Australasian
Health Facility Guidelines

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

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Australasian Health Facility Guidelines

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Index

01 INTRODUCTION

1.1 PREAMBLE

1.1.1 Purpose of Guideline

Health Planning Units (HPU) are developed for use by design teams, project managers and end users to facilitate the process of planning and design.

This revision has been informed by an extensive consultation process with clinical and other technical experts during 2017/18 and post occupancy evaluation results from recently completed healthcare developments.

1.1.2 General

This HPU outlines the specific requirements for the planning and design of a Medical Imaging Unit. It 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, WHS and Security; and
- 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; and
- HPU 520 Operating Unit.

1.1.3 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;
- CR: Computed Radiography;
- DR: Digital Radiography;
- DSA: Digital Subtraction Angiography;
- 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; and

- UPS: Uninterruptable Power Supply.

1.2 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 Version 2.0 (2017);

- RANZCR Position Statement on Safety in Medical Imaging (2015); and

- RANZCR Standards of Practice for Diagnostic and Interventional Radiology, Version 11 (2018).

Other reference materials including international resources and the relevant regulatory authorities for each jurisdiction are listed in the Further Reading section.

1.3 DESCRIPTION

1.3.1 Description of the Medical Imaging Unit

The Medical Imaging Unit provides for diagnostic and therapeutic radiological examinations to support clinical decision making and patient treatment. The range of imaging modalities addressed in this document includes:

- general imaging, fixed and mobile;

- dental / oral radiology systems including OPG and cone beam CT;

- fluoroscopy;

- ultrasonography;

- mammography, breast ultrasound and breast tomosynthesis (3D);

- digital chest screening;

- CT, including interventional CT, CT fluoroscopy, fixed and mobile;

- interventional radiology including angiography and DSA;

- image intensification, fixed (C-arm) and mobile; and

- MRI.

. The most common modalities are:

- general imaging;

- fluoroscopy;

- ultrasound; and

- CT.

Depending on the level of service and the clinical profile of the facility, the Medical Imaging Unit may also provide:

- OPG and cone beam CT in support of a facio-maxillary service;

- mammography and tomosynthesis;

- interventional radiology, e.g. angiography / DSA suite; and

- MRI, with tertiary centres often requiring capacity for research.

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.

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.

The amount of medical imaging used in surgical / procedural services is also increasing with the use of hybrid rooms, fixed and mobile image intensifiers (IIs), fixed and mobile CT and in selected cases, MRI.

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

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.

2.1.2 Determining Service Capability

Planning for medical imaging should be part of clinical service planning where future activity, casemix and trends (both clinical and technological) are analysed. This 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.

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 Changes Impacting Medical Imaging Service Delivery

Changes in service delivery include:

- increasing reliance on imaging studies to exclude disease, confirm diagnosis and monitor response to treatment, e.g. use of CT in stroke management;

- planning for centralised, coordinated response to changes in disease patterns, e.g. pandemic planning;

- acute assessment pathways that may bypass emergency departments such as;

    o acute stroke assessment, involving CT and interventional neuroradiology or interventional thrombolysis

    o chest pain pathways using coronary artery CT (CTCA)

- 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;

- the substitution of plain x-rays with CT in clinical situations, such as cervical spine trauma and abdominal pain;

- increasing use of image guided technology across many modalities including digital subtraction angiography (DSA), CT, ultrasound and fluoroscopy;

- convergence of surgery and imaging modalities with the alternate use of minimally invasive interventional radiology procedures;

- an increase in acute and ambulatory care referrals;

- 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;

- an increasing use of mobile equipment, e.g. CT;

- an increasing demand for medical imaging services at the point of care, i.e. satellite services and increasing use in patients undergoing surgical procedures;

- governance arrangements relating to radiation safety requirements and ensuring that major medical equipment is maintained in optimal working order; and

- radiologists are increasingly functioning 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   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.

Interventional Radiology

The increasing incidence and convergence of complex interventional and surgical procedures is challenging the single consolidated Medical Imaging Unit model because of concerns over access to anaesthetists and recovery services.

