person and approved by the MR Safety Expert must be carried out at the appropriate frequency. This must be recorded as completed in the relevant areas of RDUK documentation. Non-compliance of any measured parameter must be reported to the RDUK Clinical Leads.

MR operators are responsible for carrying out daily checks which should include where possible, coil image quality, oxygen monitors, warning alarms, door interlocks, release hatches, safety devices, and environmental conditions

Handover forms will be completed whenever the equipment is taken out of or put back into Clinical use.

A full range of image quality testing should be done as part of the annual quality assurance programme. This should include monitoring of signal, geometric, resolution and slice parameters.

The MRI scanner must be covered by a full service contract.

For more information about MR QA and training please contact the MR Safety Expert.

8.3 Equipment faults

Any MR equipment fault or malfunction must be reported to the RDUK Clinical Leads / Operations Manager and recorded. Damaged or repaired coils must not be used on human subjects until they have been checked by the MR engineer.

8.4 Other equipment

Only appropriately, labelled MR Conditional or MR Safe equipment is to be used within the MR Environment.

Any unmarked item must be assumed to be MR Unsafe.

8.5 Cryogen handling

The handling of cryogens must only be undertaken by properly trained staff. The MHRA Guidelines contain information on the safe handling of cryogens. Cryogen containers may only be stored in areas where there is adequate ventilation.

8.6 Quench pipe maintenance

The emergency cryogen venting system should be inspected annually by a competent person, with records kept. For the cryostat, cold head and immediate pipework within the MR unit the competent person is the MR manufacturer.

8.7 Storage and handling of MRI phantoms

MRI departments should follow the manufacturers' guidance on the storage and handling of MR phantoms.
A record should be kept detailing the contents of each phantom; this record should be passed to the fire brigade in the event of a fire in the MR scanner. The fluid content of some MR phantoms, e.g. nickel, can be toxic.
Departmental Local rules should define protocols for dealing with phantom spillages in accordance with COSHH regulations. SOP CR RDUK 025 – MRI QA Phantom Leakage

9 Adverse Incidents, Emergencies and Contingencies

9.1 Cardiac arrest

In the event of cardiac arrest, or emergencies the scan must be aborted immediately. The patient should be removed from the MR Environment at the first opportunity. Under no circumstances should ferromagnetic resuscitation equipment be brought into the MR Environment.

- Abort the scan immediately.
- Remove the patient from the bore of the magnet and begin manual resuscitation by keeping airways open and cardiac massage.
- Call the Cardiac Arrest team according to the local site instructions stating the location and that the patient is an adult.
- Remove the patient from the Magnet Room.
- Close the Magnet Room door to prevent any non-authorised person entering.
- Resuscitation must take place outside the Magnet Room. Resuscitation equipment side the hospital, (please refer to Site crash card) and is brought to the scanner by the local site emergency team.

Ferromagnetic resuscitation equipment MUST NOT be taken into the Magnet Room.

Only people who have completed the MR Safety Screening questionnaire and are metal-free are allowed in the Magnet Room.

9.2 Major equipment failure

In the event of a major equipment failure, resulting in serious malfunction, electrical fire or electric shock to the patient, the EMERGENCY OFF (red buttons) should be pressed. This switches off electrical power to the system. The patient can then be safely evacuated.

Scanning may not be resumed until a qualified MR service engineer has inspected the system and certified it as safe to use. The MR Safety Expert and RDUK Operations Manager must be informed of any such failures.

After pressing the EMERGENCY OFF button, the magnetic field remains on.

9.3 Fire

Fire alarm outside the MR Unit: On hearing a fire alarm, the current scan should be aborted and normal evacuation procedures should be followed.

Fire in the MR Controlled Access Area: On discovery of a fire, normal fire procedures should be followed:

- Raise the alarm.
- Abort all MR procedures.
- Close the Magnet Room door.
- Evacuate the area.

Fire in the MR Environment: In the event of a fire within the MR Environment, only Fire Extinguishers clearly labelled as MR Conditional may be brought into the MR Environment. Caution is however required as these may contain ferromagnetic components. Turn off the electrical supply to the scanner by pressing Emergency Off.

If there is a serious fire within the MR Environment which requires additional fire-fighting or breathing apparatus to be brought into the MR Environment, the decision to deliberately quench the magnet will need to be taken. Fire equipment may be brought into the MR Environment only after it has been verified that the field is no longer present.

9.4 Decreased oxygen levels

Air is composed of 21% oxygen. At an oxygen level of 19% or below, adverse physiological effects can begin to occur. Asphyxiation is the greatest risk of lack of oxygen and can occur if there is a helium leak into the Magnet Room which could indicate a quench (see section 29).

All Magnet Rooms have oxygen monitors. When the Oxygen level drops below 19% the monitor alarm will sound. The Magnet Room and MR Unit should be immediately evacuated and only re-entered after inspection by a suitably qualified person or representative of the manufacturer or supplier authorised by the MR Responsible Person.

9.5 Magnet quench

In a quench, either deliberate or accidental, the liquid helium in the magnet rapidly boils off as gas and should escape safely to the atmosphere. It is possible that some gas will escape into the Magnet Room. If sufficient helium escapes into the room the oxygen level may be depleted. The unit may have automatically or manually activated emergency ventilation fans to rapidly replenish the air.

Helium levels should be checked and recorded daily in accordance with manufacturers' recommendations, with staff reporting any sudden drop or low level to the Clinical Leads and Operations Manager.

In order to detect any unplanned leakage of helium into the scanner room, low oxygen warning alarms should be placed in the MR room checked daily.

