Australasian Health Facility Guidelines

Part B - Health Facility Briefing and Planning
0440 - Medical Imaging Unit

Update April 2025:
Section 3.10.10 has been updated with revised information relating to the provision of reticulated nitrous oxide.

Revision 8
December 2024

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Australasian Health Facility Guidelines

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CULTURAL ACKNOWLEDGMENT AND TERMINOLOGY

The Australasian Health Facility Guidelines (AusHFG) are developed in collaboration with stakeholders across Australia and Aotearoa, New Zealand.

Acknowledgement of Country

We acknowledge the Aboriginal people as traditional owners and continuing custodians of the land throughout Australia and the Torres Strait Islander people as the traditional owners and continuing custodians of the land throughout the Torres Strait Islands. We acknowledge their connection to land, sea and community and pay respects to Elders past, present and emerging.

Acknowledgement of Te Tiriti o Waitangi

We acknowledge Māori as tangata whenua in Aotearoa New Zealand; Te Tiriti o Waitangi obligations have been considered in developing these resources.

Terminology and Language in the AusHFG

Throughout the AusHFG resources, the term ‘Indigenous Peoples’ is used to refer to both the Aboriginal and Torres Strait Islander Peoples of Australia and Māori of Aotearoa, New Zealand. Where references to specific cultural requirements or examples are described, the terms ‘Aboriginal and Torres Strait Islander Peoples’ and ‘Māori’ are used specifically. The AusHFG respect the right of Indigenous Peoples to describe their own cultural identities which may include these or other terms, including particular sovereign peoples or traditional place names.

Contents

01 INTRODUCTION

1.1 PREAMBLE

The Australasian Health Facility Guidelines (AusHFG) (www.healthfacilityguidelines.com.au) are freely available resources for health services and project teams across Australia and New Zealand to support better planning, design, procurement and management of health facilities.

The AusHFG are an initiative of the Australasian Health Infrastructure Alliance (AHIA), a cross-jurisdictional collaboration of all health authorities across Australia and New Zealand. Part A of the AusHFG provides further information relating to the purpose, structure and use of these resources. It is acknowledged that the application of the AusHFG varies between jurisdictions across Australia and New Zealand.

This AusHFG Health Planning Unit (HPU) has been developed by AHIA following an extensive consultation process completed in 2023.

1.2 INTRODUCTION

1.2.1 General

This HPU outlines the specific requirements for the planning and design of a Medical Imaging Unit.

As described in further detail in Section 1.4.3, nuclear medicine services are included in the separate HPU 500 Nuclear Medicine / PET Unit.

The document should be read in conjunction with the Australasian Health Facility Guideline (AusHFG) generic requirements described in:

- Part A: Introduction and Instructions for Use
- Part B: Section 80 (General Requirements) and Section 90 (Standard Components);
- Part C: Design for Access, Mobility, Safety and Security
- Part D: Infection Prevention and Control.

Additional AusHFG resources that may relate to this topic include:

- HPU 170 Cardiac Investigations Unit for information relating to cardiac angiography
- HPU 280 Oral Health Unit
- HPU 300 Emergency Unit
- HPU 500 Nuclear Medicine / PET Unit
- HPU 520 Operating Unit.

Project teams should refer to local jurisdictional policies and guidelines relating to engineering and building services requirements. A summary of key references is included at AusHFG 'External Resources' tab.

1.2.2 Acronyms

Medical imaging related acronyms used in this document include:

- ALARA: As Low as Reasonably Achievable
- ARPANSA: Australian Radiation Protection and Nuclear Safety Agency
- CT: Computed Tomography

- CBCT: Cone Beam CT
- CTCA: CT Coronary Angiography
- CR: Computed Radiography
- DR: Digital Radiography
- DSA: Digital Subtraction Angiography
- EMI: Electromagnetic Interference
- II: Image Intensifier
- MRI: Magnetic Resonance Imaging
- OPG: Orthopantomography
- PACS: Picture Archival Communications System
- PET: Positron Emission Tomography
- RANZCR: The Royal Australian and New Zealand College of Radiologists
- RIS: Radiology Information System
- UPS: Uninterruptable Power Supply

1.3 POLICY FRAMEWORK

Before undertaking a project, planners and project staff are encouraged to familiarise themselves with legislation, jurisdictional plans, policies and guidelines relating to medical imaging services. Regulatory requirements vary between States and Territories, and confirmation of requirements should be sought directly from the jurisdiction's relevant regulatory authority. Different jurisdictions may make reference to information and standards published by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) and other bodies.

Key reference materials include:

- ARPANSA Radiation Protection Series No. 14 Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation (2008)
- RANZCR MRI Safety Guidelines, Version3.0 (2021)
- RANZCR Position Statement on Safety in Medical Imaging, Version 2.0 (2020)
- RANZCR Standards of Practice for Clinical Radiology, Version 11.2 (2020)
- RANZCR Standards of Practice for Interventional Radiology and Interventional Neuroradiology, Version 1 (2022)
- RANZCR Clinical Radiology Range of Practice, May 2021
- RANZCR Specialist Interventional Radiology and Interventional Neuroradiology Range of Practice, March 2022.

Other reference materials including international resources are listed in Appendix 5.6.

The relevant regulatory authorities for each jurisdiction are listed at Appendix 5.4.

Unit design should meet all necessary criteria to reach accreditation standards with regard to design, safety and equipment and in order to obtain a licence.

1.4 DESCRIPTION

The Medical Imaging Unit provides for diagnostic and therapeutic radiological examinations to support clinical decision making and patient treatment. Patients range from fully ambulant outpatients to critically ill children and adults. Volumes and patient characteristics will impact on facility needs, layout and relationships with other units.

1.4.1 Medical Imaging Modalities

The range of imaging modalities addressed in this HPU document are outlined below.

General X-ray

General X-ray (also known as Plain X-ray) is commonly available within all medical imaging departments. It may be provided with fixed or mobile equipment and involves positioning the patient so that the part of the body being imaged is located between an X-ray source and an X-ray detector.

General X-ray is typically used to detect abnormalities in bones, lungs and other internal organs, and given it is fast and easy to use, it is particularly useful in emergency diagnosis and treatment.

Orthopantomogram (OPG), Lateral Cephalogram (Lat Ceph) and Cone Beam Computed Tomography (CBCT)

An **OPG** is a panoramic or wide view X-ray of the lower face, which displays all the teeth of the upper and lower jaw on a single film. OPG is a commonly used modality to identify dental and structural problems in the maxilla, mandible, and teeth.

A **Lat Ceph** is a lateral or side view X-ray of the face, which demonstrates the bones and facial contours in profile on a single film. Lat Ceph X-rays are best for observing jaw alignment and are usually used in the diagnosis and treatment of orthodontic problems.

CBCT is a low dose, compact version of a CT designed to provide high resolution 3D images of the teeth, jaw and surrounding areas. It is increasingly being used to support the provision of oral surgery and implants. The provision of CBCT, often combined with OPG, will depend on service need, acknowledging the additional capital cost and precautions relating to radiation shielding.

Fluoroscopy

Fluoroscopy uses X-rays and a fluorescent screen to obtain real-time images of movement within the body or to view diagnostic processes, such as following the path of an injected or swallowed contrast agent. Fluoroscopy is a commonly used modality and may be used alone as a diagnostic procedure, or in conjunction with other procedures. This includes barium swallows, where fluoroscopy is used to show the movement of the gastrointestinal tract, and to guide placement of catheters or stents inside the body.

A '**C-arm'**, sometimes referred to as an image intensifier (II), is a fluoroscopic system that connects the X-ray source on one end and the detector on the other (in a C shape) and is rotated around the patient at different angles to provide real time imaging. These are commonly used to support a range of image guided procedures and may be provided through fixed or mobile units.

Angiography and Digital Subtraction Angiography (DSA)

Angiography is the X-ray imaging of blood vessels using contrast agents injected into the blood stream. Angiography provides information about blood vessel abnormalities and is commonly used to guide associated procedures.

DSA is a fluoroscopic technique used in interventional radiology for visualising blood vessels via injected contrast medium. Radiopaque structures such as soft tissues and bones are eliminated ("subtracted") digitally from the image, thus allowing for an accurate depiction of the blood vessels.

Ultrasonography

Ultrasound is a commonly used imaging modality that uses high-frequency sound waves. Images are captured in real-time so they can also show movement of the body's internal organs and blood within vessels. Unlike X-ray imaging, there is no ionising radiation exposure associated with ultrasonography.

Breast imaging - mammography and tomosynthesis (3D)

A mammogram is an X-ray imaging technique of the breast that is used for cancer detection and diagnosis. Breast tomosynthesis is less widely available and is an advanced form of mammography providing 3D images. Contrast enhanced mammography combines breast 3D tomosynthesis digital mammography with an intravenous contrast agent to show new or unusual blood flow patterns that enables earlier identification of cancers.

Computed Tomography (CT)

CT refers to a computerised X-ray imaging procedure in which a narrow beam of x-rays is aimed at a patient and quickly rotated around the body, producing signals that are processed by the machine's computer to generate cross-sectional images, or "slices." Once a number of successive slices are collected by the machine's computer, they can be digitally "stacked" together to form a three-dimensional (3D) image of the patient that allows for easier identification of basic structures as well as possible tumours or abnormalities.

CT may be provided through fixed or less commonly, mobile units. CT is a common modality provided within imaging units.

An '**O-arm'** is a mobile CT imaging structure developed for intraoperative 3D fluoroscopic imaging and is typically associated with spinal procedures.

Magnetic resonance imaging (MRI)

MRI is a commonly used modality that uses a magnetic field and computer-generated radio waves to create detailed images of organs and tissues. MRI is particularly well suited to image the non-bony parts or soft tissues of the body. The brain, spinal cord and nerves, as well as muscles, ligaments, and tendons are best imaged by MRI. There is no ionising radiation exposure with MRI and it is the preferred cross sectional imaging modality in paediatrics.

1.4.2 Interventional Radiology (IR) and Interventional Neuroradiology (INR)

Revision 8 of this HPU guideline acknowledges the significant growth in these services and the recognition of IR and INR as distinct radiology fields by RANZCR, in addition to diagnostic radiology and nuclear medicine.

IR is a clinical specialty that integrates core principles of image-guided diagnosis, treatment, and clinical management across a wide range of medical conditions and procedures. Interventional radiologists perform advanced diagnostic and therapeutic minimally invasive image-guided procedures. Imaging modalities used include fluoroscopy, CT, MRI and ultrasound.

INR is a clinical specialty that integrates core principles of diagnosis, management and image-guided endovascular, endoluminal and percutaneous treatment of patients with congenital and acquired diseases affecting the nervous system. Interventional neuroradiologists perform a range of advanced diagnostic and therapeutic, minimally invasive, image-guided procedures relating to the nervous system.

1.4.3 Medical Imaging Modalities in Other AusHFG HPUs

The following modalities are included in AusHFG HPU 500 Nuclear Medicine / PET Unit and are not covered in this guideline:

- nuclear medicine
- SPECT / CT
- PET / CT
- PET / MRI, and
- bone densitometry.

Hybrid operating rooms (ORs) are included in HPU 520 Operating Suite and are not covered in this guideline. These are an advanced procedural space that combines a traditional operating room with an image guided interventional suite. A hybrid operating room includes fixed digital medical imaging systems that provide the capability to perform image-guided procedures combined with minimally invasive or open procedures.

The utilisation of medical imaging used in surgical / procedural services is increasing with the use of hybrid rooms, fixed and mobile C-arms, fixed and mobile CT and in selected cases, MRI.

1.4.4 Satellite Imaging Services

Increasingly, medical imaging services are being expanded and delivered with other clinical services where the size, scale and complexity of the services can support additional modalities. Examples include:

- satellite services in emergency departments, i.e. general imaging, CT and ultrasound
- orthopaedic clinics, i.e. general imaging
- maternal fetal medicine services, i.e. ultrasound, and
- breast assessment services.

Where satellite imaging services are provided it is essential that medical imaging services are included in planning and design consultation processes for that unit, e.g. ED, orthopaedic clinics etc.

02 PLANNING

2.1 OPERATIONAL MODELS

2.1.1 Hours of Operation

Hours of operation depend on the level of service. Small units may only operate during business hours with an on-call, after-hours service. Large units are likely to provide a 24-hour service, especially where a satellite service is provided with an emergency department (ED).

2.1.2 Determining Service Capability and Capacity

Planning for medical imaging should be part of clinical service planning where future activity, casemix and trends (both clinical and technological) are analysed. It is essential that the proposed scope of imaging modalities aligns with the anticipated expansion of clinical services. Consideration must be given to the full patient journey to ensure appropriate provision of pre and post procedure areas such as day only and overnight beds associated with interventional services.

Key demand drivers for medical imaging include:

- ongoing growth in acute and ambulatory care referrals
- increasing demand for medical imaging services at the point of care, i.e. satellite services and increasing use in patients undergoing surgical procedures
- significant expansion in the delivery of IR and INR services with an increasing role in the diagnosis, treatment and management of elective and emergency patients
- increasing use of image guided technology across many modalities including digital subtraction angiography (DSA), CT, ultrasound and fluoroscopy
- growth of CT in clinical situations, previously serviced by general X-Ray, such as cervical spine trauma and abdominal pain
- anticipated growth in the provision of low dose CT (LDCT) for lung cancer screening in response to the Australian Lung Cancer Screening Program due to commence in July 2025
- increased provision of CBCT to support a range of specialties, particularly dentistry and maxillofacial surgery, with increasing provision to support orthopaedics
- increased provision of breast biopsies performed under MRI and increasing provision of interventional breast imaging
- increasing use of mobile equipment, and
- every evolving technology that improves speed, spatial resolution and reduced ionising radiation dose (where applicable).

Planning will also include models of care development so that the organisation of medical imaging services across the healthcare facility are determined, e.g. decentralised models.

Future redevelopment stages should be considered to ensure appropriate expansion strategies for medical imaging are provided where necessary.

An understanding of services available in the private sector, particularly in rural areas, is necessary to avoid duplication as this may impact on capital and recurrent costs and may result in the under-utilisation of a modality.

2.1.3 Service Delivery Changes Impacting the Planning and Design of Medical Imaging Units

Changes in service delivery may include:

- acute assessment pathways that may bypass emergency departments such as
    - acute stroke assessment, involving CT and interventional neuroradiology or interventional thrombolysis
    - chest pain pathways using CT coronary angiography (CTCA)
- pandemic response impacting operational practices, activity flows and, ventilation systems to support increased resilience against future pandemics and optimal infection control practices relating to cases and surges outside of pandemics
- the changing and evolving role of the service and staff, e.g. the time taken to undertake a CT is relatively quick but the data generated from image acquisition may require significant post-processing work and time for reporting
- changes to major medical equipment to facilitate bariatric care, e.g. increased bore size for bariatric patients accessing CT and MRI and a shorter bore MRI unit so that patients not requiring whole body scanning may feel less claustrophobic
- increasing use of medical imaging departments for radiation treatment planning, requiring specific design considerations as outlined in HPU 600 Radiation Oncology Unit and AusHFG Standard Component – CT Planning Room
- increasing requirement for general anaesthesia to support radiology services impacting on equipment and medical services requirements
- governance arrangements relating to radiation safety and MRI safety requirements and ensuring that major medical equipment is maintained in optimal working order
- changing expectations within the community and the need to ensure that facilities support diversity and inclusion, including relating to culture, language, gender, age and disability
- the role of the contemporary radiologist has evolved, and they increasingly function as members of multidisciplinary teams with a significant expansion of their role in diagnosis, staging of disease and decisions regarding treatment. Private space will be necessary to consult with multidisciplinary teams and patients confidentially and to review data relevant to patient care.

2.1.4 New and Emerging Imaging Modalities

The following future trends relating to imaging modalities are noted. Detailed planning and design requirements for these modalities are not provided in this HPU given they are not commonly provided in medical imaging units in Australia and New Zealand currently. These may be incorporated in future iterations should their provision continue to grow. Project teams are encouraged to refer to existing sites where these modalities are provided for further information and advice.

- Supine CBCT – this modality provides a CBCT scan while the patient is lying flat on their back. Given it provides a larger bore it can be used for a range of other body parts. These units are the same size as a small conventional CT and does not require a separate control room.