The merging of surgery and interventional imaging impacts directly on design. Intraoperative imaging is emerging to the point where selected interventional imaging is typically provided as a hybrid room and located within an operating unit.

Also see Rostenberg, B. 2009 Converging Interests: The Merging of Surgery and Imaging Influences Design.

Emergency Imaging

Where collocation of medical imaging and the emergency departments cannot be achieved, or where the emergency workload and acuity justify, it may be appropriate to include selected modalities within the emergency department.

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. 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.

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.

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

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 smaller 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 Diagnostic and Interventional Radiology (2018).

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.

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

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.

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.

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.

Radiologists will typically dictate results or use voice recognition software. There are pros and cons of each approach. Where results are dictated, a medical typist will transcribe the report. These resources may not necessarily be collocated with the Medical Imaging Unit as the work can be completed remotely.

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.

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.

2.2.8 Reprocessing of Reusable Medical Devices

Scopes and other reusable medical devices should not be reprocessed in the Medical Imaging Unit and instead returned to the sterilizing services unit (SSU) in accordance with:

- AS/NZS 4187:2014 Reprocessing of reusable medical devices in health service organizations (Standards Australia); and
- jurisdictional policies.

Local reprocessing of transvaginal probes using an approved automated and closed high level disinfection system may be considered. This unit will usually be stored in a separate room adjacent to the ultrasound rooms where they are used. These units will need to be located on a bench and supplied with power and data.

Refer to Guidelines for reprocessing ultrasound transducers, Australasian Journal of Ultrasound Medicine (2017).

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.

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 usually 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.

There is a need for a toilet attached to screening (fluoroscopy) rooms and ultrasound rooms.

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, image intensifiers, 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, image intensifier and in selected cases, mobile CT;
- NICU – general x-ray, ultrasound and image intensifiers;
- ICU - general x-ray, ultrasound and image intensifiers; and
- ED - general x-ray, ultrasound and image intensifiers.

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. 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.

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 but also the number of satellite units serviced.

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;

- PACS administrative support staff;

- porters; and

- administration officers.

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.

The location 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 lift. Non-standard door heights and demountable windows may be required to allow for the transfer of the magnet.

2.3.2 Traffic Flow

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.

2.3.3 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.

2.3.4 Work and Patient 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.

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.

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.

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

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.

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 screening (fluoroscopy) rooms;
- ultrasound and mammography;

- interventional radiology (DSA and angiography);
- 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.

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, 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.

Sonographers will also require access to space to review and organise images as this is not done within the 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. Mobile modalities are usually serviced within an x-ray room or in a workshop in large departments.

Clinical consumables and medications will be stored within a **clean utility / medication room**. This will be located near the patient holding / recovery area. 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 screening room (fluoroscopy) and patient holding / recovery.

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 and nursing unit manager 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.

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:
  o ICU / CCU;
  o acute inpatient units;
  o radiation oncology / nuclear medicine where applicable;
  o pathology; and
  o public arrival points.

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. 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.

Consider the proximity of 24-hour and 12-hour operational zones. Position 24-hour modalities so that staff are not working in isolation or have to traverse unoccupied areas at night. The positioning of modalities should also optimise the capacity for staff to observe and assist each other.

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.

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 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; and
- relevant jurisdictional policies and guidelines.

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.

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.

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 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

Ensure acoustic privacy to protect the confidentiality of patient discussions and instruction regarding examinations.

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 management of children within the Unit is a 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.

3.5.6 Wayfinding

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

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 GL2014_018 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.

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. Entry to all imaging rooms will need to facilitate bed movements.

Staff will also need access to mobile 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.

Special consideration should be given to the width and height of doorways to ensure the installation and future replacement of major medical equipment is facilitated. 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.

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.

Radiation Shielding

Advice on radiation shielding requirements must be sought for each project, and should include both clinical / operational medical imaging staff and relevant medical physics experts. Consultation with the relevant regulatory authority may also be necessary to ensure that the proposed shielding design will be acceptable.

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. Designs will typically be approved by a regulator prior to construction to ensure shielding and design complies with jurisdictional requirements.

The relevant regulatory authority is likely to mandate the installation of radiation warning signs 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.