In the event of a quench:

- Abort the scan.
- Activate emergency ventilation if available.
- Evacuate the Magnet Room.
- Leave the Magnet Room door ajar.
- Evacuate everyone from the nearby area.
- Do not enter until the system has been declared safe by a suitably qualified person (MR Clinical Lead Radiographer or deputy, MR Safety Expert/Physicist or MR Engineer).

A **deliberate quench** may only be initiated if there is:

- A serious fire in the MR Environment and fire-fighting equipment must be used

or

- A life-threatening accident involving a ferromagnetic object.

The decision to initiate a quench should be made by the Clinical Leads, the MR Responsible Person or the MR Safety Expert. In a life-threatening emergency where none of these are available, the senior System Operator present will make the decision. The decision to quench the magnet must not be undertaken lightly as it incurs a penalty of scanner down-time and cost.

Where there is no immediate threat to life an engineer will be contacted to carry out a controlled 'ramp down' of the magnet.

Staff must never attempt to move a large object stuck to the scanner. It is not possible to determine how the object will move and it may try to realign itself with the magnet causing more injury or damage. This can also cause damage to the internal windings of the scanner.

There are two quench buttons per scanner: one in the Magnet Room and one in the MR Control Room.

9.5.1 Considerations to be made when initiating a quench:

- Any object that has trapped an individual will no longer be held by the magnetic field and will fall. The object needs to be supported during the quench procedure.
- As helium may vent into the scan room a clear plan of escape must be identified for all concerned, Helium is not poisonous but could replace or reduce the oxygen levels in the room significantly
- Increased pressure in the room due to venting into the room. The scan room door must be left open to prevent any pressure changes from affecting the ability to open the door.
- The positions of the quench buttons for this unit are located as follows:

  Siemens Scanners

  - Quench button located on the wall in the control area next to the main monitor

9.5.2 Spontaneous Quench

A spontaneous quench occurs without warning. An Operator may first become aware when a loud noise is heard from the scanner and or the Oxygen monitor alarm is triggered. Other signs may include visible white cloud in the scan room, failure or alarms from the MR equipment and venting through the Helium Vent Pipe.

If a spontaneous quench occurs the MR scan room must be evacuated immediately.

When a spontaneous quench occurs out of hours the MR Responsible Person must be contacted or an MR Operator.

9.5.3 Emergency evacuation if scan room door cannot be opened

There is a break out hatch in the scan room door that opens outwards, allowing an exit if helium has filled the scan room. All staff must be aware of the operation of the door during induction training.

9.6 Projectile Incident

For an incident involving a ferromagnetic object, but no risk to life, it may not be necessary to quench the magnet. In this instance the system should be verified safe by an appropriately qualified person (RDUK Clinical Lead, MR Safety Expert or MR Engineer) before it is used again.

If a person has an impalement injury by a sharp object, the magnet should be quenched before attempting to remove the patient to prevent further injury.

In the event of a person being trapped by a ferromagnetic object, it will be necessary to support the object when the quench is initiated. Only MR Authorised Persons should enter the MR Environment.

The Operations Manager and MR Safety Expert must be informed of any projectile incident.

9.7 RF Burns

Contact Burns: caused by direct contact between the patient's skin and conductors. These conductors can heat up during imaging and result in localised burns to patients. Examples are metal in clothing, coil cables, ECG connectors and oxygen monitor probes. These items must not come into direct contact with a patient and must be separated from the patient using pads

Conductive Burns: are caused when the arms and legs of a patient are positioned in such a way that a conductive loop is formed. Care should be taken when positioning patients to avoid possible loops that can cause burns, if necessary pads should be used to separate limbs and to avoid contact with the magnet bore.

The scan must be aborted as soon as there is any indication that a burn may be occurring. The patient should be referred to Accident & Emergency for treatment of the burn.

The Clinical Leads, Operations Manager, Head of Diagnostic Services and MR Safety Expert must be informed.

The equipment must not be used again until it has been verified as safe by an MR Engineer or the MR Safety Expert.

9.8 Contrast Agent Reaction

In the event of a significant or suspected contrast agent reaction:

- Abort the scan.
- Remove the patient from the Magnet Room.
- The patient's condition should be assessed by Resident Medical Officer or Radiologist and medical assistance called for if necessary. Please refer to the Contrast policy CR-012 Administration of Gadolinium based Contrast Agents for MRI Examination and risk of NSF.
- Record the incident using the online reporting risk system. This is reviewed internally within the hospital and documented in the patient's RIS notes.
- The supplier of contrast media should be informed reasonably quickly. The supplier should be given full details of the nature and extent of reaction, but the patient's name must be kept confidential to RDUK. The batch number must be forwarded to the supplier.

Incidents involving suspected Adverse Drug Reactions to contrast agents must be reported also on the Report of Suspected Adverse Drug Reactions form located on the Home page of Ramsay intranet Report of Suspected drug reactions form

9.9 Clinical Incident Reporting

Any untoward incidents affecting patients must be immediately reported to the Clinical Lead and according to the Clinical Incident procedure.

All incidents and near misses related to patient or staff safety within the MRI unit must be reported in accordance with Ramsay policy via Radar. This includes adverse drug reactions, burns and overheating, projectile incidents and contrast injector failures.

The Operations Manager or MR Safety Expert will report adverse incidents involving injuries from projectiles or RF burns, and other equipment failures to the MHRA:

http://www.mhra.gov.uk/Safetyinformation/Reportingsafetyproblems/Devices/index.htm

Serious injuries to staff resulting from accidents at work must be reported according to RIDDOR:

http://www.hse.gov.uk/riddor/guidance.htm

10 Training

10.1 MR Safety Training

All MR Authorised Persons requiring free access to the Magnet Room must complete an initial MR safety induction and practical training followed by annual MR Safety Training updates. This includes an annual MR Safety Update lecture.