- Photon Counting CT (PCCT) – this new CT technology is provided in a small number of public tertiary services and the private sector. It utilises a new kind of detector which registers the interactions of individual photons. This provides CT data at a very high spatial resolution, without electronic noise which is helpful for imaging very fine tissue structures such as the smaller bronchi of the lungs. It also provides improved dose efficiency which is important for low dose CT and paediatric imaging. The planning and design requirements are similar to a standard CT.
- Open Magnet MRI – these are more commonly provided internationally and in the private sector in Australia, however there is a small growing trend for use in the public sector. Rather than an enclosed bore, an open MRI uses a magnet at the top and bottom and is open on all four sides. This reduces the risk of risk of claustrophobia and panic attacks and supports the provision of MRI for larger patients. Open MRI produces lower resolution images compared to closed MRI given it uses lower strength magnets and it is unable to be used for certain body parts. There are different planning and design requirements to conventional MRI, particularly given the significant weight of these units.
- Neonatal MRI – these units are more commonly provided within Neonatal Care Units rather than Medical Imaging departments to minimise the transfer distance of unstable infants. These magnets are self-shielding and can be connected into a standard GPO. It is anticipated that this technology may be expanded into stroke applications.
- PET / MRI – there is increasing provision of this modality within Australia, that is typically provided in specialised facilities such as Children's Hospitals and specialised research-oriented units. There are significant planning implications associated with the approximate 10 tonnes weight of PET / MRI.
- Portable Low Field MRI – this new technology is expected to be increasingly utilised in the future. The units are approximately the same size as an ultrasound machine and are typically used for stroke assessment.

2.1.5 Models of Service Delivery

Medical imaging services in hospitals are typically provided from a Medical Imaging Unit with both inpatients and outpatients visiting the service. The service is generally located adjacent to the emergency department to support the timely assessment and treatment of patients. Outreach services are provided to support mobile imaging at the point of care, e.g. inpatient unit, intensive care unit or operating unit. Where provided, a nuclear medicine unit may be collocated, depending on the size and scale of each service.

Other service arrangements are detailed below.

IR and INR

IR and INR were previously seen as additional imaging modalities / treatment rooms, however they are now associated with the provision of elective and emergency services that support the full patient journey, including consideration of inpatient and outpatient care associated with IR and INR services.

The model of service delivery will depend on the types of procedures undertaken and volume of activity. IR and INR services may be provided as part of a Medical Imaging Unit or as part of a dedicated unit, however in recent years there is increasing provision of selected IR and INR services within operating suites to support proximal access to anaesthetic support and recovery services and in response to the convergence of complex interventional and surgical procedures. It is also anticipated that the provision of RAPTOR (Resuscitation with Angiography, Percutaneous Techniques and Operative Repair) suites may be provided as part of ED satellite imaging units in the future.

Emergency Imaging

Where collocation of medical imaging and the ED cannot be achieved, or where the emergency workload and acuity justify, it may be appropriate to include selected modalities within the ED. A satellite imaging unit within ED typically includes general X-ray, CT and ultrasound.

Where provided, this service may operate as the medical imaging 'hub' to service the hospital overnight. Operational issues such as patient holding alongside medical imaging rooms need to be considered so that productivity is maintained.

Major trauma centres may also consider overhead gantries in resuscitation rooms, however the use of mobile X-ray is increasingly common and provides a more flexible solution. For both options, shielding requirements will require assessment by a suitably qualified expert in line with relevant radiation regulatory requirements. Where mobile X-ray is provided appropriate storage close to the resuscitation zone is essential.

Larger control rooms for CTs supporting trauma services will be required, as noted in the Schedule of Accommodation (Section 5.1) to accommodate the clinical team. Space for reporting will also be needed.

Orthopaedic Imaging

If a high volume of work is generated by an orthopaedic service, these clinics should be located as close as possible to the Medical Imaging Unit. If this cannot be achieved, and where a high volume of activity can be demonstrated, consideration may be given to the provision of a satellite imaging unit to service the outpatient clinics. This will include general X-ray and may consider the use of a small, specialised mobile C-arm collocated with the plaster room to support emergency orthopaedic presentations as a theatre avoidance strategy. Shielding requirements will require consideration.

Maternity Ultrasound

Typically, ultrasound services are collocated with maternity services that provide high risk maternal fetal medicine services, however this will vary across jurisdictions. Otherwise, women are referred to a Medical Imaging Unit or community based medical imaging service.

Breast Assessment Units

While not typically dedicated in most hospitals, specialist centres may collocate medical imaging services related to the diagnosis and management of breast cancer. Medical imaging modalities would include ultrasound, mammography, breast tomosynthesis and MRI. Interventional breast procedures are likely to be undertaken under mammographic or ultrasound guidance.

BreastScreen services are delivered across Australia and NZ, providing screening mammograms to promote early detection of cancer. Services are delivered through fixed and mobile screening units.

Mammography units may be accredited with the RANZCR Mammography Quality Assurance Program.

Community Based / Outpatient Imaging Services

Stand-alone outpatient imaging services are becoming increasingly common to reduce demand on acute services. Modalities typically include general X-ray, ultrasound and CT. These services may be aligned with Urgent Care Centres.

Mobile imaging services within the community may also be provided, requiring consideration of dedicated parking for mobile vans with access to power.

Outsourcing

Health services may consider outsourcing medical imaging services. This may include a fully outsourced model, whereby a private provider operates the service and reports on all images. Other health services may outsource some or all reporting services to a private provider. These options need to be addressed early in the planning process as they may have spatial and design implications relating to the number of reporting rooms.

2.2 OPERATIONAL POLICIES

2.2.1 General

The following issues should be considered in the development of the operational model for the Unit, as they will impact the configuration of the Unit and overall space requirements.

Operational policies should be developed as part of the project planning process. Refer to Part B Section 80 General Requirements for further information.

2.2.2 Teleradiology

Teleradiology will be used to support health services where medical imaging procedures are undertaken and the results are reported off-site. Increasingly, the use of digital applications provides the potential for the radiologist to be consulted during surgical procedures or to participate in a multidisciplinary meeting remotely.

Teleradiology standards are documented within the RANZCR Standards of Practice for Clinical Radiology (2020).

2.2.3 Anaesthesia and Recovery

The likely extent of anaesthetic requirements (general and sedation) must be considered to assess operational, equipment and facility requirements. Sedation is commonly used for CT, MRI, interventional radiology and fluoroscopy procedures with a preparation / recovery bay provided to support patient management and efficient patient turnover.

A combined holding / recovery area will be needed to support patients recovering from selected procedures. The scale will be dependent on Unit size and the nature of the procedures being undertaken.

Day stay and overnight beds may be required to support IR and INR services.

2.2.4 Image Acquisition

Digital plain film acquisition (DX) may be obtained using computed radiography (CR) or digital radiography (DR). CR is outdated technology, however it is included in this guideline given that existing facilities may still use CR systems.

CR uses cassettes and is viewed on a monitor, using a digitiser. The image can be enhanced by the operator to capture the best image before being stored onto the PACS network for reporting.

DR is a filmless X-ray image capture system, removing the need to use cassettes, except in hybrid DR systems. Images appear directly onto the workstation monitor allowing the manipulation of the images.

Implementation of CR and DR has implications for work processes and facility requirements, e.g. where DR is used, radiographers can verify images at the time of exposure, hence most of their work is done at the console in the imaging room or control room.

Some modalities, such as CT, will generate up to 15,000 images per procedure. Separate space will be required for post processing work, ideally away from the main CT control room so that patient throughput is not compromised.

Hard-copy film brought in by a patient may be digitised and stored on the network and viewed from any computer. This will however depend on local operational practices.

Digital films may be printed using a laser printer. These technologies eliminate the need for dark rooms and chemical processing.

2.2.5 Information and Image Management

Support for agile, redundant image storage, access and reporting is essential for the provision of efficient medical imaging services.

A PACS is used for the storage, retrieval, management, distribution and presentation of medical images.

A RIS is a networked software system used to manage images and tracking requests for service and billing information.

PACS provides the capability for off-site viewing and reporting (telediagnosis) and allows clinicians in different locations to view and discuss the same data simultaneously (teleradiology).

PACS allows for rapid reporting, removing the need for film transport and hard copy film storage. If there is integration with the patient administration system (PAS), then order entry may be simplified and consistent.

A fully implemented PACS / RIS will impact on work flows particularly as a result of changed clerical duties and processes.

Satellite units, off-site services, private practices, and staff homes may all be linked into the system. Inpatient and ambulatory care services will be able to view images, but manipulation of images will be restricted.

The provision of an integrated PACS / RIS should consider future medical imaging technologies / modalities that may need to be supported.

Vendor neutral archive (VNA) technology may also be considered for image access and storage.

Further information is provided in Sections 3.10.8 and 3.10.9.

2.2.6 Viewing and Reporting

Most reporting will be centralised within the Unit. Some rooms will be located adjacent to the modality, i.e. CT and MRI, and sized to facilitate urgent patient management and review activities by visiting referring teams who will need to review images immediately. Other reporting stations will be located elsewhere in the Unit to facilitate routine reporting activities. These will be located to facilitate high productivity. Some facilities may align reporting activities with sub-specialty services, e.g. head and neck, neurology etc.

High resolution diagnostic viewing monitors will be provided within reporting rooms in the Medical Imaging Unit. This type of screen will typically also be provided in emergency and intensive care units where time-critical treatment is needed. Other clinical departments throughout the hospital will access PACS images on non-diagnostic monitors.

The dictation of results is predominantly supported by voice recognition software, however this may be provided in combination with medical typists in some services. Where medical typists are provided, they may not necessarily be collocated with the Medical Imaging Unit as the work can be completed remotely.

The number of reporting stations required will need to be determined on a project-by-project basis. This will require consideration of current and future arrangements relating to outsourcing of reporting to teleradiology providers.

2.2.7 Management of Patients with Special Needs

Specialised equipment can now be provided so that bariatric patients can access a range of services. For example, increased bore sizes are now available including CT (up to 120cm) and MRI (up to 70 cm). Tables that suit wide bore units can typically manage patients to 250kg and tables to support weights in excess of 250kg are also available.

Access to a suitable lifting device may be required. Circulation space to allow the movement of patients onto equipment using mobile hoists needs to be considered. Some modality rooms may require consideration of a ceiling mounted lifter where a high volume of patients will require assisted transfers and where mobile lifters are not able to be positioned appropriately due to the constraints of the imaging table.

Doors and corridors must support access by beds, trolleys and wheelchairs, including consideration of bariatric beds and large electric wheelchairs. Refer to 3.6.4 and AusHFG Part C for further details.

Many medical imaging services will provide services to children. Access to play areas and amenities for families are needed. In addition, visual aids such as artwork can make the experience less stressful. Where possible, consideration may be given to managing flows so that some level of separation is possible.

Provision of a low stimulus sub-wait area may be considered for large departments to better support patients that may find busy waiting areas overwhelming. A separate sub-wait area may also be provided where high volumes of patients with accompanying corrective services officers, police etc are anticipated.

2.2.8 Reprocessing of Reusable Medical Devices

Reprocessing of reusable devices must align with the following publications:

- AS/NZS 4187 Reprocessing of reusable medical devices in health services organisations (Standards Australia); and
- Australian College for Infection Prevention and Control (ACIPC) & Australasian Society for Ultrasound in Medicine (ASUM) 2017, Guidelines for Reprocessing Ultrasound Transducers.

Ultrasound transducers that come into contact with intact skin are considered non-critical medical devices and require reprocessing by cleaning and may be followed by low-level disinfection (LLD) method. This is typically provided at the point of care.

Ultrasound transducers that come into contact with non-intact skin and / or mucous membranes and transducers that have had likely contact with blood / body fluids are considered as semi-critical medical devices due to the high risk of potential contamination. These transducers are reprocessed by cleaning followed by a high-level disinfection (HLD) method.

Although some facilities may provide HLD of ultrasound transducers within the sterilising services unit (SSU), the preferred approach is to undertake HLD within a separate room adjacent to the ultrasound room/s where they are used. This supports time-efficient turnaround processes and minimises the need for additional transducers to cover downtime periods. Approved automated and closed HLD systems are typically located on a bench (although may be floor mounted) and require access to power and data. The room must be designed to support unidirectional dirty to clean workflows.

2.2.9 Patient Transport

The systems and staff needed to move patients to and from the Medical Imaging Unit require consideration, e.g. dedicated or centralised patient transport systems. This process may be facilitated using a centralised patient journey board where patients are tracked during their stay within the Unit. This may be provided as an electronic journey board depending on local practices.

Space to store and charge powered bed movers and wheelchairs may need to be considered where used. Real time locating systems (RTLS) could be considered to track major equipment such as bed movers etc.

2.2.10 Provision of X-Ray Viewing Boxes

Ideally, hard copy images will be scanned and digitised when a patient presents with plain film. Where this system is not supported, access to an X-ray box, fixed or mobile, within the Unit will be needed. These are rarely used and where required are typically provided in reporting rooms.

2.2.11 Management of Patient Change and Property

There should be separation of 'changed' and 'unchanged' patients, and ambulatory patients and those in wheelchairs or on beds / trolleys requiring some supervision.

Ideally, one changing room will be provided for each modality, although this assumes a significant outpatient cohort. Change rooms should be arranged so that patient throughput is optimised, i.e. a patient can begin getting changed while another patient is being managed. This can easily be facilitated when the change room connects directly to the imaging room. Patients will typically leave their clothes in the change room but take personal items, such as handbags, with them. The location of gowns, and separation of clean and dirty gowns, needs to be considered.

Where patients will change within the modality room, consideration must be given to the provision of privacy curtains / blinds to any observation windows and doors.

There is a need for a toilet and shower attached to fluoroscopy and CT rooms, where CT colonography will be undertaken. Ultrasound rooms require direct access to a toilet. These areas also require consideration of appropriate facilities to support patient change within the toilet / shower area.

Paediatric services will require consideration to ensure appropriately sized change areas to accommodate an accompanying parent, areas to support breastfeeding and baby change, and separation from adult flows where possible.

2.2.12 Pathology

A range of specimens may be collected during imaging procedures, e.g. aspirations. A dedicated pathology room may be needed to prepare cytology samples for further analysis in pathology. Consideration may be given to the provision of a pneumatic tube station for the efficient transfer of specimens.

2.2.13 Mobile Imaging

Mobile units may include general X-ray, C-arms, CT and ultrasound.

Their use and provision should be defined in the clinical service plan / functional brief so that the facility and staffing implications can be identified.

In smaller hospitals, mobile X-ray units can be 'parked' in the Medical Imaging Unit for deployment around the facility. In larger facilities dedicated units, and associated mobile equipment bays, may be allocated for:

- operating unit – general X-ray, C-arms and in selected cases, mobile CT
- NICU – general X-ray and ultrasound

- ICU - general X-ray and ultrasound, and
- ED - general X-ray and ultrasound.

The location of storage close to the point of care needs to be determined so that the appropriate parking bays, fittings, protective aprons, power etc. can be provided. Each mobile imaging unit will require a double GPO and single data outlet. Access to RIS systems will be required on these units. Real time locating systems could be considered to track this equipment.

It is expected that images are digital or CR systems and therefore available on the PACS system, so that no processing facilities will be required. However, these units may require viewing stations for better clarity of images.

Shielding requirements will require consideration. The ability and means to ensure access control of the temporary radiation area and the use of mobile protection devices should also be considered.

2.2.14 Staffing

A staff establishment should be developed early in the planning process in order to determine spatial requirements including office space and amenities.

The staffing profile will depend on the size and configuration of the Unit with consideration of satellite units. Where possible imaging services should be centralised to support efficient use of modalities, optimal resourcing and appropriate staff support. However, some facilities may require the provision of decentralised / satellite imaging units as outlined in Section 5.1.3. Future service arrangements must be informed by consultation with Medical Imaging services to ensure they can be appropriately staffed and managed.

Staff, in addition to a range of students, may include:

- radiologists, radiology registrars, residents, students and observers
- radiographers including trainees
- image technologists / practitioners
- sonographers
- physicists
- biomedical engineers
- nursing staff
- allied health assistants
- PACS administrative support staff
- porters
- administration officers, and
- environmental services staff.