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.

3.7 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;
- 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).

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.

The installation of a ceiling mounted sling in ultrasound rooms can reduce shoulder injuries in sonographers.

Refer to local OHS 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;
- duress points at reception and staff stations; and
- the management of patient property during examinations.

3.7.4 Radiation Safety and Protection

Refer to Section 3.10.3.

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.

CT Imaging room

A shared control room between two CT scanning rooms is often preferred to maximise the utility of staff and patient throughput.

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.

Patient Plates

When purchasing patient plates, consider specifying the same vendor so they can be used interchangeably between general x-ray, mobile x-ray and fluoroscopy 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.

OPG provision

This modality is often combined with another in Medical Imaging Units, e.g. general x-ray room combined with OPG. Even when the modality is provided in its own room, this is often too small to accommodate patients in wheelchairs or beds. The use of these units needs to be well understood so adequate space is provided.

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.

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;

- conduits are not laid in the vicinity of expected core holes as some equipment is vibration sensitive;

- provision of cable trays, ducts or conduits in floors, walls and ceilings as required for equipment installation;

- ensure ceiling heights suit the equipment (a minimum of 3000 mm) for ceiling tube mount installations;

- 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;

- 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;

- thickness of RF shielded walls and window locations;

- ensure the air-handling system is able to manage the heat loads of the equipment being installed; and

- cooling system requirements for equipment such as CT, e.g. air cooled or water cooled, and suitable water quality.

The above ceiling space requirements are important given the quantity of equipment to be accommodated. This includes air conditioning, vents, cable runs, plumbing and unistrut for x-ray gantries.

3.10.3 Radiation Protection

Rooms that contain or are proposed to contain medical imaging (ionising) equipment will almost always require radiation shielding.

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.

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.

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 range and monitored via sensors so that equipment performance is maintained;

- 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. If return is via the ceiling space, ensure that building structure, services and full height walls are not negating the efficiency of the air handling system operation.

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.

3.10.5 Call Systems

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

- 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;

- 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.

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 NSW Health GL2016_020 Engineering Services Guideline which 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;
- 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) 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; and

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

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 Workroom

Description and Function
This space will fulfill a range of functions including:

- CR processing - in this room phosphor plates (cassettes) are processed and the image is viewed on a computer monitor;

- manipulation of DR images;

- general access to PC and phones;

- allocation of work; and

- meetings.

Location and Relationships
Locate immediately outside the general radiology rooms ideally with access from each room.

Considerations
Provide temperature control and ventilation.

The following equipment for two radiographer workstations can service four general rooms:

- CR plate readers - a multi-plate unit and a smaller back-up unit;

- computers for entering patient information - one per workstation;

- CR monitors for viewing images - one per workstation;

- storage for manuals; and

- plate holders (carriers) ideally mobile for moving between the imaging rooms and workroom.

4.2.5 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.

4.2.6 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.

4.2.7   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.

4.2.8   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 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.

4.2.9   Computer 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.

4.2.10 Film Library

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.

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 'SD/SD-C' 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;
- emergency department satellite unit; and
- ambulatory care 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 quantum 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.

A schedule of accommodation is not included for a breast assessment service however some of the components listed in the following tables can be used.

MAIN IMAGING DEPARTMENT – MODALITIES

GENERAL X-RAY AND FLUOROSCOPY (SCREENING)

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
GENXR	General X-Ray Room	Yes	1 x 38	1 x 38	2 x 38	4 x 38	Includes control console space.
	OPG Room			12	12	12	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. 12m2 will accommodate an ambulant patient and / or a patient using a wheelchair, including bariatric patients. Where bed access is required, 15m2 will be needed.
SCRN	Fluoroscopy Room	Yes	-	1 x 40	1 x 40	1 x 40	Room positioned and arranged so that patient privacy is optimised. Includes equipment store within room.