If additional training is required they should be arranged with the Operations Manager, Clinical Leads or MR Safety Expert. New staff should attend a safety lecture at the first opportunity.

10.2 MR System Operator Training

All MR Authorised Persons requiring the entitlement to operate the MR system and be an MR System Operator must complete initial practical training, as specified by the Clinical Leads followed by annual MR Competency Training. The initial Training Checklist and annual Competency Checklist (see Appendix VI) must be completed, signed off and stored in the staff member's records.

All staff including agency staff working in MR units must be competency assessed by a competent Clinical Lead or delegated MRI radiographer to provide support and knowledge on Ramsay policy and procedures. Full training and competency assessments must be documented and signed off.

Where competent agency radiographers are able to manage a non-complex MRI list, supervision from a contracted Radiographer must be available within the department. A substantive member of staff must be available to support agency staff.

10.3 Radiography Assistants (RA) working in MRI environments

Trained Radiography Assistants provide valuable support when working alongside MRI radiographers. Provision must be made for adequate rest periods for the radiographer due to the scanning responsibilities.

The radiographer must be skilled in clinical decision making e.g. taking appropriate action for incidental findings and take responsibility for the episode of care, where there is an absence of other staff trained in MRI

10.3.1 RA MRI Training

The supervising MRI radiographer is responsible for the RA working in the MRI environment.

The supervising MRI radiographer must ensure the RA has been given full training and has undertaken the relevant competency assessment to work safely and carry out specific duties whilst working within MRI environment.

10.4 Life support training

All clinical (i.e. medical, radiographic, or nursing) staff should be experienced in life support and should attend at least a basic life support course annually. Staff administering contrast agents or caring for potentially unstable patients should attend at least ILS courses. Senior medical staff should have ILS or ALS experience.

11 Cleaning, Security & Estates Management

11.1 Cleaning

Cleaning of the Magnet Room will be carried out by cleaning staff who have been trained in MR safety and completed the MR Safety Screening Form. Please refer to section 6.4

11.2 Cleaning equipment

The suitability of cleaning equipment to be used in the Magnet Room must be verified by the Clinical Lead. Cleaning equipment to be used in the Magnet Room should be clearly labelled.

11.3 Infection control

Cleaning of the magnet must conform to local infection control procedures.

11.4 Maintenance

Estates and Engineering staff requiring access to the MR Environment may only do so as *unauthorised* persons and must undergo screening. They may only gain access to the MR Environment under direct supervision of an Authorised Person and with the approval of the Clinical Lead. All items (tools etc.) required to be used in the MR Environment must be demonstrated to be non-ferromagnetic.

11.5 Access

Un-authorised persons may not enter the Magnet Room *under any circumstances* when it is unattended by an Authorised Person.

11.6 Security

The Magnet Room, Equipment Room and Belly lockers must be secure when the unit is unattended. It is the duty of the last Authorised Person each day to ensure that the Magnet Room and suite doors are locked and keys are stored appropriately.

12 Further Information

- **ICNIRP (International Commission on Non-ionizing Radiation Protection) Guidelines for Limiting Exposure to Time-varying Electric and Magnetic Fields (1 Hz to 100 kHz).** Health Physics 2010; 99: 818-836 and Erratum Health Physics 2011; 100: 112.
- **Reference Manual for Magnetic Resonance Safety 201x, (Current year edition)** Frank G Shellock, Biomedical Research Publishing Group, Los Angeles, USA.
- **MRI safety website** and search 'The List' **http://www.mrisafety.com**
- **Health Protection Agency**. Protection of Patients and Volunteers Undergoing MRI Procedures. Documents of the Health Protection Agency Radiation, Chemical and Environmental Hazards August 2008. RCE-7. ISBN 978-0-85951-623-5. https://www.gov.uk/government/publications/magnetic-resonance-imaging-mri-protecting-patients
- **The Royal Australian and New Zealand College of Radiologists MRI Safety Guidelines** – www.ranzcr.com
- **Manufacturer's documentation.**

Appendix I EXPOSURE LIMITS

Patients and Volunteers

	Unit	Operating mode		
		Routine	Controlled	Experimental
Static field	Tesla (T)	4	8	>8
Switched gradient field	PNS % Median perception threshold	80%	100%	120%
Radio-frequency field	Core temperature increase °C	0.5	1	2
	Max temp head	38	38	39
	Max temp trunk	39	39	40
	Max temp limbs	40	40	41

Protection of Patients and Volunteers undergoing MRI Procedures
Health Protection Agency, Documents of the HPA Radiation, Chemical and Environmental Hazards, Aug 2008

Staff

Exposure Limit Values (expressed in RMS values) Frequency (Hz)	Basic Restriction (V/m)	Reference Level (mT)
	Controlled situation	Controlled situation
1 – 8	0.8	$200/f^2$
8 – 25	0.8	25/f
25-300	0.8	1
300 – 3000	0.8	300/f
3000 – 100000	2.7 x 10-4 f	0.1
100 kHz-300 MHz	0.4 W kg^{-1} (SAR)	0.2

ICNIRP (International Commission on Non-ionizing Radiation Protection). Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (1Hz to 100 kHz). *Health Physics* 2010; **99**: 818-836 and **Erratum** *Health Physics*2011; **100**: 112.