2.3 PLANNING MODELS

2.3.1 Location

Ideally a medical imaging service should be located directly adjacent to an emergency department and be readily accessible to ambulatory care clinics and inpatients being transported on beds. Proximal access, often vertical, to inpatient units and ICU is also required to minimise travel distances associated with mobile imaging.

The location of the unit will also consider the future replacement of major medical equipment and the weight of shielding on floor loads.

If modalities such as interventional radiology, CT, MRI are not located on the ground floor, a lift capable of transporting heavy, bulky equipment to the upper levels of the facility will be needed. A 3-Tesla MRI, and related equipment, can weigh over 10 tonne and will not be transferable by hospital lift. Non-standard door heights and demountable windows may be required to allow for the transfer of the magnet. Where installation via a crane is required appropriate access must be considered.

The replacement of these modalities must be considered early in planning to minimise the disruption to services in the future and ensure appropriate access and floor loading throughout the travel pathway. This should also consider future changes to the scope of imaging modalities, such as changing from a 1.5 to 3 Tesla MRI.

The proposed location of MRIs must also consider electromagnetic interference (EMI) from internal and external adjacent areas. Magnets should not be placed in close proximity to heavy moving metal structures such as lifts. The impact of noise transmission from MRI to adjacent areas should also be considered.

2.3.2 Flexibility

Project staff and users should consider future needs in planning the facility. The Unit should ideally be planned with future expansion zones identified and flexibility for internal conversion. Where expansion zones are not available, options for decentralised medical imaging services may need to be considered to facilitate growth.

2.3.3 Interdepartmental Patient Flows

Direct horizontal or vertical access should be provided between the Medical Imaging Unit and the emergency department to manage a high volume of patient movements.

Depending on the service model, it is likely that there will be a substantial volume of patients moving between the Medical Imaging Unit and orthopaedics, ambulatory care clinics and inpatient units.

2.3.4 Intradepartmental Patient and Staff Work Flows

Analysis of work flow is an important issue that underpins the planning and design of the Medical Imaging Unit. The layout of the unit should facilitate work flows and avoid bottle necks. Lean thinking theories support separation of work flows for booked and emergency patients where possible. High volume throughput services, such as booked outpatient appointments may require waiting areas and dedicated service rooms near the main entry of the unit. Flows to be considered include:

- scheduled ambulatory care patients including residential aged care facility patients who may arrive by ambulance
- scheduled bookings from inpatient units, and
- emergency patients from the emergency department, operating unit, intensive care unit or ambulatory care unit.

Activity flows within the unit should support one way flow where possible, with consideration of pathways for infectious patients.

Sub-wait areas may be provided to support activity flows and patient privacy for those who are already changed. Requirements will depend on activity volumes and the patient cohort. For example, a separate sub-wait area may be required where high volumes of patients with accompanying corrective services officers, police etc are anticipated.

2.3.5 Pandemic Preparedness

In response to lessons learned during the COVID-19 pandemic, it is important that the planning and design of medical imaging departments supports resilience against future pandemics and optimal infection control practices relating to cases and surges outside of pandemics.

Operational practices relating to medical imaging during COVID-19 are documented in the following resources:

- Royal Australia and New Zealand College of Radiologists (RANZCR). COVID-19: Position Statements and Guidance
- NSW Health Agency for Clinical Innovation, September 2020, 'Information for Medical Imaging Managers and Clinicians - Building capacity and protection during COVID-19 surge'.

The following recommendations relating to the planning of medical imaging units are noted:

- Ventilation systems – the risk https://www.who.int/publications/i/item/9789240021280of airborne transmission is minimised through the provision of appropriate HVAC systems, including consideration of ventilation rates (air changes), and filtration requirements in line with building and engineering services guidelines.
- Interventional imaging rooms should be routinely equipped with air handling systems that are consistent with operating theatre design.
- Class S isolation room/s – isolation room/s (with collocated toilet) should be considered for holding / recovery zones for appropriate isolation of patients where required. This approach may instead be managed operationally, especially where holding recovery zones have few spaces and minimal staff to monitor them.
- Patient pathways for infectious patients must be considered.
- Provision of mobile X-ray for infectious patients on inpatient units can be undertaken through a window in the bedroom door assuming appropriate design. This includes provision of an appropriately sized window with window coverings that can be moved out of the way while still allowing patients to have control over their privacy (i.e. avoid inclusion of integrated blinds).
- Consider opportunities to locate flexible use rooms, such as meeting rooms, adjacent to waiting rooms to provide overflow waiting capacity and a separated area during pandemic periods.
- Storage of equipment and consumables to be considered. For interventional rooms, separate storage will be required for devices such as catheters, implants and guide wires that cannot be stored within the room.
- Selection of finishes must consider the intensive cleaning requirements to meet infection prevention and control protocols.

For further information refer to:

- AusHFG Resource: Pandemic Preparedness – Health Infrastructure Planning and Design Guidance (pending publication)
- Jurisdictional guidelines for building and engineering services.

2.4 FUNCTIONAL AREAS

The Medical Imaging Unit will consist of functional zones as detailed below.

2.4.1 Entry, Reception and Waiting

The public entry to the Unit must be easily identified. Seating considerations include provision for patients with mobility issues, bariatric patients, ambulant patients and wheelchairs.

A child play area may be included. Unless public toilets are provided nearby, access to toilets within the public areas of the Unit is needed.

The reception will have oversight of the entry and waiting areas and act as a control point to the rest of the Unit. The reception desk should be designed to assist in maintaining patient privacy while personal information is being exchanged. Given staff working at reception may be isolated at times, it is also essential that the reception area is designed to ensure there are no opportunities for staff entrapment, a retreat space is identified and access to duress is provided. Bench space requirements should consider the provision of CD burning for imaging, however in most services this is being phased out through the use of USBs or uploading of images to online systems.

In large units, it may be preferable to limit the numbers of patients at the main waiting area and direct them to sub waiting areas once patients have registered. The size of the waiting room will be dependent on ambulant activity. Where this activity is provided by satellite services, main departments may require less waiting space.

Sub-wait areas may also be used for high throughout clinics e.g. orthopaedics, where patients may be required to have imaging undertaken prior to a clinic appointment.

Location of flexible use rooms, such as meeting rooms, adjacent to waiting areas can support overflow waiting capacity, as noted under Section 2.3.5. These rooms are less utilised during pandemic periods and can provide an effective temporary solution.

Access to a drinking fountain will be important as selected patients will need to drink large volumes of water prior to ultrasound procedures.

MRI services within large medical imaging units may require a separate reception area for MRI if services are operated outside of standard operating hours for the main medical imaging department.

2.4.2 Patient Holding / Recovery Area

There is a need for a patient holding / recovery area where patients in beds will be held:

- before and after an imaging examination, and
- to be prepared for and / or recover from an examination or procedure.

The number of holding bays required depends on the number and mix of imaging modalities. For example, interventional radiology, CT and MRI may require preparation and recovery. Inpatients and those attending the service from other hospitals and residential aged care facilities will need to be held before and after examinations.

Patient holding and recovery should be configured as a single area where appropriate to optimise staff efficiencies. This excludes MRI patient holding / recovery bays which will be provided in the MRI suite.

Consideration should be given to the type of scans provided. For example, cardiac capable CT (CTCA) and MRI require the patient's heart to be slowed and for them to remain as relaxed as possible so accommodation in a holding bay is preferred rather than an open waiting area.

Holding / recovery areas to support IR and INR will depend on the location of these services, as noted under Section 2.1.5. Additional time is required to recover patients following interventional procedures (up to four hours) and some patients will require admission to an inpatient unit.

The patient holding / recovery area will be located in close proximity to imaging rooms so that time is not wasted transferring patients.

Patient bays within this area will be overseen by a staff station and patients will require access to a patient toilet. Staff will need access to clean and dirty utility rooms, linen and a beverage bay. These can be shared across the Unit but will be routinely needed by the nursing staff working in this area.

2.4.3 Clinical Modalities Areas

Interview / Consultation Rooms

Some rooms are required for patient assessment by medical and technical staff, procedure information and consent. These rooms should be readily accessible from imaging rooms including CT, MRI and fluoroscopy.

Imaging Rooms

Imaging rooms are usually clustered into suites of like rooms that can share appropriate radiological and patient support. For example:

- general X-ray and fluoroscopy rooms
- ultrasound and mammography
- interventional radiology (DSA and angiography), and
- CT, and where provided, MRI.

Selected rooms will need a control room (i.e. CT, MRI, fluoroscopy and interventional radiology). These rooms will be located alongside the imaging room and configured so the patient can be supervised throughout the procedure.

Where a Medical Imaging Unit is collocated with an emergency department, ideally general X-ray and CT will be located so they are accessible for emergency use without delay but also ensure that other flows within the ED are maintained. A satellite medical imaging unit requires a significant footprint so a location in the middle of the department may not be ideal

Radiographers will be stationed in some imaging rooms, e.g. X-ray and mammography, with consoles located within the room as images are manipulated on the screen. Where CR is used (acknowledging this is outdated technology as noted in Section 2.2.4), a small desk top processor will be accessed. This can be located in a shared work area where radiographers can access computers, manage workload and meet.

Equipment and computer systems required to support selected modalities may also need to be collocated. This will depend on cable lengths and will be vendor dependent.

2.4.4 Clinical Support

A range of space is required to support medical imaging activities.

Image acquisition is increasingly done at the point of care, usually at a console within the imaging room or an attached control room.

Post processing will be needed for modalities such as CT and MRI as the radiographer needs to organise the images generated. This work can be done in a separate space within the department as it is time consuming and requires concentration. Usually one workstation is needed per modality, however requirements will need to be considered on a project by project basis.

Sonographers may require access to a separate space (sonographer work room) to review and organise images as this is not always undertaken within the ultrasound room.

Reporting rooms will be provided in some cases close to the modality (i.e. CT, MRI and interventional radiology) where the clinical team can discuss complex clinical cases, e.g. trauma. Most reporting will however be done in another location within the Unit. In larger centres, space for a radiologist working alongside a fellow or registrar and possibly a medical student will be needed.

A **work base for radiographers** will be needed to undertake a range of activities. This will usually include a fully equipped diagnostic workstation for QA activities. This space will be located nearby imaging rooms so that productivity is optimised.

Some vendors or IT consultants may utilise remote access to provide diagnostics and software maintenance of imaging equipment and workstations. The system should therefore be configured to facilitate access to PACS via external means. Larger departments will have dedicated staff to maintain the PACS system and office space will be required.

Hard copy **film storage** should be eliminated with PACS. Patients may still bring hard copy images with them. While a range of images may need to be held for longer periods in accordance with state records requirements, these do not need to be stored within the Unit.

Film to be retained for teaching and research purposes may be housed in a **Film Library** although increasingly these images are being digitised.

Small **pathology preparation laboratory areas** will be required in close proximity to areas performing interventional procedures such as biopsies and drainages. These include CT, ultrasound and mammography.

Equipment storage will include bays for equipment used on a routine basis, e.g. mobile hoist, and rooms for specialist equipment that may be infrequently used, e.g. specialised chairs for speech pathology barium swallows, stands and supports for orthopaedic procedures. A bay for a resuscitation trolley will also be needed.

A dedicated **equipment workshop** to support the safe testing and maintenance of mobile modalities is typically only provided in larger, high level units where there is sufficient activity and staff to support this. For other services, mobile modalities are usually serviced within an existing X-ray room, acknowledging that this does impact on utilisation of the room. Shielding requirements will need to be considered for equipment workshops.

Appropriate **medical physics** support space should also be considered for larger units including storage and workspace areas.

Clinical consumables and medications will be stored within a **clean store/ medication room**. This will be located near the patient holding / recovery area. The size of the medication storage area will depend on the service profile and will be highly utilised by interventional services. Some jurisdictions will require separation of the clean store and medication room in line with local policies. Other storage will be needed to accommodate bulk quantities of contrast media.

The number of **dirty utility rooms** required will depend on the number and types of imaging modalities in the Unit. The placement of this room will minimise staff travel distances and be located nearby the fluoroscopy room and patient holding / recovery.

An **ultrasound reprocessing room** should be provided adjacent to the ultrasound room/s as described in Section 2.2.8.

Other support rooms will include disposal rooms and cleaner's rooms. These may be shared with an adjacent department depending on the size of the Unit.

2.4.5 Staff Areas – Office Space and Amenities

Depending on the size and location of the Unit, and collocation with adjoining units, staff will need access to:

- meeting rooms to support a range of staff activities including management meetings, education and research
- office space in accordance with staff establishment and teaching / research roles. Ideally, core staff such as the medical director, chief radiographer, nursing unit manager, clerical supervisor and medical imaging technologist supervisor are located in close proximity so that management of the Unit can be effectively coordinated, and
- staff amenities including staff room, toilets, change rooms and lockers. Lockers should be located in a secure staff area.

Access to a large meeting or conference room may be required in larger departments for multidisciplinary case conferences. The rooms should include access to PACS, pathology slide viewing and teleradiology.

Staff work areas will be provided in line with local jurisdictional policies and accreditation requirements.

2.5 FUNCTIONAL RELATIONSHIPS

2.5.1 External

The Medical Imaging Unit will typically have functional relationships with other services including:

- direct access to the emergency department
- ready access to ambulatory care clinics, particularly orthopaedic and surgical clinics,
- easy access, via horizontal or vertical links to:
    - ICU / CCU
    - acute inpatient units
    - radiation oncology / nuclear medicine where applicable
    - pathology, and
    - public arrival points.

The location of the unit must support these priority functional relationships, whilst also ensuring that the unit does not become a thoroughfare for accessing other departments.

2.5.2 Internal

Planning a Medical Imaging Unit will be more complex as the size and scale of the service increases. In small hospitals, services may be limited with only X-ray and ultrasound services provided. In this example, most support space will be shared with an adjacent service, e.g. emergency department.

In larger units, the entry, reception and waiting area will feed into sub-wait areas where patients will change and prepare for examinations. These areas will not be visible from reception.

Examination and procedural imaging rooms will be grouped by modality with their specific support areas immediately adjacent. Much of the clinical support areas will be shared between modalities, depending on utilisation and functional relationship requirements, e.g. utilities, linen bays, toilets, holding bays and reporting areas. All imaging rooms will have ready access to the patient holding / recovery area.

Staff offices, and a central reporting area, should be located away from areas of high clinical activity in staff-only areas. Proximal access from the staff office areas to the clinical unit is essential to ensure appropriate staff support. Staff amenities will be used by all staff, but change facilities are most likely to be accessed by staff involved in procedural imaging. The staff room will ideally be provided in a staff-only area of the Unit.

The operating hours of modalities must be considered and the unit zoned accordingly. Position 24-hour modalities so that staff are not working in isolation or traversing unoccupied areas at night. The positioning of modalities should also optimise the capacity for staff to observe and assist each other. The zoning of the unit will also require consideration of any shared facilities with other units.

03 DESIGN

3.1 ACCESS

Provide only one point of access to the Unit for outpatients and visitors. Entry and waiting areas will be overseen by reception staff.

There should be separate discrete entry for patients being transferred to the service on beds or trolleys from clinical departments within the hospital and the ambulance / hospital transport service to stream flows. This entry may also serve as a dedicated staff entry and facilitate the movement of supplies and waste.

Future replacement of major medical equipment will also need to be considered during planning.

3.2 PARKING

Visitors will use public car parks with access to drop-off and accessible car spaces.

Emergency and other patient transport vehicles will use dedicated hospital bays for these vehicles.

Mobile imaging vans, where provided, will require dedicated parking with access to power, and appropriate security, particularly where imaging equipment needs to remain within the van.

Access to parking for vendors and technicians should also be considered.

For staff parking, refer to AusHFG Part C, Section 6.0 for further information.

3.3 DISASTER PLANNING

The impact on the Medical Imaging Unit will need to be understood as part of broader disaster planning for the health service in line with local jurisdictional policies. Systems to support major medical equipment continuity in the event of interruption to the supply of power is detailed in Section 3.10.6.

Refer to Part B Clause 80 and Part C of these Guidelines for further information.

3.4 INFECTION PREVENTION AND CONTROL

3.4.1 General

Provide access to basins and alcohol-based hand rub and alcohol-based wipes in all imaging rooms and clinical support areas.