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
	Fluoroscopy Control Room		-	1 x 12	1 x 12	1 x 12	Attached to Fluoroscopy Room.
ENS-ACC	Ensuite – Accessible	Yes	-	1 x 7	1 x 7	1 x 7	Dual access from Fluoroscopy Room and corridor.
CHPT	Change Cubicle – Patient	Yes	-	1 x 2	2 x 2	4 x 2	One cubicle per imaging room (excluding OPG) and assumes change rooms are decentralised and located with modalities.
CHPT - D	Change Cubicle – Accessible	Yes	1 x 4	1 x 4	1 x 4	1 x 4	
WCPT	Toilet – Patient	Yes	1 x 4	1 x 4	1 x 4	1 x 4	
PBTR-H-9	Patient Bay – Holding	Yes	9				Include where a separate holding / recovery zone is not provided.
BLIN	Bay - Linen	Yes	1 x 2	1 x 2	1 x 2	1 x 2	
	Bay – Lead Aprons		1 x 0.5	2 x 0.5	3 x 0.5	5 x 0.5	Storage outside of imaging room (excluding OPG) for lead apron. Alternatively they can be stored in the room.
	Radiographer Workroom		1 x 16	1 x 24	1 x 30	1 x 40	Room for equipment, e.g. CR processor & workspace with computers etc.
DTUR-10	Dirty Utility	Yes	1 x 10 (o)	-	-	-	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.

ROOM CODE	ROOM/SPACE	SC/ SC-D	1 Room (m2)	2 Rooms (m2)	3 Rooms + 1 Procedure Room (m2)	4 Rooms + 1 Procedure Room	REMARKS
WAIT-SUB	Waiting – Sub	Yes	1 x 5	1 x 8	1 x 10	1 x 10	Assumed patients are waiting and are changed.
BWD-1	Bay – Water Dispenser	Yes	Share	1 x 1	1 x 1	1 x 1	
	Patient Locker Bay		-	1 x 1 (o)	1 x 1 (o)	1 x 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 x 14	2 x 14	3 x 14	4 x 14	Number of rooms adjusted to suit service plan.
WCPT	Toilet – Patient	Yes	1 x 4	2 x 4	3 x 4	4 x 4	Ideally, toilet with each room is desirable owing to type of work undertaken.
	Ultrasound Room - Procedures				1 x 20	1 x 20	For interventional procedures. Recovery from ultrasound procedures is recommended to be in the combined holding / nursing recovery area for all interventional imaging procedures.

ROOM CODE	ROOM/SPACE	SC/ SC-D	1 Room (m2)	2 Rooms (m2)	3 Rooms + 1 Procedure Room (m2)	4 Rooms + 1 Procedure Room	REMARKS
MAMMO	Mammography Room	Yes	-	1 x 16 (o)	1 x 16	1 x 16	Mammography room – Not all Units offer a mammography service. Inclusion of areas for mammography is subject to the service plan. Number or rooms adjusted to suit service plan. A larger room would be needed where interventional procedures are undertaken – refer ULTR-PR.
CHPT	Change Cubicle – Patient	Yes	1 x 2 (o)	2 x 2	3 x 2	4 x 2	Total one cubicle per room (including accessible).
CHPT-D	Change Cubicle – Accessible	Yes	1 x 4 (o)	1 x 4	1 x 4	1 x 4	Total one cubicle per ultrasound room.
	Sonographer Work Room		1 x 9	5.5	5.5	5.5	Per person. Benching.
	Reporting Workstation		Use PACS reporting workstation	6	6	6	No. dependent on expected throughput. As a guide two workstations will likely be required for two-three ultrasound rooms. An additional reporting station will be required for mammography.
	Prep Room / Lab		-	-	1 x 5	1 x 5	Ready access to mammography and reporting rooms. Provide where procedures are undertaken.
	Discounted Circulation		37%	37%	37%	37%	

INTERVENTIONAL RADIOLOGY - ANGIOGRAPHY / DSA

Unless located alongside the recovery / holding area, post-operative recovery bays may be needed to support the interventional services. When calculating the required number of holding bays, consider that additional time will be needed to recover these patients (up to four hours).