Appendix II ORGANISATIONAL DETAILS

RDUK

System	RDUK Mobile Scanners 10-14	
Location	Mobile Ramsay sites	
Employer	Ramsay Health Care UK	
MR Responsible Person	Beverley Halfpenny	☎ 07423697644
Operations Manager	Emma Liddle	☎ 07500 056 903
MR Safety Expert	Rebecca Quest *Head of MR Physics & MR Safety Expert* *Imperial College Healthcare NHS Trust* E: rebecca.quest@nhs.net Imperial.mrphysics@nhs.net	☎ 020 3313 0642

List of MR Authorised Personnel and MR Operators

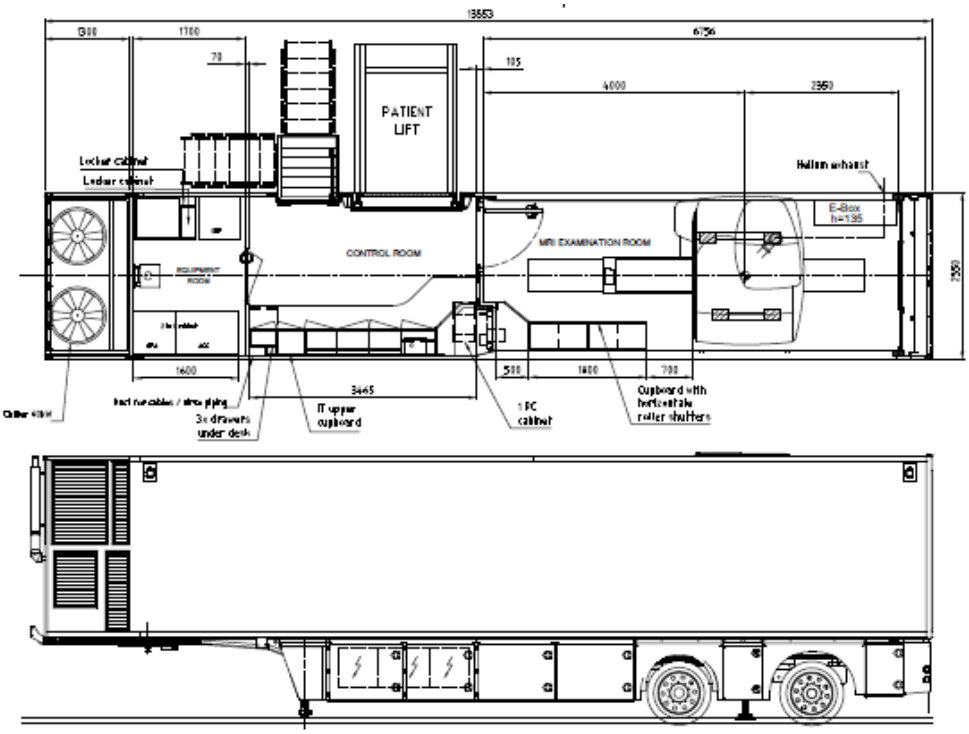
Name	Job title	Non-MR Environ	MR Environ	Supervisor	Operator (Clinical & Tech)	Operator (Non-clinical)
Beverley Halfpenny	Clinical Lead Radiographer	☑	☑	☑	☑	☑
Rosalee Rowe-Brissett	Clinical Lead Radiographer	☑	☑	☑	☑	☑
Edward Wekesa	Radiographer	☑	☑	☑	☑	☑
Jill Kellett-Wild	Radiographer	☑	☑	☑	☑	☑
		☑	☑	☑	☑	☑
Kevin Hogan	Radiographer	☑	☑	☑	☑	☑
Noushad Puthiyottil	Radiographer	☑	☑	☑	☑	☑
Stephen Pennington	Radiographer	☑	☑	☑	☑	☑
Tracie Blundell	Radiographer	☑	☑	☑	☑	☑
Iram Iqbal	Radiographer	☑	☑	☑	☑	☑
Julie Robinson	Radiographer	☑	☑	☑	☑	☑
Rachel Wilcock	Radiographer	☑	☑	☑	☑	☑
Tom McGuinn	Radiographer	☑	☑	☑	☑	☑
Andrew Reid	Radiographer	☑	☑	☑	☑	☑
Anneka Gower	Radiographer	☑	☑	☑	☑	☑
Christina Griffiths	Radiographer	☑	☑	☑	☑	☑
Emily Smith	Radiographer	☑	☑	☑	☑	☑
George Karanja	Radiographer	☑	☑	☑	☑	☑
Matt Evans	Radiographer	☑	☑	☑	☑	☑
Matt Edwards	Radiographer	☑	☑	☑	☑	☑
Jessica Knifton-Smith	Radiographer	☑	☑	☑	☑	☑
Sean Plumb	Radiographer	☑	☑	☑	☑	☑
Ryan Harrison	Radiographer	☑	☑	☑	☑	☑
Zelitsha Mathuthu	Radiographer	☑	☑	☑	☑	☑
Sarah Morley	Radiographer	☑	☑	☑	☑	☑