Cleaning between examinations may be required in some circumstances.

Refer to:

- AusHFG Part D Infection Prevention and Control
- relevant jurisdictional policies and guidelines
- Section 2.3.5, and
- AusHFG Pandemic Preparedness – Health Infrastructure Planning and Design Guidance.

3.5 ENVIRONMENTAL CONSIDERATIONS

3.5.1 Acoustics

Ensure acoustic privacy of all imaging rooms and spaces where patient information is discussed, e.g. reception, interview and consult rooms. Reporting rooms need to be located and designed so that the environment is suitable for work that requires a high level of concentration and acoustic treatment to ensure quality voice recordings where dictation is used.

Consideration needs to be given to noise generated from CT computer equipment / servers. Refer to Section 4.2.10 for further information.

MRI rooms generate noise, estimated in excess of 100 dBA at the room boundary. This noise travels to nearby spaces through airborne and structure-borne transmission paths so the design and construction should address these transmission routes to manage the impact of noise on adjacent spaces.

The installation of sound systems in MRI rooms may be considered to play soothing, calm music to regulate patient mood and anxiety. For further advice on integrating music-based acoustic experiences from early planning, refer to the AusHFG Arts in Health Framework.

3.5.2 Natural Light

Although imaging rooms are usually windowless, natural light should be provided wherever possible as it contributes to a sense of wellbeing for both patients and staff. Selected rooms and spaces need to be able to control / limit natural light including reporting and ultrasound rooms.

Access to natural light in staff rooms and office areas is also desirable.

Where windows are provided in imaging rooms, they should be fitted with operator controlled screening and be radiation / RF (electromagnetic) shielded where necessary. This is a more costly solution than a solid wall.

3.5.3 Temperature and Humidity

The control of heat and humidity is critical in equipment / computer areas. In addition, the performance of equipment such as CT is temperature dependent. As the heat load for equipment is high, provision of individual heat sensors for these spaces can assist with room temperature regulation. Given the large diversity of heat output from imaging equipment, individual room temperature control may be required.

Rooms containing large numbers of computers, e.g. reporting rooms, may also generate significant heat loads which need to be managed to ensure that the conditions support the work being undertaken.

Refer to manufacturer’s specifications for technological requirements of equipment. Also consider patient comfort, particularly if uncovered during an examination.

3.5.4 Privacy

Facility design should ensure that patients who have changed for an examination, are not on public view.

3.5.5 Interior Decor

Where possible a sterile clinical environment should be avoided. The emotional wellbeing of children within the Unit is an important consideration and the use of colour, artwork, furnishings or other features targeted at this group can provide distraction. The use of backlighting in MRI rooms can provide a useful distraction.

Arts integration can support a range of wellbeing initiatives for staff and patients to mitigate anxiety and acute stress for improved clinical outcomes.

The below areas should be considered as a priority for arts integration:

- Reception and waiting areas
- Patient holding and recovery areas
- MRI rooms
- Mammography rooms.

Options could include:

- Virtual skylights and windows
- Scanner skins
- Wall and floor wraps
- Ambient and mood lighting
- VR and AR technology
- Music
- Projections.

For further advice on initiating the arts integration process from early planning, refer to the AusHFG Arts in Health Framework.

3.5.6 Wayfinding

All signage should be easily understood by visitors and staff and where appropriate, languages other than English, including local Indigenous languages, should also be used.

Appropriate wayfinding language should be informed through consultation with representatives from the local Indigenous community and other cultural groups.

Any signposting, or other initiatives put in place, should be considered from the perspective of out-of-hours use. Certain access points may be locked out-of-office hours or after visiting hours. Directions indicated through signposting should therefore be evaluated in this context.

Signage related to radiation safety is detailed in Section 3.6.5.

Refer to:

- AusHFG Part C, Section 5.0 Wayfinding, and
- NSW Health Infrastructure, Wayfinding for Healthcare Facilities.

3.6 SPACE STANDARDS AND COMPONENTS

3.6.1 Room Sizes and Configuration

Imaging rooms should be sized and proportioned to suit the equipment to be installed, to provide a safe working environment and to allow for effective movement of staff and patients.

Since technology changes frequently and from manufacturer to manufacturer, rooms should be sized to allow upgrading of equipment in the future, particularly if existing equipment is to be transferred in the first instance.

Within an acute hospital environment, all rooms should enable bed / trolley access so that flexible room use is possible.

3.6.2 Human Engineering

Human engineering covers those aspects of design that permit effective, appropriate, safe and dignified use by all people, including those with disabilities. It includes occupational ergonomics, which aims to fit the work practices, FF&E and work environment to the physical and cognitive capabilities of all persons using the building.

Refer to AusHFG Part C – Section 04 – Human Engineering in addition to WHS related guidelines.

3.6.3 Ergonomics

Design and build in such a way that patients, staff, visitors and maintenance personnel are not exposed to avoidable risks of injury. For example, some ultrasound rooms will include ceiling mounted arm slings for sonographers to reduce fatigue.

Consideration should be given to height adjustable workstations and monitor arms in control rooms and reporting rooms.

Refer to AusHFG Part C Section 04 Human Engineering for more details.

3.6.4 Access and Mobility

A medical imaging department will manage a wide range of patients and many will present on a bed, in a wheelchair or using a mobility aid. Circulation corridors in large and busy departments will need to accommodate two beds passing.

Corridors and doors leading into imaging rooms will need to be considered so that beds can be moved easily in and out of each room and tight turns are avoided. Where imaging rooms require access by patients on beds, double doors are preferred.

Staff will also need access to hoists and other manual handling equipment to manage the transfer of patients from beds etc. to medical imaging tables.

Where necessary, ensure that design complies with AS 1428 – Design for Access and Mobility.

Refer to Part C – Design for Access, Mobility, Safety and Security - Section 03 for details.

3.6.5 Building Elements

Building elements include walls, floors, ceilings, doors, windows and corridors and are addressed in detail in AusHFG Part C.

Strategies for the replacement of MRI will be needed, typically through a removable external wall.

Additional structural support will be needed in X-ray rooms with a wall mounted bucky. Noggins will be required for hooks if lead aprons are stored in this way. Ceilings in selected rooms will have ceiling mounted injectors for contrast media and will require structural support.

3.6.6 Radiation Shielding

Refer to Section 3.7.4

3.7 SAFETY AND SECURITY

3.7.1 General

Consideration of safety and security risks should begin during the planning and design phase of a healthcare facility to eliminate or minimise adverse outcomes.

3.7.2 Safety

Enhance safety through design, the methods of construction and use of materials, and also through choice of fittings, fixtures and equipment. Consider the following specific safety issues:

- exposure to radiation and other chemicals
- manual handling such as the transfer of patients from trolley to table
- appropriate staff oversight of patients located in holding / recovery areas
- staff working in isolation, especially after hours, and
- risks associated with the MRI magnetic field. Controlled access to the suite will be needed (refer to Appendix 5.3). The RANZCR MRI Safety Guidelines (Version 3.0, 2021) currently advises that a contour of 0.5mT (5g, 'the 5 gauss line') must be provided to define the perimeter for pacemaker safety. This area should usually be confined to the scan room. The project team should refer to current RANZCR advice given proposed changes to adopt a 0.9mT line as the hazard area in response to updates to the international standards to reflect more modern pacemaker limits. Demarcation of the 30g (3mT) line may be helpful for interventional and intraoperative MRI, and MRIs used for radiotherapy planning. Advice should be sought from the relevant radiation regulatory authority to ensure the physical design is satisfactory.

Signage is an important consideration and should comply with:

- AS 1319 Safety signage for occupational environments
- Section 3.1.18 of ARPANSA Radiation Protection Series No. 14 Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation (2008), and
- requirements outlined by jurisdictional regulators which are listed in the appendices.

Locate illuminated warning lights outside all imaging rooms. The local radiation regulator will be able to advise if these are required to be automatically activated.

Consider installing ceiling-mounted lifters in rooms dealing with non-ambulant patients.

Refer to local WHS legislation and Part C for further information.

3.7.3 Security

Enhance security by incorporating the principles of territorial reinforcement, surveillance, space management and access control into design decisions. The specific security issues that should be considered include:

- access control particularly after-hours
- risk assessment of specific locations to ensure that staff working at receptions and staff work points are not at risk from entrapment
- duress points at reception and staff stations, and
- the management of patient property during examinations.

3.7.4 Radiation Safety and Protection

Rooms that contain or are proposed to contain medical imaging (ionising) equipment will almost always require radiation shielding. Radiation shielding will be required to any room within the Unit where fixed imaging equipment is used but may also be required in rooms with a predicted high use of mobile X-ray apparatus.

The requirements of the relevant radiation regulatory authority must be considered, and approval may be required prior to construction of the premises, or the installation of equipment. Plans and specifications should be assessed by a suitably qualified expert, e.g. a medical physicist or radiation protection expert, and consideration given to the proposed workload of the department. The resulting radiation protection assessment specifies the type, location and amount of radiation shielding required according to final equipment selection, planned workload, occupancy of surrounding areas and layout.

Doors, internal viewing windows, door viewing panels, and external windows where people may be passing, i.e. ground floor locations, must be protected to the same standard as the wall in which they sit, and tagged with the lead equivalence. The assessment will also specify the height above finished floor level to which the shielding must extend. This will vary depending on the modality in line with expert advice. Consideration must be given to the protection of staff, patients and others in the surrounding areas.

The relevant regulatory authority is likely to mandate the installation of radiation warning signs and shielding tagging at every entry point to rooms requiring radiation protection. Many apparatus types will require the installation of illuminated warning signs that automatically illuminate and deluminate with the operation of the apparatus.

A suitably qualified expert will be required to provide advice regards to suitable construction methods and materials, with special consideration given to shielding of wall penetrations and the stability of any barriers over time. Where protection is specified, this may be provided on either side of the barrier.

Radiation shielding requirements should be incorporated into the final specifications and building plans.

For further information please refer to the relevant regulatory authority (see Appendix 5.4), and Radiation Protection Series Publication No 14.1 Safety Guide for Radiation Protection in Diagnostic and Interventional Radiology, Section 10 Site Requirements.

3.8 FINISHES

3.8.1 General

Finishes in this context refers to walls, floors, windows and ceilings.

Refer to Part C Section 03 Amenity, Safety and Design Tolerances.

3.8.2 Wall Protection

Ensure that intra-departmental corridors have protection to the lower part of the walls to minimise what can be considerable damage from trolleys. Entry doors to examination rooms will also require door protection.

3.8.3 Ceilings

Metal framing system at the ceiling line, such as a unistrut system, are typically used where ceiling mounted equipment is installed to promote future flexibility. Access to ceiling space is important.

3.8.4 Floor Finishes

Select floor finishes will be required to mitigate manual handling issues including the impact of the flooring on push / pull forces of wheeled equipment.

Select flooring finishes that mitigate potential slips and trips, including those that may result from joints.

Antistatic floor finishes will be required within the MRI scanning room.

3.9 FIXTURES, FITTINGS & EQUIPMENT

3.9.1 General Requirements

Room Data and Room Layout Sheets in the AusHFGs define fixtures, fittings and equipment (FFE). Refer to the Room Data Sheets (RDS) and Room Layout Sheets (RLS) and AusHFG Part C: Section 03 Amenity, Safety and Design Tolerances.

3.9.2 Specific Requirements for Major Medical Equipment

Some special considerations within the Medical Imaging Unit are detailed below.

Pressure Injectors used in CT, MRI and Fluoroscopy

These injectors, either single or dual barrelled, are used to inject contrast into patients during selected procedures. While these injectors have traditionally been provided on a trolley and wheeled into the room, increasingly, this equipment is ceiling mounted on a pendant (with exception of MRI). Often the solution will be vendor dependant so further information will be needed to document the final requirements. For example, set ups may vary to be:

- provided on a mobile trolley
- ceiling mounted in a self-contained system within a pendant, or
- ceiling mounted on a pendant connected to the control room via a cable.

CT- Fluoroscopy

This equipment, used at selected sites, is attached to a CT and enables the radiologist to perform difficult interventional procedures with more accuracy. The equipment includes a display screen and trigger handle. Options for provision of this equipment include:

- a cart that is wheeled into the CT room
- ceiling mounted, or
- ceiling mounting of the display screen with the trigger provided on the cart.

Given the trend of ceiling mounted equipment within selected rooms, coordination is needed as there may be a CT room with ceiling mounted equipment including a procedure light, pressure injector, display screen and trigger handle.

MRI Room

RANZCR (2017) MRI Safety Guidelines recommend the establishment of a zoning system to provide a ‘buffer’ around the imaging room which is free of potentially hazardous metal objects, and to support access restriction policies. Refer to Appendix 5.3.

General X-ray rooms

As the fixed machines are becoming larger and heavier in terms of tube stands, vertical and horizontal auto tracking should be considered when specifying equipment requirements.

DR Detectors

When purchasing detectors, consider specifying the same vendor so they can be used interchangeably between modalities for efficient use.

Ultrasound rooms

Those Units with a large maternity workload should include a slave display screen so that the parents can see their baby. This will include a mounting pole, power and video to be provided within the ceiling.

3.10 BUILDING SERVICE REQUIREMENTS

3.10.1 General

Each piece of imaging equipment has specifications for optimal installation advised by the manufacturer. These specifications should be reviewed for each equipment item selected to ensure the general building services requirements support optimal installation.

In addition to the information below, refer to local jurisdictional guidelines relating to engineering services.

3.10.2 Construction

Considerations include:

- door entry width and height, and corridor widths to enable the removal of old equipment and the delivery and installation of new equipment in the future
- weight of shielded doors
- floor structures to meet load requirements for equipment, wall shielding, patients and staff
- above ceiling space requirements given the quantity of equipment to be accommodated. This includes air conditioning, vents, cable runs, plumbing and unistrut for X-ray gantries
- ensure ceiling heights suit the equipment (a minimum of 3000 mm) for ceiling tube mount installations
- conduits are not laid in the vicinity of expected core holes as some equipment is vibration sensitive
- provision of core holes, cable trays, ducts or conduits in floors, walls and ceilings as required for equipment installation
- provide properly designed, rigid support structures located above the finished ceiling for ceiling mounted equipment needs
- ensure the range of movement for ceiling suspended X-ray tubes is sufficient to cover patients on mobile trolleys
- consider a metal framing system such as unistrut or equivalent for ease of installation, service and remodelling
- ensure that the ceiling lighting and air supply systems are coordinated with ceiling mounted equipment and metal framing systems
- early consideration of wall mounted equipment and items (especially recessed items) on shielded walls
- ensure the air-handling system is able to manage the heat loads of the equipment being installed
- cooling system requirements for equipment such as CT, e.g. air cooled or water cooled, and suitable water quality, and
- provision of stud / service walls for hydraulic fixture water services and drainage systems rough-in pipework i.e., basins to eliminate impacts on shielding systems.

MRI

- location of the MRI as the equipment is sensitive to radio frequency and can be easily affected by factors such as vibration and moving ferrous objects e.g. lifts, cars
- acoustic mitigation strategies to manage noise transmission from MRI rooms to adjacent spaces
- no go ceiling zones for MRI scanners, e.g. hydraulics above MRIs from the floor above may create issues
- MRI venting / exhaust requirements and location, and
- thickness of RF shielded walls and window locations.

3.10.3 Radiation Protection

Refer to Section 3.7.4.

3.10.4 Air Handling Systems

Air handling in Medical Imaging Units is extremely important as:

- major medical imaging equipment can be heat and humidity sensitive, e.g. CT, MRI. Imaging rooms need to be maintained within a temperature and humidity range and monitored via sensors so that equipment performance is maintained, and
- heat loads generated by computer rooms (plant), reporting rooms and control rooms can be significant and air handling systems will ensure that equipment continues to function and staff are working in a comfortable environment.

Chillers are required to support selected medical imaging equipment such as MRI and in some cases CT. It is recommended that separate plant is considered to supply this equipment so that interruptions to the main system do not affect service provision, e.g. fire alarms.

Careful consideration must be given to return air arrangements, and the direction of airflows to ensure that temperature distribution is uniform in rooms accommodating heat sensitive equipment and meets the specified requirements.