ROOM CODE	ROOM/SPACE	SC/ SC-D	1 interventional room	2 interventional rooms	REMARKS
ANAE-16	Anaesthetic Preparation Room	Yes	1 x 16	2 x 16	This space will often act as a pre-procedure holding and preparation space.
SCRB-4	Scrub-Up	Yes	1 x 4	1 x 8	
ANSS	Angiography Sterile Store / Set-Up	Yes	1 x 18	1 x 24	
CLAB	Catheter Laboratory Procedure Room	Yes	1 x 55	2 x 55	Number of rooms adjusted to suit service plan.
ANCRT	Angiography Control / Reporting Room	Yes	1 x 14	2 x 14	
	Computer Room		1 x 6	2 x 6	
	Bay – Lead Aprons	Yes	1 x 0.5	2 x 0.5	
CLUP-7	Clean-Up Room	Yes	1 x 7 (o)	1 x 7 (o)	Optional. May be shared with other modalities in smaller units.
	Reporting Room		1 x 12	1 x 12	
INTF	Interview Room	Yes	Share	1 x 9	Consents etc. May be shared with adjacent area.
BBW	Bay – Blanket / Fluid Warmer	Yes	1 x 1	1 x 1	
WCPT	Toilet – Patient	Yes	1 x 4	1 x 4	May be shared with adjacent area.

ROOM CODE	ROOM/SPACE	SC/ SC-D	1 interventional room	2 interventional rooms	REMARKS
	Prep Room / Lab		1 x 5	1 x 5	
BLIN	Bay – Linen	Yes	1 x 2 (o)	1 x 2 (o)	Optional. May be shared with adjacent area.
	Discounted Circulation		37%	37%	

Note 2: Access to centralised medication store or drug safe in each interventional radiology suite will be required.

Note 3: Change rooms are detailed under the clinical support areas.

CT

ROOM CODE	ROOM/SPACE	SC/ SC-D	1 CT Room (m2)	2 CT Rooms (m2)	3 CT Rooms (m2)	REMARKS
CTIR	CT Imaging Room	Yes	1 x 45	2 x 45	3 x 45	
CTCR	CT Imaging Control Room	Yes	1 x 12	2 x 12	3 x 12	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	-	1 x 20 (o)	1 x 20 (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.
	CT Equipment Room		1 x 10 (o)	2 x 10 (o)	3 x 10 (o)	Optional. Required if equipment to be stored outside examination room.
	Reporting Room		1 x 9	12	12	Additional reporting stations at 6m2 may be required to support routine reporting.
CHPT	Change Cubicle – Patient	Yes	1 x 2	1 x 2	2 x 2	
CHPT-D	Change Cubicle – Accessible	Yes	1 x 4	1 x 4	1 x 4	One per CT room.
WAIT-SUB	Waiting – Sub	Yes	1 x 5	1 x 8	1 x 10	Optional. Shared for MRI and CT.
WCPT	Toilet – Patient	Yes	1 x 4	1 x 4	1 x 4	
PBTR-H-6	Patient Bay – Holding	Yes	1 x 6	2 x 6	3 x 6	One outside of each CT imaging room.
	Preparation / Chair Bay		-	1 x 9	1 x 9	Space for a chair and storage with a curtain for privacy for inserting cannula if IV contrast is required.
	Patient Locker Bay		1 x 1	1 x 1	1 x 1	Unless patient belongings travel with the patient.
	Prep Room / Lab			1 x 5 (o)	1 x 5	To support interventional procedures. Share with MRI.
CLUR-8	Clean Utility / Medication Room – Sub	Yes	1 x 8	1 x 8	1 x 8	May be shared by MRI and CT and other modalities.
DTUR-S	Dirty Utility – Sub	Yes	1 x 8 (o)	1 x 8 (o)	1 x 8 (o)	Optional. May be shared with other modalities.
SCRB-4	Scrub Up	Yes	-	1 x 4	1 x 4	Where interventional procedures are undertaken. Shared between rooms.
BHWS-B	Bay – Handwashing, Type B	Yes	1 x 1	1 x 1	1 x 1	Part of preparation area.
	Discounted Circulation		37%	37%	37%	