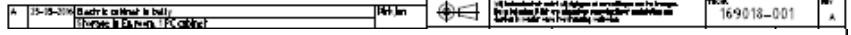
Bradley Powell	Radiographer	☑	☑	☑	☑	☑
Susanna Vorster	Radiographer	☑	☑	☑	☑	☑
Kate Parker	Radiographer	☑	☑	☑	☑	☑
Jo Evans	Radiographer	☑	☑	☑	☑	☑
Narender Singh	Radiographer	☑	☑	☑	☑	☑
Mubasher Ahmed	Radiographer	☑	☑	☑	☑	☑
Justus Obasi	Radiographer	☑	☑	☑	☑	☑
Sophie Trott	Radiographer	☑	☑	☑	☑	☑
Tochukwu Obikunie	Radiographer	☑	☑	☑	☑	☑
Allison Bethwaite	Radiographer	☑	☑	☑	☑	☑
Junaid Gullnawaz	Radiographer	☑	☑	☑	☑	☑
Ismael Mitha	Radiographer	☑	☑	☑	☑	☑
Matthew Motley	CT Lead	☑	☑	☑	☑	☑
Ugochukwu Okeke	Radiographer	☑	☑	☑	☑	☑
Iqbal Fiaz	Radiographer	☑	☑	☑	☑	☑
Olivia Norman	Radiographer	☑	☑	☑	☑	☑
Akeel Tafseer	Radiographer	☑	☑	☑	☑	☑
Daniel Farrar	Assistant Practitioner	☑	☑		☑	
Daria Wawrzak	RA	☑	☑			
Various	Cleaners	☑	☑			
Various	Quest Drivers	☑	☑			
Various	Quest Drivers	☑	☑			
Various	Siemens Engineers	☑	☑	☑		☑
Rebecca Quest	MR Safety Expert	☑	☑	☑		☑

Should the List of MR Authorised Personnel and MR Operators need amending before the next review of the MR Local Rules, please do so in this box. Changes should be countersigned by the Responsible Person