Quenching refers to the events that occur when the liquid cryogens that cool the MRI magnet coils boil off rapidly, which results in helium escaping very rapidly. The scanner must be vented directly and safely into the atmosphere. The quench pipe, including external vent / exhaust location will require consideration in the design. The design must consider potential quench pipe failure and room pressurisation release to enable door opening. An escape hatch will be required where an MRI room has an inwards opening door. Oxygen depletion sensors should be considered in areas with cryogen services, such as the MRI suite.

3.10.5 Call Systems

Call system information is included in the AusHFG standard components. Additional considerations include:

- identifying who will respond to calls. Smaller departments will not have a nursing workforce provided so radiographers will instead need to respond
- nurse call located in or near change cubicles
- locating staff assist and emergency call buttons within imaging rooms to ensure that they can be easily reached by staff, and
- a call button / intercom system at reception or Unit entry for occasions when reception is unattended.

Locate annunciator panels in corridors for optimum viewing.

3.10.6 Electrical Services

Provide three phase power for X-ray generating rooms for specific equipment needs.

All patient areas within the Medical Imaging Unit will require body protection, assuming no cardiac interventional procedures are undertaken in interventional radiology rooms.

For large hospitals, with two or more substations, imaging services may be supported by different substations with backup support from separate main generator switchboard(s) to address continuity of services under disaster or emergency conditions. Requirements will be guided by jurisdictional engineering services guidelines and local disaster management plans.

Stand-by power will be needed to support all fixed imaging equipment and other selected infrastructure, e.g. lighting, selected computers. Many modalities will also require UPS including general X-ray, fluoroscopy, CT, MRI, imaging workstations and interventional radiology.

UPS is provided to ensure that data is not lost and in the case of interventional radiology services, to ensure the procedure can continue so that patient safety is not compromised. Interventional radiology equipment will require sufficient capacity to allow catheters to be withdrawn and / or procedures to be completed.

Computer rooms will include UPS which will have minimum KVA requirements. The UPS in most cases is provided not to keep the machine operating but so that data is not lost. The power requirements will be dependent on the modality.

Many staff in Medical Imaging Units, such as radiologists and radiographers, utilise multiple computers and monitors. Standard office arrangements for power and data will need to be enhanced to support this work practice.

For detailed information refer to relevant jurisdictional engineering services guidelines. NSW Health Engineering Services Guideline describes UPS and stand-by power requirements for all major medical imaging equipment and associated engineering plant.

3.10.7 Lighting

Dimmable lighting is required in all imaging and reporting rooms. Lighting should be designed so that it does not obstruct ceiling-mounted tube stands.

The provision of task lighting is not generally supported as it can produce glare on monitors.

3.10.8 Information Technology and Communications

Systems may include:

- wireless technology throughout the Unit
- PACS / RIS
- dictation system for reporting and / or voice recognition system
- high speed network for digital and CR equipment
- remote reporting capability
- critical results management distribution systems software
- videoconferencing capacity / teleradiology
- intercom / communication systems
- patient administration systems (PAS)
- RIS ideally linked to the PAS and billing systems, and
- electronic medical records.

Digital images will meet the requirements outlined in ATS 5816_2013, Digital Images for Diagnostic and Other Clinical Purposes: Presentation, Communication, Display and Manipulation (Standards Australia). This document also provides information on display screen specifications (Appendix B) for a range of purposes, e.g. primary diagnostic and basic image viewing.

Selected vendors will have constraints that will affect physical design. For example, cable lengths that connect the CT to equipment such as the transformer and communications box (system cabinet) located within the CT Computer Room are restricted to a limited cable run (although in some cases, transformers are located within the imaging room). Typical considerations include:

- X-ray – system cabinet typically located within the X-ray room
- CT - system cabinet can be located within the imaging room or in a dedicated computer room. Cable length restrictions and the heat load need to be considered
- angiography - system cabinet can be located within the imaging room or in a dedicated computer room. Cable lengths restrictions and the heat load need to be considered
- fluoroscopy - system cabinet can be located within the imaging room or in a dedicated computer room. Cable lengths restrictions and the heat load need to be considered, and
- MRI - system cabinet located in a dedicated computer room.

Patient observation cameras are used in selected situations in a Medical Imaging unit, e.g. when monitoring patients within the CT or MRI machine bore. The clinical function needs to be understood so that the camera quality is fit for purpose and should not be confused with CCTV used for security purposes.

3.10.9 Radiology Information Systems

A Radiology Information System (RIS) is a computerised database used by medical imaging units to store, manipulate and distribute patient data. The system may include patient tracking and scheduling, result reporting, image tracking and financial information.

RIS complements Hospital Information Systems (HIS) and is critical for efficient radiology practices. It can also store scanned documents such as request forms and images from other disciplines, e.g. gastroenterology. There are several models of image storage including:

- local PACS and RIS with provision of a server room, local storage and administrator
- hub and spoke model with the hub site specifically located to provide redundant access to spoke sites, supported by a large data facility managed by IT
- state hub and extensive state-wide spoke sites, and
- access to a state-wide or National Archive.

3.10.10 Medical Gases

Medical gas information is contained in the standard components. Additional considerations include:

- locating the medical services panels so that they can be easily accessed by staff and the patient when ‘in position’
- medical air, nitrous oxide (if used, see below) and scavenging in all rooms where general anaesthesia is delivered, (such as CT, MRI, fluoroscopy and interventional radiology)
- carbon dioxide may be needed where insufflation is required during CT procedures
- a medical gas alarm system within the Unit to alert staff to diminished capacity or potential failure which will be located so that staff can observe frequently. These will typically be located in the control room, where provided, given staff will typically be located here while patients are present, and

- an MRI warning label fixed to all portable ferrous oxygen cylinders.

The use of nitrous oxide in operating theatres, procedural suites and emergency departments is declining due to a range of clinical and environmental concerns. Reticulated systems have been found to increase leakage of nitrous oxide (a potent greenhouse gas) to atmosphere, can increase facility operating costs and potentially expose staff to nitrous oxide.

Reticulated nitrous oxide and associated scavenge outlets are not mandatory for any healthcare service and point of care cylinders can meet clinical requirements for the majority of healthcare facilities.

Where found to be clinically necessary, the provision of nitrous oxide via piped outlets or via cylinder is to be determined at a project level, based on an assessment of expected clinical need and associated risk assessment, particularly for services with high utilisation such as birthing suites. Birthing suites may have a dedicated reticulated nitrous oxide system, whilst the rest of a facility is supplied by point of care cylinders. The associated cost impacts should be considered including the storage and management of cylinders.

Due consideration must be given to a range of operational considerations including:

- monitoring and measurement of usage
- management of leakage
- Work Health and Safety (WHS) requirements relating to the use of cylinders
- approach to the provision of scavenge where cylinders are used
- appropriate storage for cylinders, and
- security of gas sources given it is used as a recreational drug.

3.10.11 Hydraulic Services

It is recommended that drainage systems are not installed within the ceiling of medical imaging rooms containing sensitive equipment as defined by the project team. Where overhead drainage discharge pipework is unavoidable, special provisions should be made to protect the space below from leakage, which may include, drip trays with leak detection linked back to the building monitoring and control system.

Careful consideration shall be given to the selection of materials used in the hydraulic systems that are suitable for any non-standard requirements that may exist.

3.10.12 Fire Protection Services

Considerations include:

- Where the unique requirements of a medical imaging room / suite require departures from the deemed to satisfy requirements of the relevant fire protection standards they shall be addressed in a performance solution developed by a fire safety engineer (consultation to be undertaken with key stakeholders including the local fire brigade);
- MRI rooms must be designed to suit the operational requirements of the facility:
    - Where fire sprinklers are provided the sprinklers shall be designed and tested for use in an MRI environment.
    - Where fire sprinklers are provided the sprinkler pipework and equipment shall be non-ferrous and suitable for use in an MRI environment (e.g. CPVC). Pipes should be empty as water can become a signal tracker.
    - Smoke detection shall be multi-aspirated smoke detection with the sampling unit located outside of the shielded room.

- Removal of speakers and strobes from the MRI room to avoid disruption or in accordance with the operational requirements of the facility.

04 COMPONENTS OF THE UNIT

4.1 STANDARD COMPONENTS

Rooms / spaces are defined as:

- *standard components* (SC) which refer to rooms / spaces for which room data sheets, room layout sheets (drawings) and textual description have been developed
- *standard components – derived rooms (SC-D)* are rooms, based on a SC but they vary in size. In these instances, the standard component will form the broad room 'brief' and room size and contents will be scaled to meet the service requirement, and
- *non-standard components* which are unique rooms that are usually service-specific.

The standard component types are listed in the attached Schedule of Accommodation.

The current Standard Components can be found at:
www.healthfacilityguidelines.com.au/standardcomponents

4.2 NON-STANDARD COMPONENTS

4.2.1 Trolley / Wheelchair Park

Description and Function
An open storage area in which patients' wheelchairs and trolleys can be parked without obstructing corridors.

Location and Relationships
Adjacent to the Transport Staff Work base if provided. It should be located centrally to procedure rooms and examination rooms.

Considerations
This bay is not substantially different to a Bay - Wheelchair Park (Standard Component) but has been increased in size to accommodate trolleys which will be used by some inpatients and emergency patients.

4.2.2 Transport / Staff Work Base

Description and Function
This is an optional space. If provided, include linen supply, portable oxygen cylinder storage and bench and sink for wiping down trolleys. A larger space is needed at facilities with a heavy interventional workload. Alternatively, this service might be provided by a central Transport Unit.

Location and Relationships
Adjacent to the Trolley / Wheelchair Park. It should be located centrally to procedure rooms and examination rooms.

Considerations
The inclusion of this space is determined by the operational policies of the Unit in relation to patient transport.

4.2.3 Patient Locker Bay

Description and Function
A locker area for secure storage of patient clothes and belongings whilst they are waiting (changed) and undergoing their examination.

Location and Relationships
Locker areas should be adjacent to change cubicles and sub-waiting areas for changed patients.

Considerations
An alternative to patient lockers is provision of baskets that patients use to store their belongings, keeping the baskets with them whilst waiting and being examined. This basket system is not appropriate for MRI patients, who may not bring personal possessions into the examination room.

4.2.4 Radiographer Work Area

Description and Function
The use of this room has changed in recent years given the transition from CR to DR image processing (refer to Section 2.2.4). CR is now outdated technology, however project teams should confirm requirements given existing facilities may still use CR systems and will require appropriate support.

This space will fulfill a range of functions including:

- Recharging of DR detectors (where CR is used this room will be used for processing of phosphor plates (cassettes) to enable viewing on a computer monitor)
- manipulation of DR images
- general access to PC and phones
- allocation of work, and
- meetings including private meetings with students, regulators etc.

Location and Relationships
Locate immediately outside the general radiology rooms ideally with access from each room. A central location to all rooms enables direct support for all staff.

Considerations
Provide temperature control and ventilation.

A number of workstations will be required depending on service requirements. This may include up to one workstation per modality. Mobile radiographers may also be accommodated here.

An electronic patient journey board is typically located in this area, as well as storage for manuals and appropriate communication / intercom systems. Storage for lead aprons may also be provided.

For some services consideration should be given to an appropriate area within this zone to support after hours staff who are unable to leave the unit for breaks.

4.2.5 Ultrasound Reprocessing Room

Description and Function
The ultrasound reprocessing room supports the high level disinfection (HLD) of ultrasound transducers. Refer to Section 2.2.8 for further details.

Some facilities may undertake this process within SSU however the more common approach is to undertake reprocessing within the imaging unit adjacent to the ultrasound area.

Location and Relationships
The ultrasound reprocessing room should be provided within a separate room adjacent to the ultrasound room/s where they are used.

Considerations
The reprocessing room must be designed to support unidirectional dirty to clean workflows.

HLD units are typically located on a bench (although may be floor mounted) and require access to power and data.

A handwash basin and separate sink will be required.

Storage of chemicals must comply with jurisdictional workplace health and safety regulations.

4.2.6 3D Post Processing Workstations

Description and Function
A workstation that is used by radiographers to manipulate images for modalities such as interventional radiology, CT and MRI. This work is better done away from the control room so that patient throughput is maximised. A workstation with two or more screens is needed.

Location and Relationships
Provide ready access from the imaging rooms but in a quiet location.

Considerations
Provide temperature control and ventilation.

4.2.7 Bay – Lead Apron

Description and Function
A dedicated space to hang / store lead aprons for use by staff working in examination rooms.

Location and Relationships
The space should be located adjacent to examination rooms.

Considerations
A fixed or mobile unit may be used. Alternatively, aprons are stored within examination rooms.

4.2.8 Sonographer Work Room

Description and Function
The Sonographer Work Room is used by sonographers to review images, discuss clinical issues and attend to administration. It may be used for reporting also, but it is preferable that reporting occurs in a separate, quiet area. Benching is required for workstation viewing.

Location and Relationships
The work room should be located in close proximity to ultrasound rooms.

Considerations
5.5m2 per person is required per viewing workstation, however the minimum size of the room should be 9m2.

4.2.9 Prep Room / Lab

Description and Function
This room provides a limited pathology facility to support mammography services, utilised for the detection of breast cancer, as well as the examination of other biopsy samples generated by ultrasound services. The room may also be used for set up of ultrasound or mammogram interventional procedures. Similar prep rooms or lab rooms may be required to support other interventional imaging services such as Angiography, CT and MRI.

Location and Relationships
This room has direct access to the mammography room and the reporting room. Rooms used to support other modalities will be located in an adjacent area.

Considerations
Provide sufficient bench space for relevant laboratory equipment / microscopes.

4.2.10 Computer Equipment Room

Description and Function
Computer, machine or server rooms are required for PACS, CT, interventional radiology and MRI imaging modalities. CT computer equipment can be included in the CT scanning room as an alternative to a dedicated computer room. A small space increase in the CT scanning room and early heat load evaluation is required to enable this.

Manufacturers' guidelines should be observed in determining the precise fit out requirements for computer rooms.

Location and Relationships
Computer rooms should be located next to the applicable imaging control room.

The PACS server room should be located in a shared support area.

All computer rooms should be easily accessible by the PACS operational / management team for trouble shooting and maintenance purposes.

Considerations
Air conditioning is required to computer / server rooms.

4.2.11 Film / Records Store

Description and Function
A quiet room in which staff may review historical films, review journals, assemble small teaching groups etc. Functional requirements include workstations, computer access, shelving for journals and films, whiteboard etc.

The hard copy storage of film is decreasing significantly and so the provision of this room is noted as optional.

Location and Relationships
This room is located with staff amenities, in a quiet location away from operational activity.

Considerations
The number of staff working in the department should be considered in confirming the room size.

05 APPENDICES

5.1 SCHEDULE OF ACCOMMODATION

A Schedule of Accommodation follows for medical imaging services.

The ‘Room / Space’ column describes each room or space within the Unit. Some rooms are identified as ‘Standard Components’ (SC) or as having a corresponding room which can be derived from a SC. These rooms are described as ‘Standard Components –Derived’ (SC-D).

The ‘SC/SC-D’ column identifies these rooms and relevant room codes and names are provided. In some cases, Room / Spaces are described as ‘Optional' or ‘o’. Inclusion of this Room / Space will be dependent on a range of factors such as operational policies or clinical services planning.

Information to inform planning is included in the Schedule of Accommodation for a:

- main medical imaging department
- IR /INR unit
- emergency department medical imaging satellite unit, and
- ambulatory care medical imaging satellite unit.

The model of care, size and scale of medical imaging services will need to be determined before detailed spatial planning can begin.

The application of the schedule of accommodation below will require confirmation of the type and quantity of modalities required through detailed clinical services planning. In addition, the allocation of reception, staff work areas and staff amenities will be informed by workforce planning.

Information relating to medical imaging required to support surgical and procedural services is contained in HPU 270 Day Surgery / Procedural Unit and HPU 520 Operating Unit.

MAIN IMAGING DEPARTMENT - ENTRY / RECEPTION / CLERICAL

Each department/unit will have central reception and clerical area which may be shared with other departments or units.

Space has not been provided for film storage as it is assumed hard copy images are not a feature of a contemporary medical imaging unit.