MRI

ROOM CODE	ROOM/SPACE	SC/ SC-D	1 MRI Room (m2)	2 MRI Rooms (m2)	3 MRI Rooms (m2)	REMARKS
ANAE-16	Anaesthetic Preparation Room	Yes	1 x 16	2 x 16	3 x 16	Will also be used to hold patients on beds.
BHWS-B	Bay – Handwashing, Type B	Yes	1 x 1	1 x 1	1 x 1	Part of preparation area.
	MRI Room		1 x 46	2 x 46	3 x 46	Storage within the rooms will be needed.
	MRI Control Room		1 x 14	2 x 14	3 x 14	Must oversee with controlled entry into magnet room.
	MRI Equipment Room		1 x 10	2 x 10	3 x 10	
	Reporting Room		1 x 9	12	12	Additional reporting stations at 6m2 may be required to support routine reporting.
WAIT-SUB	Waiting – Sub	Yes	1 x 5	1 x 5	1 x 8	
CHPT	Change Cubicle – Patient	Yes	1 x 2	1 x 2	2 x 2	
WCAC	Toilet – Accessible	Yes	1 x 6	1 x 6	1 x 6	
PBTR-H-9	Patient Bay – Holding	Yes	1 x 9	2 x 9	3 x 9	For holding, preparation and recovery
SSTN	Staff Station	Yes	1 x 5	1 x 5	1 x 8	
BLIN	Bay – Linen	Yes	1 x 2	1 x 2	1 x 2	Optional if stand-alone unit.
BMEQ-4	Bay – Mobile Equipment	Yes	1 x 2	1 x 4	1 x 4	E.g. anaesthetic machine.
BRES	Bay – Resuscitation Trolley	Yes	1 x 1.5	1 x 1.5	1 x 1.5	Non-ferrous construction.
	Patient Locker Bay	Yes	1 x 1	1 x 1	1 x 1	
WCST	Toilet – Staff	Yes	1 x 3	1 x 3	1 x 3	
	Store – Dewar Tank		Remote areas only	Remote areas only	Remote areas only	
	Discounted Calculation		37%	37%	37%	

MAIN IMAGING DEPARTMENT – SUPPORT AREAS

ENTRY / RECEPTION / CLERICAL

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

ROOM CODE	ROOM/SPACE	SC/ SC-D	Area (m2)	REMARKS
WAIT-20	Waiting	Yes	20	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.
BWD-1	Bay – Water Dispenser	Yes	1 x 1	With capacity to fill cups or water bottles.
PLAP-10	Play Area – Paediatric	Yes	1 x 10	Assumed to be shared with adjacent department for smaller services
WCAC	Toilet – Accessible	Yes	1 x 6	Assumed to be shared with adjacent department for smaller services
WCPU-3	Toilet – Public	Yes	3	Numbers will depend on the size of the unit.
RECL-10	Reception / Clerical	Yes	1 x 10	Assumes 1 staff member; to be adjusted depending on the staff profile.
OFF-2P	Office – 2 Person Shared		1 x 12	For clerical and booking staff and related equipment. Area to be adjusted depending on the staff profile.
CONS	Consult Room	Yes	1 x 12	Only include within larger services. Assumed to be shared with adjacent department for smaller services.
INTF	Interview Room	Yes	1 x 12	Assumed to be shared with adjacent department for smaller services
BMEQ-4	Bay - Mobile Equipment	Yes	1 x 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		37%	

Note 4: 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.

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.

ROOM CODE	ROOM/SPACE	SC/ SC-D	Area (m2)	REMARKS
PBTR-H-9	Patient Bay – Holding	Yes	9	At least two patient holding / recovery bays per interventional room are required, as post-procedure holding can extend to four hours. 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 x 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.
CLUR-12	Clean Utility / Medication Room	Yes	1 x 10	Shared with adjacent modality areas. Area requirement will depend on 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-OP	Bay – Beverage, Open Plan	Yes	1 x 4	
BRES	Bay – Resuscitation Trolley	Yes	1 x 1.5	Additional bays may be required depending on the size of the unit.
DTUR-S	Dirty Utility – Sub	Yes	1 x 10	Share with adjacent modality areas. Area requirement will depend on size of the unit.
BMEQ-4	Bay – Mobile Equipment	Yes	4	Number will depend on the size of the unit.
	Discounted Circulation		37%	