Appendix III MR ENVIRONMENTS

Ramsay 10





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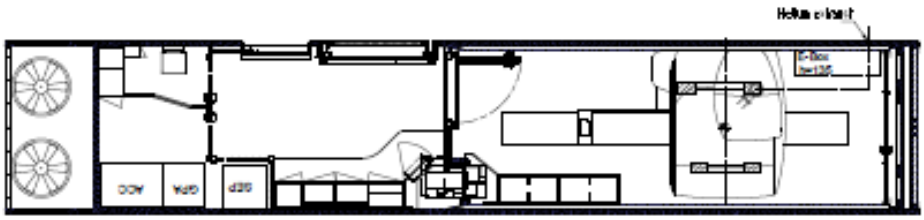
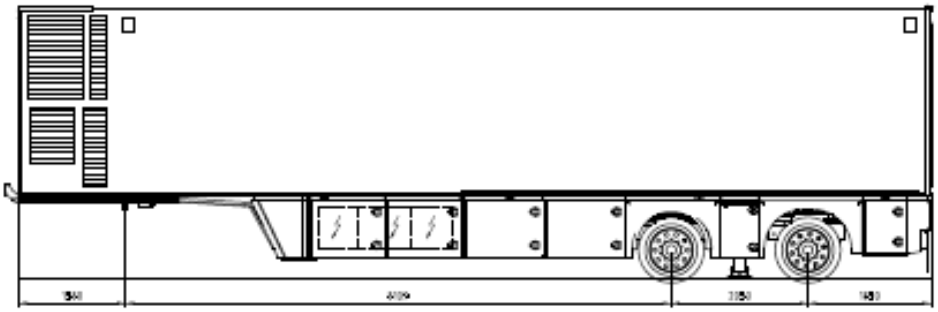
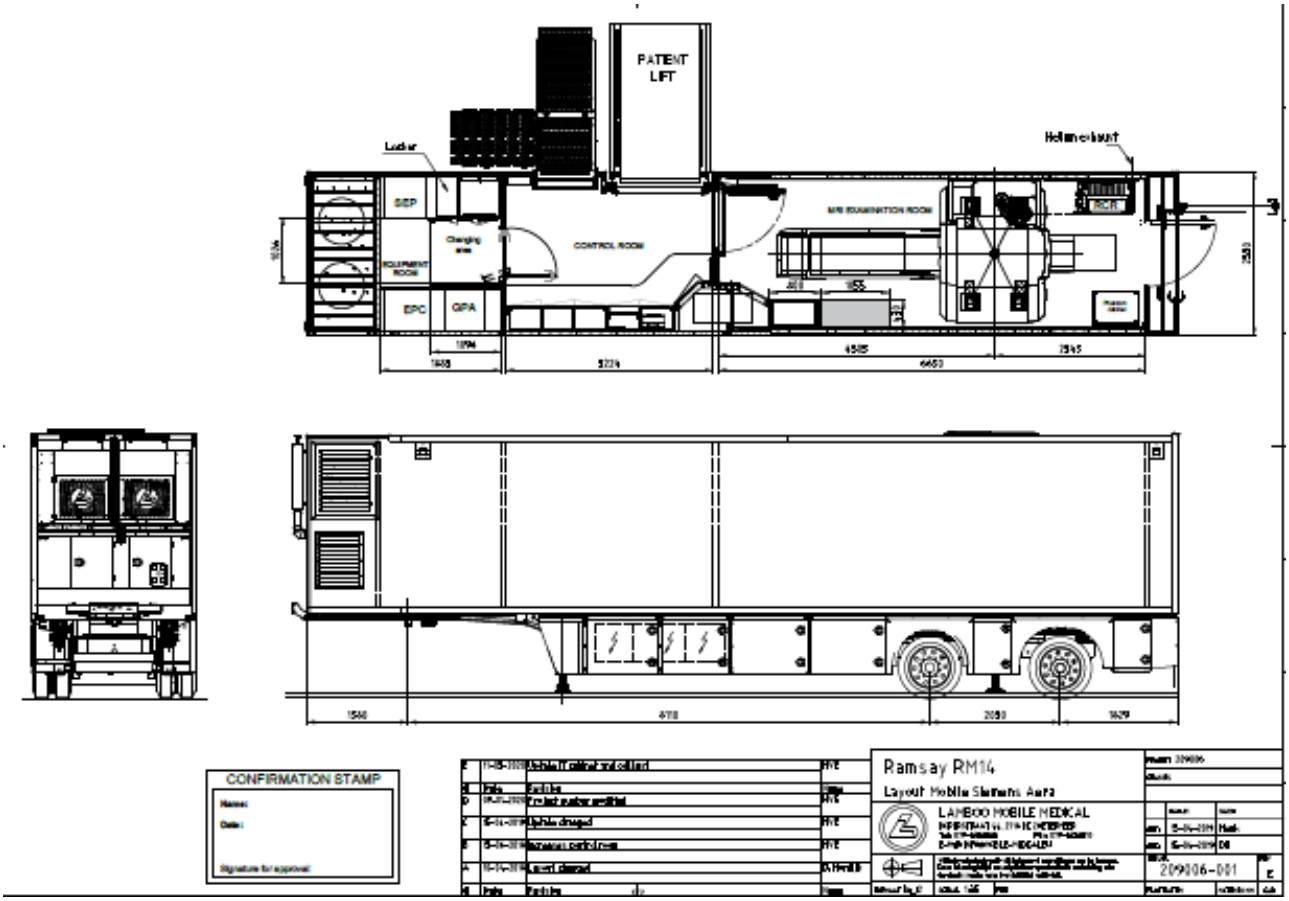
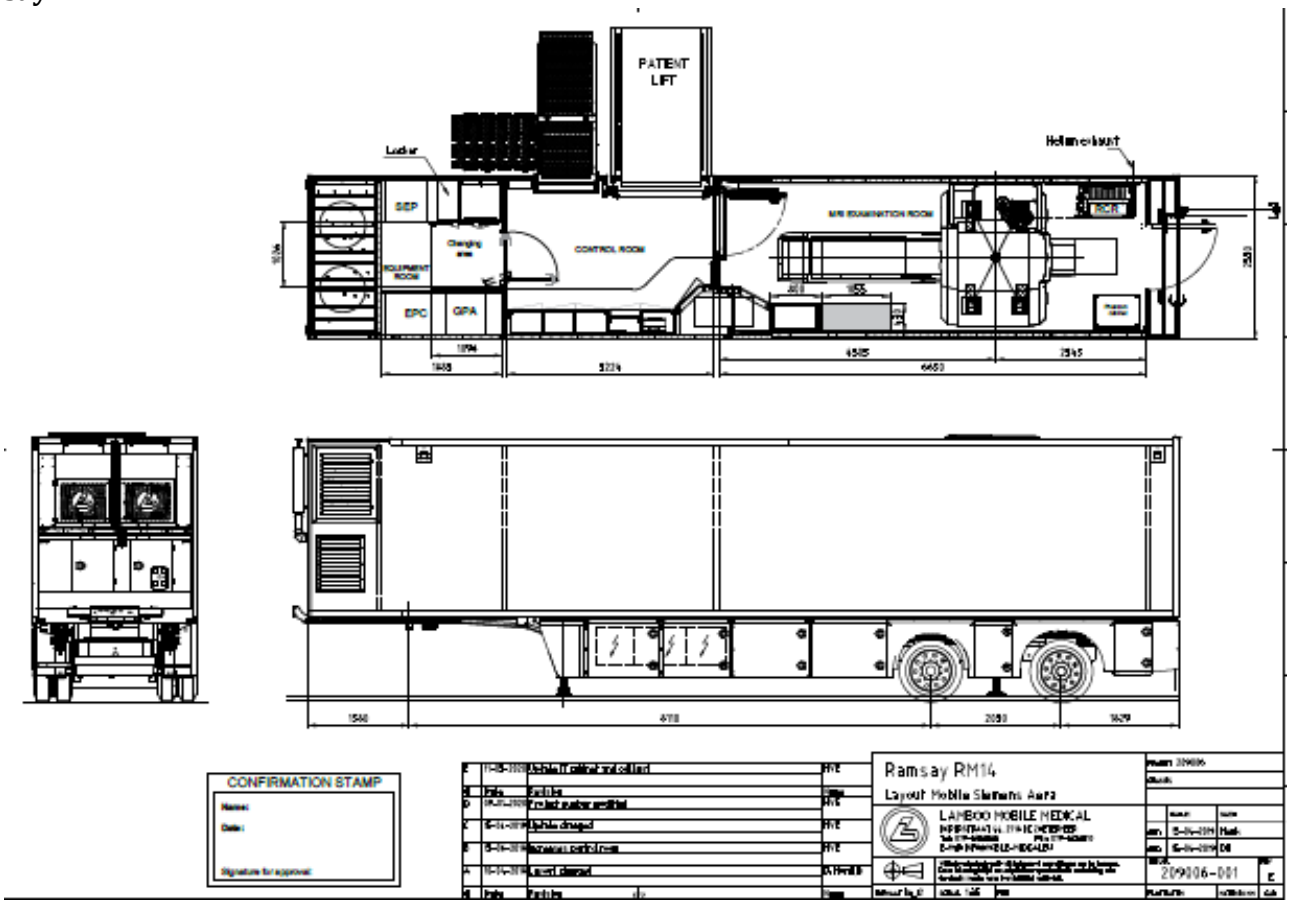