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	Qty	m2	REMARKS
WAIT-20	Waiting	Yes	1	20	Area allocation is indicative. Requirements will depend on the relative mix of outpatient vs inpatient services being provided by the imaging unit. 1.2m2 required per seat, 1.5m2 per wheelchair space. Consider collocation of meeting room to used for overflow eg for pandemic preparedness.
BWTR	Bay - Water Fountain	Yes	1	1	With capacity to fill cups or water bottles.
PLAY	Play Area - Paediatric	Yes	1	10	Assumed to be shared with adjacent department for smaller services.
WCAC	Toilet - Accessible	Yes	1	6	Assumed to be shared with adjacent department for smaller services
WCPU	Toilet - Public	Yes		3	Numbers will depend on the size of the unit.
RECP-10	Reception, 10m2	Yes	1	10	Assumes 1 staff member; to be adjusted depending on the staff profile. Must be wheelchair accessible. Locate collocated clerical area to support staff working in reception.
OFF-2P	Office - 2 Person		1	12	For clerical and booking staff and related equipment. Area to be adjusted depending on the staff profile.
CONS	Consult Room	Yes	1	12 (o)	Optional. Typically required for larger services and/or where IR / INR services are provided. Assumed to be shared with adjacent department for smaller services. Additional consult rooms will be required to support outpatient IR/INR services.
INTV	Interview Room	Yes	1	12	Assumed to be shared with adjacent department for smaller services.
BMEQ-4	Bay - Mobile Equipment	Yes	1	4 (o)	Optional. May be required for small services only. For larger services it is assumed that storage bays with power and data are provided close to clinical services where they are used, e.g. ICU.
	Discounted Circulation			25%	

5.1.1 Main Imaging Department Modalities

GENERAL X-RAY AND FLUOROSCOPY

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	1 X-Ray without Fluoro (m2)		1 X-Ray with Fluoro (m2)		2 X-Ray with Fluoro (m2)		4 X-Ray with Fluoro (m2)		REMARKS
			Qty	m2	Qty	m2	Qty	m2	Qty	m2	
GENXR	General X-Ray Room	Yes	1	38	1	38	2	38	4	38	Includes control console space.
OPG	OPG Room			-		19 (o)		19 (o)		19 (o)	Optional. OPG, where provided, may be collocated with another room such as general x-ray. Where high use is anticipated, a separate room may be preferred. Area allocation will accommodate OPG, Lateral Cephalogram and Cone Beam CT with minor adjustments to room design to suit equipment and shielding requirements.
GENXR-OPG	General X-Ray / OPG Room					45 (o)		45 9o)		45 (o)	Optional. Combined modality room
FLUO	Fluoroscopy Room	Yes		-	1	40	1	40	1	40	Given traditional fluoroscopy activity has significantly declined in recent years, most facilities will also incorporate general x-ray within fluoroscopy rooms. This is reflected in AusHFG Standard Component FLUO. Many of these rooms will also be used for interventional work and will require associated support areas - refer to IR/INR SOA for further details.
FLUOC	Fluoroscopy Control Room			-	1	13	1	13	1	13	Attached to Fluoroscopy Room.
BMEQ	Bay - Mobile Equipment	Yes			1	2	1	2	1	2	For accommmodation of barium swallow chair, and other mobile equipment.
ENS-ACC	Ensuite – Accessible	Yes		-	1	7	1	7	1	7	Dual access from Fluoroscopy Room and corridor. Include area for patient to change.
CHPT	Change Cubicle – Patient	Yes		-	1	2	2	2	4	2	One cubicle per imaging room (excluding OPG). Final requirements will depend on patient casemix and volume of inpatients vs outpatients.
CHPT - AC	Change Cubicle – Patient, Accessible	Yes	1	4	1	4	1	4	1	4	
WCPT	Toilet – Patient	Yes	1	4	1	4	1	4	1	4	
BLIN	Bay - Linen	Yes	1	2	1	2	1	2	1	2	
	Bay – Lead Aprons		1	0.5	2	0.5	3	0.5	5	0.5	Storage outside of each imaging room (excluding OPG) for lead apron. Alternatively they can be stored in the room.
	Radiographer Work Area		1	16	1	24	1	30	1	36	Centrally located radiography work hub with workstations (dual monitors), storage for manuals and detectors, and area for coordination of workflow, clinical discussions / teaching wih medical, radiography, nursing staff and students. May be an open area / zone however needs to support private conversations away from patients.
PT-HOLD-B	Patient Bay – Holding, Bed	Yes		9 (o)		-					Optional. Include where a separate holding / recovery zone is not provided. Must be in a location for supervision by staff.
DTUR-10	Dirty Utility	Yes	1	10 (o)		-		-		-	Optional. Include where a separate holding / recovery zone is not provided.
	Discounted Circulation			37%		37%		37%		37%	

ULTRASOUND AND MAMMOGRAPHY

A breast assessment service is not included in the schedule of accommodation below, however some of the components listed in the following tables may be used as a starting point.

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	1 US Room (m2)		2 US Rooms (m2)		3 US Rooms + 1 Procedure Room + 1 Mammo (m2)		4 US Rooms + 1 Procedure Room +1 Mammo (m2)		REMARKS
			Qty	m2	Qty	m2	Qty	m2	Qty	m2	
WAIT-S	Waiting - Sub	Yes	1	5	1	8	1	10	1	10	Assumed patients are waiting and are changed. Need to consider location for supervision by staff.
BWTR	Bay - Water Fountain	Yes		Share	1	1	1	1	1	1	
	Patient Locker Bay			-	1	1 (o)	1	1 (o)	1	1 (o)	Optional. Operational process may be for patients to take clothes / possessions with them. Where provided, collocate with changed wait.
ULTR	Ultrasound Room	Yes	1	16	2	16	3	16	4	16	Number of rooms adjusted to suit service plan.
WCPT	Toilet - Patient	Yes					1	4	2	4	Close access to toilets is essential. Some ultrasound rooms will require a dedicated toilet or one toilet may be shared between 2 rooms, depending on case mix and layout. Combined toilet / change areas may be provided. Many patients will change within the ultrasound room assuming provision of privacy curtain.
WCAC	Toilet - Accessible	Yes	1	6	1	6	1	6	1	6	
ULT-PR	Ultrasound Room - Procedures	Yes					1	20	1	20	For interventional procedures. Recovery from ultrasound procedures is recommended to be in the combined holding / nursing recovery area for all interventional imaging procedures.
	Ultrasound Reprocessing Room		1	7	1	7	1	7	1	7	For high level disinfection of ultrasound transducers. Refer to Section 2.2.8 in the HPU for further information.
MAMMO	Mammography Room	Yes		-	1	18 (o)	1	18 (o)	1	18 (o)	Optional. Not all Units offer a mammography service, inclusion will be subject to the service plan. Number or rooms adjusted to suit service plan. Room size supports access for a bed given most hospital mammography rooms are used for procedural services. For screening services only 16m2 is sufficient.
CHPT	Change Cubicle - Patient	Yes	1	2 (o)	1	2 (o)	2	2 (o)	3	2 (o)	Optional. Many patients will change within the modality room assuming appropriate privacy provisions.
CHPT-AC	Change Cubicle - Patient, Accessible	Yes	1	4 (o)	1	4 (o)	1	4 (o)	1	4 (o)	Optional. Total one cubicle per ultrasound room.
BLIN	Bay - Linen	Yes	1	2	1	2	1	2	1	2	
	Sonographer Work Room		1	9		5.5		5.5		5.5	Per person. Benching. Radiography assistants are also typically located in this room.
REPW	Reporting Workstation			Use PACS workstation		6		6		6	No. dependent on expected throughput. As a guide one workstation will likely be required for two-three ultrasound rooms, however additional will be required for training sites. An additional reporting station will be required for mammography.
	Prep Room / Lab			-		-	1	5	1	5	Ready access to mammography and reporting rooms. Provide where procedures are undertaken.
	Discounted Circulation			37%		37%		37%		37%	

CT

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	1 CT Rooms		2 CT Rooms		3 CT Rooms		REMARKS
			Qty	m2	Qty	m2	Qty	m2	
CTIR	CT Imaging Room	Yes	1	45	2	45	3	45	
CTCR	CT Imaging Control Room	Yes	1	16	2	16	3	16	If shared is preferred, refer to space allocation below. A larger control room will be required where the CT is supporting trauma services, depending on the number of staff to be accommodated.
	CT Imaging Control Room - Shared	Yes		-		26 (o)		26 (o)	Optional. A shared control room may be preferred between two rooms in terms of staffing efficiency and patient throughput. This is an alternative to a dedicated room. A larger control room will be required where the CT is supporting trauma services, depending on the number of staff to be accommodated.
OFF-WS	Office - Workstation	Yes		4.5 (o)		4.5 (o)		4.5 (o)	Optional. Additional workstations for workflow control and advanced processing. These may be integrated into the CT control room depending on workflows. Preferred to be included for trauma / stroke.
	CT Computer Equipment Room		1	10 (o)	2	10 (o)	3	10 (o)	Optional. Required if equipment to be stored outside examination room.
SCRB-4	Scrub Up	Yes			1	4 (o)	1	4 (o)	Optional. Where interventional procedures are undertaken. Shared between rooms.
REPR	Reporting Room		1	9		12		12	Additional reporting stations at 6m2 may be required to support routine reporting.
WAIT-S	Waiting - Sub	Yes	1	5 (o)	1	10 (o)	1	12 (o)	Optional. Shared for MRI and CT. Size of waiting area will depend on mix of outpatient and inpatient activity.
CHPT	Change Cubicle - Patient	Yes	1	2	1	2	2	2	One per CT room.
CHPT-AC	Change Cubicle - Patient, Accessible	Yes	1	4	1	4	1	4	One per CT room.
	Patient Locker Bay		1	1	1	1	1	1	Unless patient belongings travel with the patient.
WCAC	Toilet - Accessible	Yes	1	6	1	6	1	6	
PT-HOLD-A	Patient Bay - Holding	Yes	2	6.5	3	6.5	5	6.5	Indicative number. Final number of bays will depend on mix of inpatient vs outpatient activity. Share with other modalities where appropriate.
	Preparation Bay		1	9	2	9	2	9	Indicative number. Space for a chair and storage with a curtain for privacy for inserting cannula if IV contrast is required. Combine with patient bay-holding for flexible use of bays. Contrast administering and check list outside of the room supports higher CT throughput. Some patients require observation eg post contrast and to slow heart down for cardiac scans.
SSTN-10	Staff Station	Yes			1	5	1	8	Assume smaller units will share holding / recovery and associated support areas with other modalities.
BHWS-B	Bay - Handwashing, Type B	Yes	1	1	2	1	2	1	Part of preparation area.
BLIN	Bay - Linen	Yes	1	2	1	2	1	2	
	Prep Room / Lab				1	5 (o)	1	5	To support interventional procedures. Share with MRI.
CLN-10	Clean Store	Yes		Share	1	6	1	6	May be provided as a combined space of 10m2 including medication store depending on local jurisdictional policies. May be shared with other modalities.
MED-14	Medication Room	Yes	1	Share	1	8	1	8	May be provided as a combined space of 10m2 including clean store depending on local jurisdictional policies. May be shared with other modalities.
DTUR-S	Dirty Utility - Sub	Yes	1	8 (o)	1	8 (o)	1	8 (o)	Optional. May be shared with other modalities.
	Discounted Circulation			37%		37%		37%	

MRI

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	1 MRI Rooms		2 MRI Rooms		3 MRI Rooms		REMARKS
			Qty	m2	Qty	m2	Qty	m2	
ANAE-16	Anaesthetic Preparation Room	Yes	1	16 (o)	1	16 (o)	1	16 (o)	Optional. Will also be used to hold patients on beds. May be shared between MRI rooms. Typically only one anaesthetic preparation room required.
MRIR	MRI Room		1	46	2	46	3	46	Storage within the rooms will be needed.
MRICR	MRI Control Room		1	14	2	14	3	14	Must oversee with controlled entry into magnet room. Recommend 25m2 where shared (back to back) between rooms.
	MRI Computer Equipment Room		1	10	2	10	3	10	
REPR	Reporting Room		1	9		12		12	Additional reporting stations at 6m2 may be required to support routine reporting.
BMEQ-4	Bay - Mobile Equipment	Yes	1	3	1	5	1	6	E.g. anaesthetic machine, detachable MRI tables.
WAIT-S	Waiting - Sub	Yes	1	5	1	6	1	8	
CHPT	Change Cubicle - Patient	Yes			1	2	2	2	2 per MRI room including 1 accessible. Combination change cubicle / toilet may be provided.
CHPT - AC	Change Cubicle – Patient, Accessible	Yes	1	4	1	4	1	4	
WCAC	Toilet - Accessible	Yes	1	6	1	6	1	6	
PT-HOLD-B	Patient Bay - Holding	Yes	1	9	2	9	3	9	For holding, preparation and recovery. Number will depend on outpatient vs inpatient mix.
SSTN-10	Staff Station	Yes	1	5	1	5	1	8	
BHWS-B	Bay - Handwashing Type B	Yes	1	1	1	1	2	1	Access from holding and preparation areas.
BLIN	Bay - Linen	Yes	1	2	1	2	1	2	Optional if stand-alone unit. Locate in zone 2 and decant to zones 3/4 as needed. May have shared access to main department.
BRES	Bay - Resuscitation Trolley	Yes	1	1.5	1	1.5	1	1.5	Non-ferrous construction.
	Bay - Patient Property	Yes	1	1	1	1	1	1	Patient Lockers
WCST	Toilet - Staff	Yes	1	3	1	3	1	3	
	Store - Dewar Tank			Remote areas only		Remote areas only		Remote areas only	
	Discounted Circulation			37%		37%		37%	

MAIN IMAGING DEPARTMENT - PATIENT HOLDING / RECOVERY

It is assumed that a centre with a limited range of services, such as a small rural facility, will not require a dedicated patient holding / recovery zone given the smaller range of modalities. For these services refer to the schedules of accommodation by modality above.

The number of holding / recovery bays requires careful consideration given insufficient capacity will create bottlenecks within the unit.

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	Qty	m2	REMARKS
PT-HOLD-B	Patient Bay - Holding	Yes		9	Assume five patient holding / recovery bays per interventional room are required (as per separate IR/INR SOA). This will depend on anticipated casemix and anaesthetic requirements. In larger services, these may be collocated with the modality if distances are an issue. Where possible, generally configured as a single area to maximise staff efficiencies. MRI patient holding / recovery bays however are excluded and are instead located in the MRI suite – MRI Induction / Preparation / Recovery Room Bays should have direct observation from a staff station. They may be used for preparation also.
SSTN-10	Staff Station	Yes	1	10	Area required will depend on number of bays allocated.
WCPT	Toilet - Patient	Yes		4	No. to suit capacity of unit.
BHWS-B	Bay - Handwashing, Type B			1	No. to suit capacity of unit. Refer to Part D.
CLN-10	Clean Store	Yes	1	6	Area requirements will depend on the size of the unit. May be combined with the medication room depending on local jurisdictional policies.
MED-14	Medication Room	Yes	1	8	Area requirements will depend on the size of the unit. May be combined with the clean store depending on local jurisdictional policies.
BMEQ	Bay - Mobile Equipment	Yes		4	Number will depend on the size of the unit.
BLIN	Bay - Linen	Yes		2	Number will depend on the size of the unit.
BBW	Bay - Blanket / Fluid Warmer	Yes		1	Number will depend on the size of the unit.
BBEV	Bay - Beverage	Yes	1	4	
BRES	Bay - Resuscitation Trolley	Yes	1	1.5	Additional bays may be required depending on the size of the unit.
DTUR-S	Dirty Utility - Sub	Yes	1	10	Share with adjacent modality areas. Area requirement will depend on size of the unit.
	Discounted Circulation			37%	

MAIN IMAGING DEPARTMENT - CLINICAL SUPPORT AREAS

Note: A dedicated server room for a PACS server has been not been included as it is assumed that either a site or decentralised solution is adopted. If a departmental server is included, adequate space should be allowed in engineering / plant allocation.