CLINICAL SUPPORT AREAS

ROOM CODE	ROOM/SPACE	SC/ SC-D	Area (m2)	REMARKS
BHWS-B	Bay – Handwashing, Type B	Yes	1	Locate in shared areas where needed, in addition to those provided within each modality room.
BLIN	Bay – Linen	Yes	2	Number dependent on size and layout of unit. Should be easily accessible from modality rooms
BMEQ-4	Bay – Mobile Equipment	Yes	4	Various equipment, including bed mover. 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)	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-5	Cleaner's Room	Yes	1 x 5	
STGN-9	Store – General	Yes	9	For accommodation of consumables such as contrast media. For a unit with a small 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.
DISP-8	Disposal Room	Yes	1 x 8	Area requirement will depend on size of unit.
	Discounted Circulation		37%	

Note 5: 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.

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.

ROOM CODE	ROOM/SPACE	SC/ SC-D	Area (m2)	REMARKS
OFF-S12	Office – Single Person	Yes	12	Requirement will depend on staff profile.
OFF-S9	Office - Single Person	Yes	9	Chief Radiologist, NUM, staff specialists etc. Number will depend on staff profile.
	Office – Workstation		5.5	3D post processing activities. Associated with CT and MRI. Number to suit number of staff dedicated to this activity.
	Reporting Workstation		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.
	Office – Workstation		5.5	Number of spaces as per staff establishment. Staff may include registrars, administration and transcription staff, PACS / IT administration etc.
	Film Library		1 x 15 (o)	Optional. May be required for larger services.
STPS-8	Store – Photocopier / Stationery	Yes	1 x 8	
MEET-L-20	Meeting Room	Yes	1 x 20	Number will depend on size of unit. May be shared with adjacent service.
MEET-L-30	Meeting Room	Yes	1 x 30 (o)	Access to a large meeting / conference room for multidisciplinary case conferences may be required in larger facilities.
STGN-8	Store – General	Yes	1 x 8	Area requirement will depend on size of unit.
	Discounted Circulation		25%	

STAFF AMENITIES

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

ROOM CODE	ROOM/SPACE	SC/ SC-D	Area (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.
PROP-2	Property Bay - Staff	Yes	2	Estimate only. Numbers dependent on staff establishment and local policies.
SHST	Shower – Staff	Yes	3 (o)	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 – Staff (Male / Female)	Yes	2 x 10	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.
	Discounted Circulation		25%	

SATELLITE – EMERGENCY UNIT

Where the model of service delivery supports a satellite unit, the following types of spaces would support a decentralised imaging service. The types and numbers of each modality will be dependent on the projected activity. It is assumed that staff support and amenities are shared with the emergency department, and mobile equipment bays will be available within the emergency department to store mobile x-ray etc.

| ROOM CODE	ROOM/SPACE	SC/ SC-D	m2	REMARKS
WAIT-SUB	Waiting – Sub	Yes	**5 - 10**	Spatial allocation dependent on size of satellite service.
	Staff Base		8	
BRES	Bay – Resuscitation Trolley	Yes	1.5	
PBTR-H-9	Patient Bay – Holding	Yes	9	Number of bays dependent on expected throughput. These bays allow satellite service to optimise throughput.
GENXR	General X-Ray Room	Yes	40	Sized slightly larger for trauma cases. Extra space required if OPG included.
ULTR	Ultrasound Room	Yes	14	
CTIR	CT Imaging Room	Yes	45	
CTCR	CT Imaging Control Room	Yes	12	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-D	Change Cubicle – Accessible	Yes	1 x 4	
	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 - 8	Store – General	Yes	8	
WCPT	Toilet – Patient	Yes	1 x 4	Unless provided nearby.
	Discounted Circulation		37%	

SATELLITE – AMBULATORY CARE UNIT

Where the model of care support this model, the following types of spaces would support a decentralised imaging service. 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.