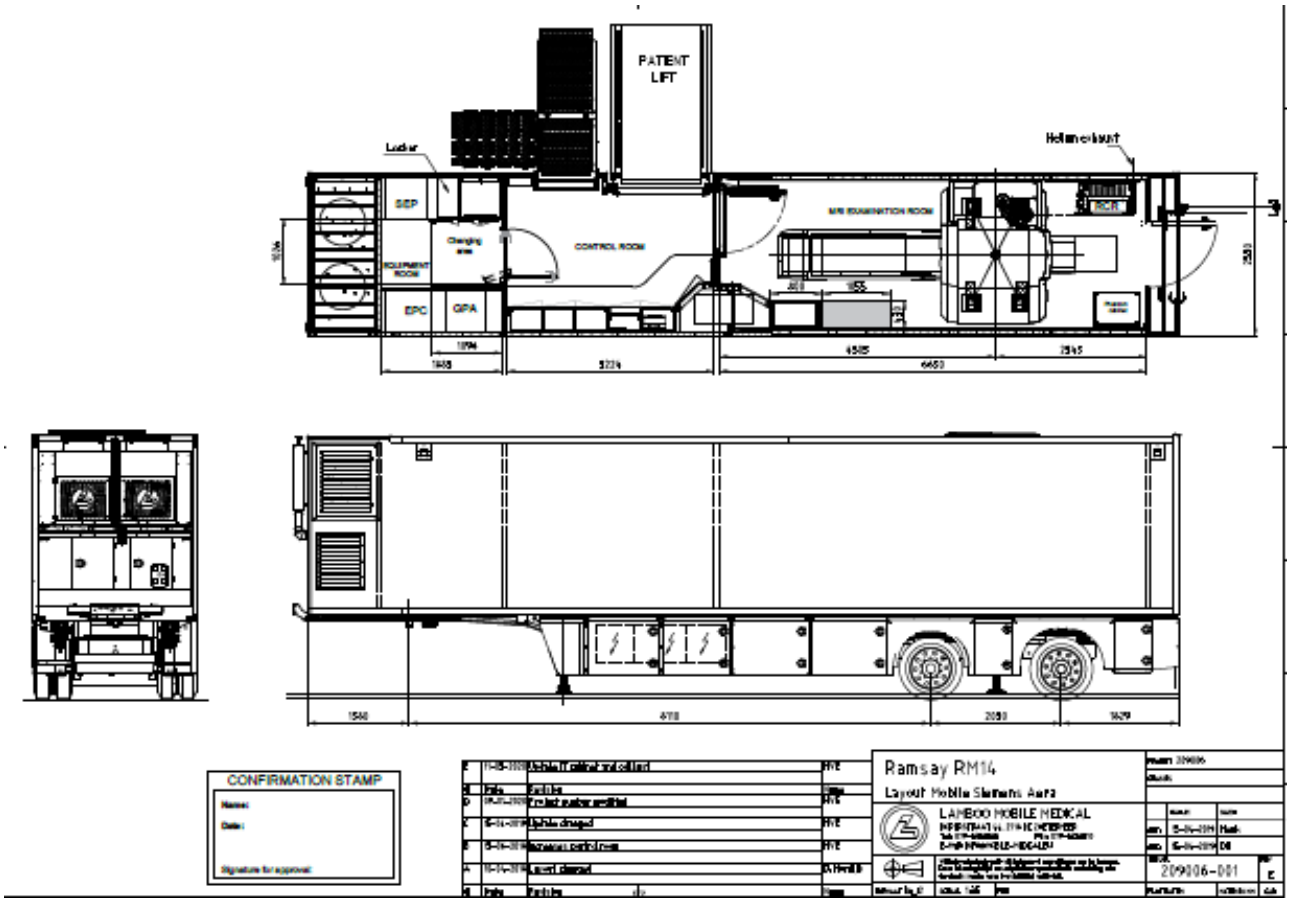
Ramsay 12


PATIENT LIFT
Ladder
Helium exhaust
SEP
Charging area
EQUIPMENT ROOM
CONTROL ROOM
MRI EXAMINATION ROOM
EPC
GPA
CONFIRMATION STAMP
Ramsay RM14
Layout Mobile Stations Axial
LANDOO MOBILE MEDICAL
209106-001

Ramsay 14


PATIENT LIFT
Loader
Helium exhaust
SEP
EQUIPMENT ROOM
Charging area
CONTROL ROOM
MR EXAMINATION ROOM
EPC
GPA
CONFIRMATION STAMP
Ramsay RM14
Layout Mobile Shielded Suite
LAMBOO MOBILE MEDICAL
209106-001

Ramsay 15


PATIENT LIFT
SEP
EPC
GPA
CONTROL ROOM
CONFIRMATION STAMP
Ramsay RM14
Layout Mobile Stations Aut2
LAMBOO MOBILE MEDICAL
209006-001

Appendix IV RAMSAY MRI FORMS

The following MRI forms are included in this Appendix:

MRI Patient Checklist

https://ramsayintranet.ukramsay.rhc.local/departments/diagnostics/imaging/Shared%20Documents/MRI%20Patient%20Safety%20Screening%20Form%20v4.pdf

Clinician/Visitor screening form

The Clinician/Visitor safety screening forms will be held in the site folder or with the MRI Local rules

https://ramsayintranet.ukramsay.rhc.local/departments/diagnostics/imaging/Shared%20Documents/MRI%20Safety%20Screening%20Questionnaire%20-%20Staff%20v1.2.docx.pdf

Referrers MRI Safety Screening Questionnaire – patient lacks capacity

https://ramsayintranet.ukramsay.rhc.local/departments/diagnostics/imaging/Shared%20Documents/Referrers%20MRI%20Safety%20Screening%20Qs%20(Lacks%20Capacity)%20V1.2.pdf