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	Qty	m2	REMARKS
BMEQ	Bay - Mobile Equipment	Yes		4	Various equipment, including bed mover. Patient transport services model to be confirmed, may be based within department or centralised within hospital. Bays accommodating mobile imaging units will require access to power and data. Number will depend on size of unit.
	Trolley / Wheelchair Park			6	Smaller area required if porter service provided by central Transport Unit. Charging needed. Area requirement will depend on size of unit.
	Transport Staff Work Base			4 (o)	Optional. Not required if porter service provided by central Transport Unit. Ideally collocated with nursing staff base. Area requirement will depend on size of unit.
CLRM	Cleaner's Room	Yes		5	
STGN	Store - General	Yes		9	For accommodation of consumables such as contrast media. For a unit with a small number of modalities 9m2 is recommended. For a large, tertiary service up to 30m2 may be required.
STEQ-14	Store - Equipment	Yes		9	For a unit with a small number of modalities 9m2 is recommended. For a large, tertiary service up to 20m2 may be required. Used for storage of items that are required in modality rooms on an ad hoc basis, eg stands for weight bearing imaging, stitching equipment, patient hoist, mobile x-ray units, chairs for modified swallows etc. Area requirements will depend on range of equipment to be accommodated.
	Equipment Workshop			16 (o)	Optional. For testing and maintenance of mobile imaging modalities on large units where there is sufficient activity and staff to support a dedicated space. Requires shielding assessment. Transfer pathway to ORs and ICU to be considered for servicing of mobile imaging equipment.
	Physics Laboratory			14 (o)	Optional. For large units only, depending on activity and staff profile. Includes work space and storage.
DISP-8	Disposal Room	Yes		8	Area requirement will depend on size of unit.
	Discounted Circulation			37%	

MAIN IMAGING DEPARTMENT - STAFF WORK AREAS

The planning of staff work areas should be based on the future staff establishment and jurisdictional policies relating to office space. Impacts of research will also need to be considered.

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	Qty	m2	REMARKS
OFF-1P-12	Office - 1 Person, 12m2	Yes		12	Requirement will depend on staff profile.
OFF-1P-9	Office -1 Person, 9m2	Yes		9	Requirement will depend on staff profile. Number will depend on staff profile. Consider the location of offices given some roles will need to be located in close proximity to the clinical area.
OFF-WS	Office - Workstation	Yes		5.5	3D post processing activities. Associated with CT and MRI. Number to suit number of staff dedicated to this activity. Typically require 2 monitors per workstation. Distribution will depend on local requirements. Larger services will likely have central 3D post processing room in addition to workstations located with modalities.
REPW	Reporting Workstation	Yes		6	Number of spaces to suit activity. For example, two reporting stations may be needed to support the activity generated by a CT. Consider height adjustable desks for standing reporting.
OFF-WS	Office - Workstation	Yes		4.5	Number of spaces as per staff establishment. Staff may include registrars, administration and transcription staff, PACS / IT administration etc.
	Film / Record Store		1	15 (o)	Optional, film libraries are reducing given transition to digital images. Units with high volume paediatrics may still require this given length of record keeping required.
BMFD-3	Bay - Multifunction Device	Yes	1	3	Area requirement will depend on size of department.
MEET- L-20	Meeting Room	Yes	1	20	Number will depend on size of unit. May be shared with adjacent service. Consider RANZCR accreditation requirements to support training programs.
MEET-L-30	Meeting Room	Yes	1	30 (o)	Optional. Access to a large meeting / conference room for multidisciplinary case conferences may be required in larger facilities.
STGN	Store - General	Yes	1	8	Area requirement will depend on size of unit.
	Discounted Circulation			25%	

MAIN IMAGING DEPARTMENT - STAFF AMENITIES

Planning for staff amenities should be based on the future staff establishment.

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	Qty	m2	REMARKS
SRM-15	Staff Room	Yes		15	Area requirement will depend on the staff establishment. Refer to standard components for capacity requirements. Shared staff room for small units. Depending on the size of service, additional beverage bays may be needed to support staff near to where they work.
BPROP	Bay - Property, Staff	Yes		2	Estimate only. Numbers dependent on staff establishment and local policies.
SHST	Shower - Staff	Yes		3 (o)	Optional. Numbers dependent on staff establishment.
WCST	Toilet - Staff	Yes		3	Number will suit FTE and be located in staff areas but also close to examination rooms.
CHST-10	Change Room - Staff	Yes	1	20	Required for facilities with high interventional workload. May support interventional radiology, CT, MRI. Will include showers and WCs. Area requirement will depend on the staff establishment. Male / female allocations to be determined a project level with consideration of all gender facilities.
	Discounted Circulation			25%	

5.1.2 Interventional Radiology and Interventional Neuroradiology

In line with Section 2.1.5, the area requirements for IR and INR will depend on the range of modalities provided (as informed by the types of procedures and volume and activity) and the service delivery model. IR and INR facilities may be provided as part of a Medical Imaging Unit, within a separate, dedicated IR / INR unit, and / or selected services may be provided within operating suites. The service model must be developed in consultation with Medical Imaging services and should seek to optimise staffing efficiencies and workforce sustainability.

The recommended SOAs for IR/INR below include the following indicative scenarios:

- Scenario 1: a single IR room within a medical imaging department with shared access to the reception / waiting, patient holding / recovery and staff areas provided as part of the broader imaging department.
- Scenario 2: a separate dedicated IR/INR unit with four modality rooms. Separate reception / waiting, patient holding / recovery and staff areas are included however these may be shared with collocated services (e.g. operating theatres) depending on the operational model and volume of activity. Collocation of holding / recovery areas should be considered as appropriate to support staffing efficiencies. When calculating the required number of holding bays, consideration needs to be given to the time required to recovery these patients (up to four hours).

The modalities included below assume angiography / DSA. There is a trend towards the increasing provision of biplane angiography over single plane units. Where it is anticipated that single plane angiography may be converted to biplane units in the future these rooms should be sized accordingly given these rooms are challenging to expand at a later date. Other IR and INR modalities, such as CT, MRI and ultrasound will require reference to the relevant SOAs for these modalities, as included above.

Given IR and INR services support the full patient journey, consideration will also need to be given to inpatient and outpatient services. These are not included in the SOA below and will require reference to AusHFG HPUs 155 Ambulatory Care and 340 Adult Acute Inpatient Unit.

IR / INR ENTRY, RECEPTION AND WAITING

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	1 IR Room within Medical Imaging Unit (m2)		4 IR / INR Rooms within Dedicated IR / INR Unit (m2)		REMARKS
			Qty	m2	Qty	m2	
WAIT-10	Waiting	Yes	Shared		1	15	Indicative area allocation. Requirements will depend on throughput. For services with a significant paediatric mix include a paediatric waiting and play area.
WCPU	Toilet – Public	Yes	Shared		1	3	
WCAC	Toilet – Accessible	Yes	Shared		1	6	
RECP-10	Reception	Yes	Shared		1	10	
OFF-WS	Office - Workstation	Yes	Shared			4.4	Administration workstations collocated with reception. Number of workstations dependent on staff profile.
BMFD-3	Bay - Multifunction Device	Yes	Shared		1	3	
OFF-CLN	Office - Clinical Workroom	Yes	Shared		1	15	
	Discounted Circulation		30%			30%	

IR / INR PATIENT HOLDING AND RECOVERY

Where possible holding and recovery areas for interventional services should be shared with a collocated unit, e.g., medical imaging or the operating suite depending on the size of unit and the need to support staffing efficiencies whilst minimising patient transfer distances.

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	1 IR Room within Medical Imaging Unit (m2)		4 IR / INR Rooms within Dedicated IR / INR Unit (m2)		REMARKS
			Qty	m2	Qty	m2	
CONS	Consult Room	Yes	1	12	1	12	Flexibly used for consents, education, pre-op asessment/observations and pre and post procedure clinical examinations. For outpatient IR services refer to HPU 155. Locate to enable access from recovery zone also.
CHPT	Change Cubicle -Patient	Yes	Shared		1	2	Access from recovery also required.
CHPT-AC	Change Cubicle – Patient, Accessible	Yes	1	4	1	4	
WCPT	Toilet – Patient	Yes	Shared		1	4	
WCAC	Toilet – Accessible	Yes	Shared		1	6	
	Property Bay - Patient		Shared		1	3 (o)	Optional. Assumes lockers. Property may instead travel with the patient. Access from recovery also required.
PT-HOLD-A	Patient Bay – Holding	Yes	Shared		12	6.5	Recommend 1 pre-procedure bay and 2 Stage 2/3 recovery bays per IR room. Patient may be accommodated on a chair or trolley. May need to be 9m2 should access be required at each side. Where possible share holding / recovery areas with a collocated unit eg medical imaging or operating suite to support staffing efficiencies.
PT-HOLD-B	1 Bed Room – Holding	Yes	Shared		1	12	Used for children, special needs or isolation. Number will depend on patient cohort.
PT-RS1	Patient Bay - Recovery Stage 1	Yes	Shared		7	9	Recommend 2 per IR room (including enclosed rooms). Where possible share holding / recovery areas with a collocated unit eg medical imaging or operating suite to support staffing efficiencies.
SSTN-10	Staff Station	Yes	Shared		1	18	Located to support pre and post-operative areas.
BHWS-B	Bay – Handwashing, Type	Yes	Shared		5	1	1 per 4 bays.
BLIN	Bay - Linen	Yes	Shared		1	2	
BBW	Bay - Blanket / Fluid Warmer	Yes	Shared		1	1	1 per 16 spaces.
BBEV	Bay- Beverage	Yes	Shared		1	4	
BMEQ	Bay - Mobile Equipment	Yes	Shared		1	3	
BRES	Bay - Resuscitation Trolley	Yes	Shared		1	1.5	
CLN-10	Clean Store	Yes	Shared		1	6	May be provided as a combined space of 14m2 including medication store depending on local jurisdictional policies.
MED-14	Medication Room	Yes	Shared		1	10	May be provided as a combined space of 14m2 including clean store depending on local jurisdictional policies. Access to centralised medication store or drug safe in each interventional radiology suite will be required.
STGN	Store - General	Yes	Shared		1	10	For other non-sterile / deboxing storage.
STEQ-14	Store - Equipment	Yes	Shared		1	20	With power points for recharging pumps etc.
	Dirty Utility / Disposal Room		Shared		1	14	
CLRM	Cleaner's Room	Yes	Shared		1	5	
WCST	Toilet - Staff	Yes	Shared			3 (o)	Optional. Number and location dependent on travel distances to staff change rooms.
	Discounted Circulation			37%		37%	

IR / INR INTERVENTIONAL ROOMS

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	1 IR Room within Medical Imaging Unit (m2)		4 IR / INR Rooms within Dedicated IR / INR Unit (m2)		REMARKS
			Qty	m2	Qty	m2	
ANAE-16	Anaesthetic Preparation Room	Yes	1	16 (o)	4	16 (o)	Optional depending on local requirements, may be provided through separate pre-procedure holding area.
CLAB-I	Interventional Radiology Room - Single Plane Angiography	Yes	1	55	2	55	Number and types of IR rooms to be allocated in line with the service plan / analysis of service need. Where it is anticipated that single plane angiography may be converted to biplane units in the future these rooms should be sized accordingly given these rooms are challenging to expand at a later date. Refer to CT and MRI allocations within this SOA for interventional CT and MRI modalities. The provision of Angiography-CT hybrid interventional rooms is growing (80m2 recommended for this modality, however project team should refer to recently delivered facilities). Access to centralised medication store or drug safe in each interventional radiology suite will be required.
CLAB-EP	Interventional Radiology / Neuroradiology Room - Biplane Angiography	Yes			2	60	Number and types of IR rooms to be allocated in line with the service plan / analysis of service need. Where it is anticipated that single plane angiography may be converted to biplane units in the future these rooms should be sized accordingly given these rooms are challenging to expand at a later date. Refer to CT and MRI allocations within this SOA for interventional CT and MRI modalities. The provision of Angiography-CT hybrid interventional rooms is growing (80m2 recommended for this modality, however project team should refer to recently delivered facilities). Access to centralised medication store or drug safe in each interventional radiology suite will be required.
	Angiography Control Room	Yes	1	14	4	14	May be combined and shared between 2 rooms. Must support digital systems included associated cameras and recording systems.
	Computer Equipment		1	10	4	10	For storage of vendor computer cabinets.
REPR	Reporting Room	Yes	1	12	2	12	
SCRB-4	Scrub Up	Yes	1	4	2	4	May be shared between rooms.
STSS-20	Angiography Sterile Store / Set-Up	Yes	1	12	4	12	
	Bay - Lead Aprons	Yes	1	0.5	4	0.5	
CLUP-7	Clean-Up Room	Yes	1	7 (o)	1	15	May be shared with other modalities in smaller units.
	Prep Room / Lab		1	5	1	8	
	Discounted Circulation			37%		37%	

IR / INR STAFF AREAS

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	1 IR Room within Medical Imaging Unit (m2)		4 IR / INR Rooms within Dedicated IR / INR Unit (m2)		REMARKS
			Qty	m2	Qty	m2	
OFF-1P-9	Office- 1 Person, 9m2	Yes	Shared			9	Number and area allocation will depend on staff profile and local jurisdictional policies.
OFF-WS	Office - Workstation		Shared			4.5	Number and area allocation will depend on staff profile and local jurisdictional policies.
MEET-20	Meeting Room	Yes	Shared		1	15	Size will depend on number of people to be accomodated and local jurisdictional policies.
SRM-15	Staff Room	Yes	Shared		1	24	Requirements will depend on the staff profile for the unit.
CHST-35	Change - Staff	Yes	Shared		1	50	Requirements will depend on the staff profile for the unit. Full lockers - adjust female, male, all gender mix as required. Toilet and showers included.
	Discounted Circulation			25%		25%	

5.1.3 Satellite Imaging Units

Where possible imaging services should be centralised to support efficient use of modalities, optimal resourcing and appropriate staff support. However, some facilities may require the provision of decentralised / satellite imaging units due to significant travel distances to the main imaging department and high volumes of activity. These models are appropriate for larger facilities only and must be informed by consultation with Medical Imaging services to ensure the decentralised arrangements can be appropriately staffed and managed.

SATELLITE – EMERGENCY UNIT (OPTIONAL)

A satellite imaging unit in ED should only be considered where there are significant travel distances to the main imaging department. The operational model for the satellite unit must be confirmed including the range of services accessing the unit. For example, some services such as inpatient units may access this unit after hours when the main imaging department is closed and will require consideration of patient holding capacity and staff oversight.

The type and number of imaging modalities provided will be informed by clinical services planning with consideration of the range of services accessing the satellite unit and projected activity volumes. Although not commonly provided in satellite imaging units currently, it is noted that the role of MRI in emergency diagnostics is increasing.

It is assumed that staff support and amenities are shared with the emergency department.

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	Qty	m2	REMARKS
WAIT-S	Waiting - Sub	Yes		5 (o)	Optional, depending on operational policies relating to transfer of patients to Imaging and resourcing for staff oversight. Area allocation is dependent on size of satellite service.
	Staff Base			8	
BRES	Bay - Resuscitation Trolley	Yes		1.5	
PT-HOLD-B	Patient Bay - Holding, Bed	Yes		9	Number of bays dependent on expected throughput and access for patients from other units eg for after hours services. Consideration needs to be given to staff oversight. These bays allow satellite service to optimise throughput.
GENXR	General X-Ray Room	Yes		40	Sized larger for trauma cases. Assume 45m2 if OPG included.
ULTR	Ultrasound Room	Yes		16	Ultrasound reprocessing requirements to be confirmed. Refer to HPU Section 2.2.8.
WCAC	Toilet - Accessible	Yes		6	Direct access to ultrasound room.
CTIR	CT Imaging Room	Yes		45	
CTCR	CT Imaging Control Room	Yes		16	A larger control room will be required where the CT is supporting trauma services, depending on the number of staff to be accommodated.
	CT Equipment Room	Yes		10	
CHPT-AC	Change Cubicle - Patient, Accessible	Yes		4	
WCPT	Toilet - Patient	Yes		4 (o)	Optional, to be provided depending on access to patient amenities within ED.
REPW	Reporting Workstation			6	Busy services may require one station per x-ray and two per CT. Locate to ensure ease of communication with the emergency medical team.
STGN	Store - General	Yes		8	
DTUR-S	Dirty Utility - Sub	Yes		8 (o)	Optional, depending on access to dirty utility within ED.
BMEQ	Bay - Mobile Equipment	Yes		2 (o)	Optional, for storage of mobile imaging equipment where additional mobile units are required to service areas outside of the resuscitation zone.
BLIN	Bay - Linen	Yes		2 (o)	Optional, depending on access to linen within ED.
WCST	Toilet - Staff	Yes		3 (o)	Optional, where there are significant travel distances to ED staff amenities. Access to other staff amenities also requires consideration.
	Discounted Circulation			37%	

SATELLITE – AMBULATORY CARE UNIT (OPTIONAL)

A satellite imaging unit within an Ambulatory Care Unit should only be considered where there are significant travel distances to the main imaging unit and / or where there are high volumes of activity that can justify a decentralised unit. These units are often associated with high volume orthopaedic clinics.