Gadolinium Safety Screening Form

https://ramsayintranet.ukramsay.rhc.local/departments/diagnostics/imaging/Shared%20Documents/Gadolinium%20Safety%20Screening%20Form%20v3.0%20with%20cann%20record.docx.pdf

Pregnancy MRI Scan History Record

https://ramsayintranet.ukramsay.rhc.local/departments/diagnostics/imaging/Shared%20Documents/Pregnancy%20MRI%20scan%20history%20record%20V1.2.pdf

Radiology/Clinician Authorisation form for Pregnancy patients

https://ramsayintranet.ukramsay.rhc.local/departments/diagnostics/imaging/Shared%20Documents/Pregnant%20patient%20Radiologist%20authorisation%20form%20for%20MRI%20examination%20V1.1.pdf

MRI Volunteer patient consent form

https://ramsayintranet.ukramsay.rhc.local/departments/diagnostics/imaging/Shared%20Documents/Volunteer%20Patient%20Consent%20Form%20v1.1.docx.pdf

MRI Risk vs Benefit Device Assessment

https://ramsayintranet.ukramsay.rhc.local/departments/diagnostics/imaging/Radiology/MRI%20Risk%20vs%20Benefit%20Device%20Assessment%20v2.0.pdf

Appendix V IMPLANT GUIDANCE FOR MRI

Implant Advice

If in doubt, check with the Clinical Leads or MR Safety Expert

Can scan immediately post-operative:	• **Post-surgical patients with no implants**. • **Orthopaedic devices** such as hip replacements, small metallic pins and plates made of non-ferrous materials. Stay in **NORMAL MODE** for patients with multiple implants. • **Coronary stents:** All commercially available coronary stents (including drug-eluting, non-drug eluting and two or more overlapped stents) can be scanned immediately post placement. Stay in **NORMAL MODE**; Maximum imaging time per sequence <15 min. • **Heart valve prostheses and annuloplasty rings:** All commercially available heart valve prostheses and annuloplasty rings can be scanned immediately post placement. Stay in **NORMAL MODE**; Maximum imaging time per sequence <15 min.
Check details of implant and confirm in writing	• **Post-surgical patients with an MR conditional implanted device** e.g. biliary stents, embolisation coils, IVC filters, aortic stents can be scanned **six weeks post** implantation **provided full documentation on the device is available.** The patient's surgical notes should be consulted to determine the particular device that has been implanted and written evidence obtained if possible from the notes, and / or the manufacturer. Any findings must be documented and stored with the patient checklist. • **Intra-cranial aneurysm clips:** Specific information (i.e., manufacturer, type or model, and material) about the aneurysm clip must be recorded in the surgical notes and this must have been verified in writing as safe to be scanned. • **Insertable cardiac monitors** e.g. Reveal can be scanned . The patient must also be made aware information may be lost post scan. https://www.medtronic.com/uk-en/healthcare-professionals/products/cardiac-rhythm/cardiac-monitors/reveal-linq-icm/mri-conditions.html • **Detatched retina repairs:** patients must be carefully questioned about the details of a scleral buckle and orbital x-ray performed if in doubt.
Absolute contraindication	• **ALL MR cardiac pacemakers** (standard and MR Conditional) • **Implantable cardioverter devices (ICDs)** • **Neurostimulators** • **Implantable drug infusion pumps** • **Programmable hydrocephalus (VP) shunts** • **Cochlear implants** • **Ingested capsule endoscopy device**s • **Breast contour profile tissue expander** which contains a magnetic injection dome and is considered to be unsafe for an MR examination.

Appendix VI MRI TRAINING CHECKLISTS

The following MRI Checklists are included in this Appendix:

MR Training Checklist for Operators

Appendix VII MRI CONTRAST POLICY

Please refer to this link on the intranet:

https://ramsayintranet.ukramsay.rhc.local/policy/Policies/Administration%20of%20Gadolinium%20Based%20Contrast%20Agents%20for%20MRI%20Examination%20and%20risk%20of%20NSF.pdf#toolbar=0&zoom=70

INFORMATION READER-BOX			
Please identify the department(s) this document applies to:	*Ramsay Diagnostics – MRI Local rules*		
Please highlight the area(s) of governance this document is applicable to:			
Clinical effectiveness;		Use of clinical information;	
Risk management;		Developing user/patient involvement;	
Education and training;		Clinical audit;	
Staffing and staff management;		Other (please specify).	
Document Purpose: *(please highlight in yellow) Note: For what purpose has this document been produced?*		• *Guidance;* • *Policy;* • *Procedural Document* • *Information.*	
Document Reference number:	*This is the document/policy number and department – see main policy for naming convention.*		
Title:	*RDUK MRI Local Rules*		
Author/Sponsor:	*Jessica Knifton-Smith/Emma Liddle/Rebecca Quest, MRI Safety Advisor*		
Publication Date:	*19-07-22*		
Target Audience:	*Employees and Referrers*		
Circulation List:	*All RDUK Staff, Quest Medical, Industrial cleaners*		
Description:	*Amalgamation of RDUK MRI local rules and MRI Safety Manual v7 CR02*		
Cross Reference:	*MHRA MRI safety Guidelines*		
Superseded Documents:	*Replaces MRI Local rules v1.2 and MRI Safety Manual v7– CR02*		
Action Required:	*With immediate effect*		
Timing:	*Immediately*		
Contact Details	*Jessica Knifton-Smith/Emma Liddle/ Rebecca Quest, MRI Safety Advisor*		
For Recipient's Use:	Action: *What action has been carried out by the receiver of the document– please detail in bullet points?*		
Signed:		Date	
Print Name:			
Role:			