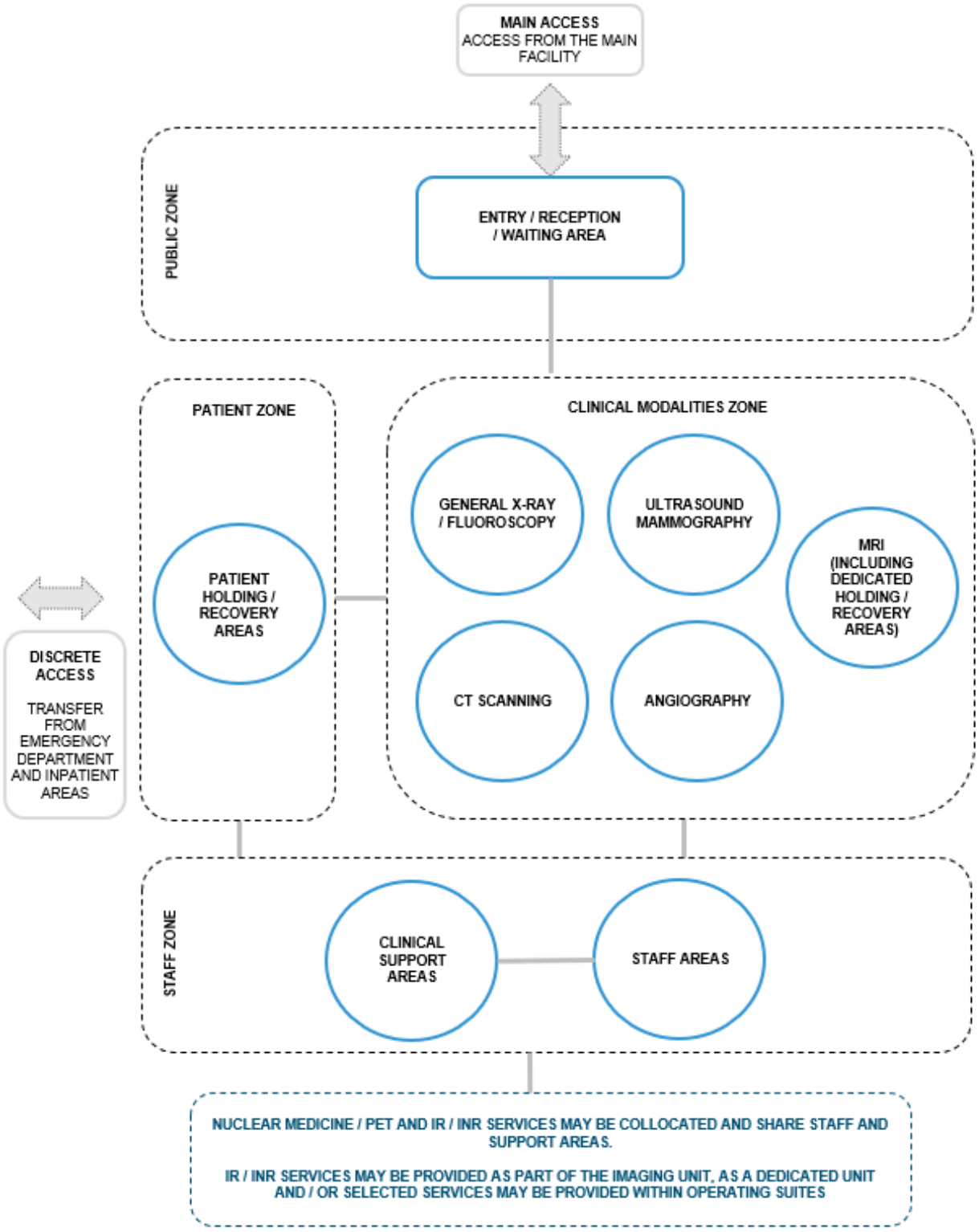
The types and numbers of each modality will be dependent on the clinical services plan. In certain circumstances, additional modalities such as CT and MRI may be included. In this case, room sizes depicted in the Main Department should be used.

Staff support and amenities are assumed to be shared with other ambulatory care services.

AusHFG ROOM CODE	ROOM/SPACE	SC/ SC-D	Qty	m2	REMARKS
WAIT-S	Waiting, Sub	Yes		5	Spatial allocation dependent on size of satellite service and opportunities to share with other ambulatory care services. 1.2m2 required per seat, 1.5m2 per wheelchair space.
	Staff Base			8	May be shared with staff base for ambulatory care clinic.
PT-HOLD-B	Patient Bay - Holding, Bed	Yes		9 (o)	Optional. Provision of holding bays will depend on patient cohort and operational policies. This may include patients from residential care, or hospital transfers of patients on trolleys. Consider staff supervision of holding bays.
GENXR	General X-Ray Room			38	
ULTR	Ultrasound Room	Yes		16 (tbc)	
CHPT-AC	Change Cubicle - Patient, Accessible	Yes		4	Extra rooms will be planned at 2m2.
REPW	Reporting Workstation			6	Busy services may require one station per x-ray and two per CT
WCPT	Toilet - Patient	Yes	1	4	Unless provided nearby and ensure access to an accessible toilet.
STGN	Store - General	Yes		8	
	Discounted Circulation			32%	

5.2 FUNCTIONAL RELATIONSHIPS / DIAGRAMS

The following diagram sets out the relationships between the various zones of the Medical Imaging Unit:

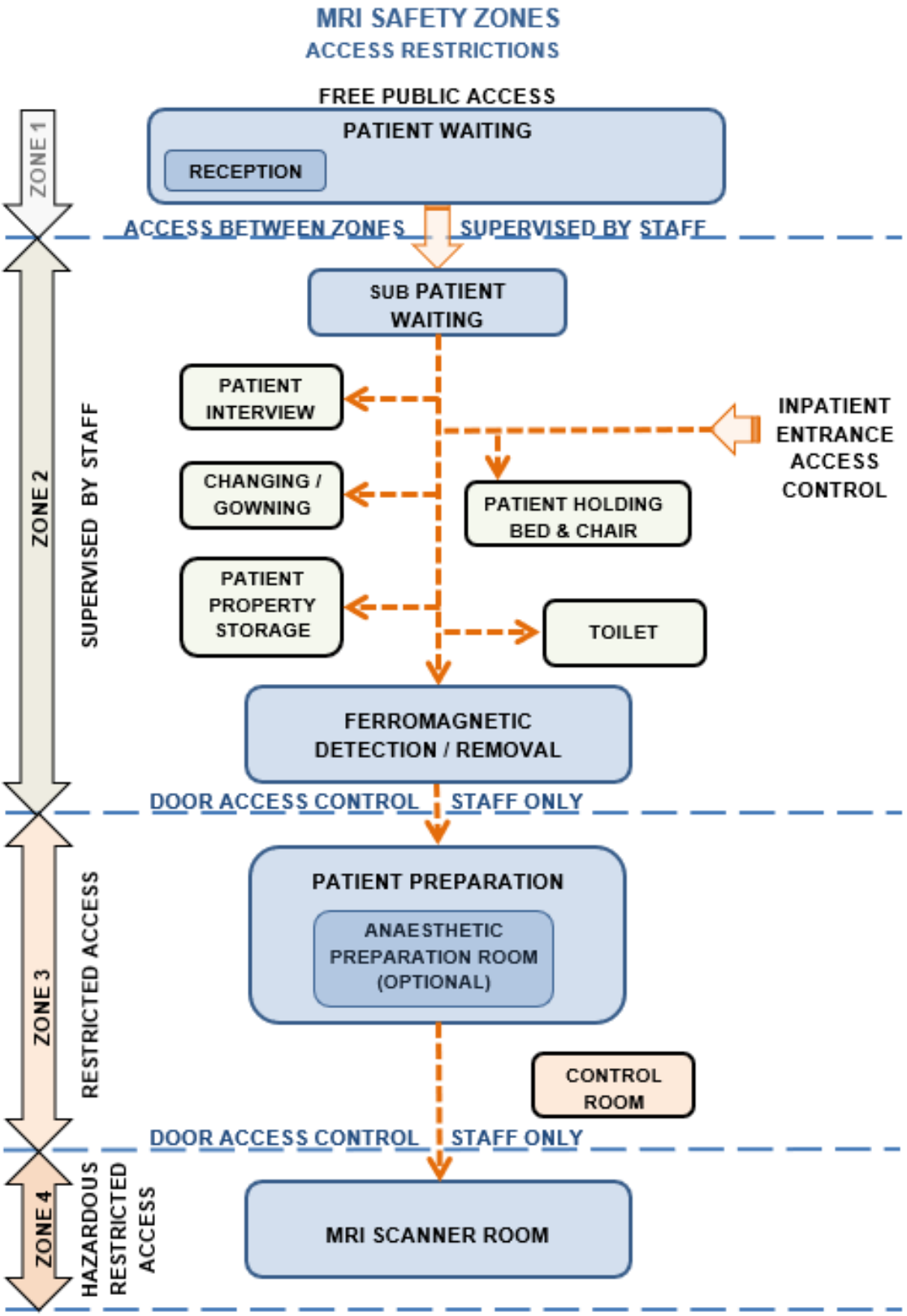


5.3 MRI SAFETY ZONES

The diagram below provides a visual representation of the MRI four zone system to provide a ‘buffer’ around the MRI which is free of potentially hazardous metal objects, and to support access restriction policies. Refer to RANZCR (2021) MRI Safety Guidelines for further detail.

The RANZCR MRI Safety Guidelines (Version 3.0, 2021) currently advises that a contour of 0.5mT (5g, ‘the 5 gauss line’) must be provided to define the perimeter for pacemaker safety. This area should usually be confined to the scan room. The project team should refer to current RANZCR advice given proposed changes to adopt a 0.9mT line as the hazard area in response to updates to the international standards to reflect more modern pacemaker limits. Demarcation of the 30g (3mT) line may be helpful for interventional and intraoperative MRI, and MRIs used for radiotherapy planning.

The provision of cameras and communications systems should be installed to support staff oversight and communications between zones.


MRI SAFETY ZONES
ACCESS RESTRICTIONS
FREE PUBLIC ACCESS
ZONE 1
PATIENT WAITING
RECEPTION
ACCESS BETWEEN ZONES
SUPERVISED BY STAFF
SUB PATIENT WAITING
ZONE 2
SUPERVISED BY STAFF
PATIENT INTERVIEW
CHANGING / GOWNING
PATIENT PROPERTY STORAGE
INPATIENT ENTRANCE ACCESS CONTROL
PATIENT HOLDING BED & CHAIR
TOILET
FERROMAGNETIC DETECTION / REMOVAL
DOOR ACCESS CONTROL
STAFF ONLY
ZONE 3
RESTRICTED ACCESS
PATIENT PREPARATION
ANAESTHETIC PREPARATION ROOM (OPTIONAL)
CONTROL ROOM
DOOR ACCESS CONTROL
STAFF ONLY
ZONE 4
HAZARDOUS RESTRICTED ACCESS
MRI SCANNER ROOM

5.4 RADIATION REGULATORS - AUSTRALIA / NEW ZEALAND

ACT	ACT Health – Health Protection Service, Radiation Safety Contact: hps@act.gov.au / (02) 5124 9700 https://www.health.act.gov.au/businesses/radiation-safety
NSW	Environment Protection Authority Contact: radiation@epa.nsw.gov.au / 131 555 https://www.epa.nsw.gov.au/your-environment/radiation
New Zealand	Ministry of Health - Manatū Hauora, Office of Radiation Safety Contact: orsenquiries@health.govt.nz https://www.health.govt.nz/our-work/ionising-radiation-safety
Northern Territory	NT Health – Radiation Protection Contact: radiationprotection@nt.gov.au / (08) 8922 7152 https://health.nt.gov.au/professionals/environmental-health/radiation-protection
Queensland	Radiation Health Unit, Department of Health Online contact forms: Contact Radiation Health | Queensland Health https://www.health.qld.gov.au/radiationhealth
South Australia	Environment Protection Authority – Radiation Protection Contact: radiationprotection@epa.sa.gov.au / (08) 8463 7826 http://www.epa.sa.gov.au/environmental_info/radiation
Tasmania	Department of Health & Human Services – Radiation Protection Unit Contact: radiation.protection@health.tas.gov.au / (03) 6166 7256 https://www.health.tas.gov.au/health-topics/radiation-protection
Victoria	Department of Health – Radiation Safety Team Contact: radiation.safety@health.vic.gov.au / 1300 767469 https://www.health.vic.gov.au/public-health/radiation
WA	Radiological Council Contact: radiation.health@health.wa.gov.au / (08) 9222 0888 http://www.radiologicalcouncil.wa.gov.au/

5.5 REFERENCES

The following references and further reading are specific to various aspects of medical imaging.

- AHIA, 2018, Part C: Design for Access, Mobility, Safety and Security, Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney, NSW
- AHIA, 2016, Part B: Section 80 General Requirements, Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney NSW
- AHIA, 2016, Part D: Infection Prevention and Control, Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney, NSW
- AHIA, 2018, Part B: HPU520 Operating Unit, Australasian Health Facility Guidelines, AHIA, Sydney, NSW
- AHIA, 2020, Part B: HPU 170 Cardiac Investigations Unit, Australasian Health Facility Guidelines, AHIA, Sydney, NSW
- AHIA, 2021, Part B: HPU280 Oral Health Unit, Australasian Health Facility Guidelines, AHIA, Sydney, NSW
- AHIA, 2019, Part B: HPU300 Emergency Unit, Australasian Health Facility Guidelines, AHIA, Sydney, NSW
- AHIA, 2022, Part B: HPU500 Nuclear Medicine/ PET Unit, Australasian Health Facility Guidelines, AHIA, Sydney, NSW
- ARPANSA 2008a, Radiation Protection Series 14: Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation, ARPANSA
- ARPANSA 2008b, Radiation Protection Series 14.1 - Safety Guide for Radiation Protection in Diagnostic and Interventional Radiology, Australian Radiation Protection and Nuclear Safety Agency
- AS/NZS 4187:2014 Reprocessing if Reusable Medical Devices in Health Service Organisations Standards Australia)
- AS 1428 (Set) - 2010 Design for Access and Mobility Set (Standards Australia)
- AS 1319 Safety Signage for Occupational Environments
- ATS 5816_2013 Digital Images for Diagnostic and Other Clinical Purposes: Presentation, Communication, Display and Manipulation (Standards Australia)
- Basseal JM, Westerway SC, Juraja M, van de Mortel T, McAuley TE, Rippey J, et al. Guidelines for reprocessing ultrasound transducers. Australasian Journal Ultrasound Medicine 2017; 20: 30–40
- NSW Health, 2022, Wayfinding for Healthcare Facilities
- RANZCR MRI Safety Guidelines, Version 3.0 (2021)
- RANZCR Position Statement on Safety in Medical Imaging, Version 2.0 (2020)
- RANZCR Standards of Practice for Clinical Radiology, Version 11.2 (2020)
- RANZCR Standards of Practice for Interventional Radiology and Interventional Neuroradiology, Version 1 (2022)
- RANZCR Clinical Radiology Range of Practice, May 2021
- RANZCR Specialist Interventional Radiology and Interventional Neuroradiology Range of Practice, March 2022

5.6 FURTHER READING

- Basseal JM, Westerway SC. Advancing infection control in Australasian medical ultrasound practice. Australasian Journal Ultrasound Medicine 2017; 20: 26-27
- International Atomic Energy Agency (IAEA), Radiation protection for patients