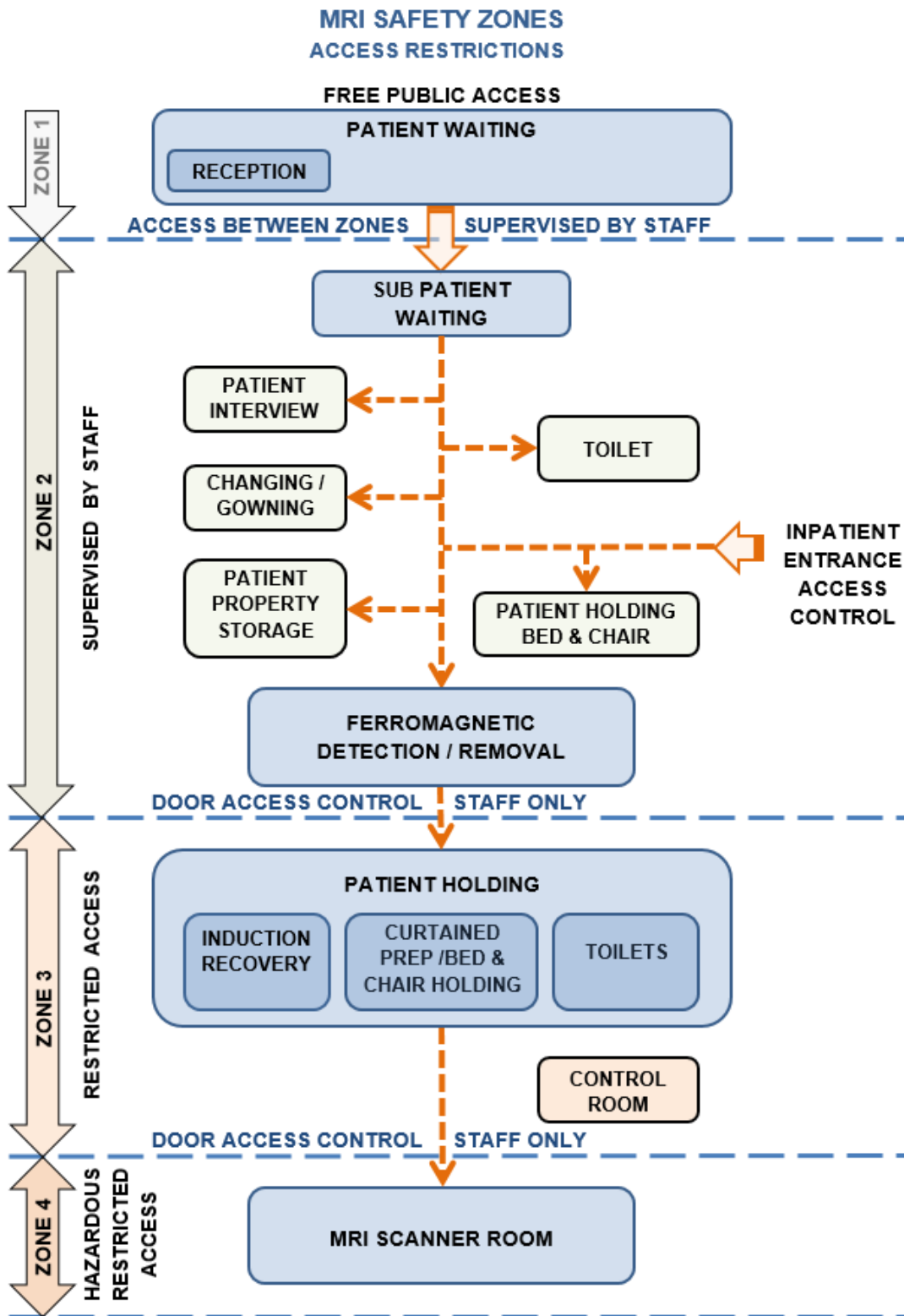| ROOM CODE	ROOM/SPACE	SC/ SC-D	m2	REMARKS
WAIT-SUB	Waiting, Sub	Yes	5 - 10	Spatial allocation dependent on size of satellite service.
	Staff Base		8	
GENXR	General X-Ray Room		38	
ULTR	Ultrasound Room	Yes	14	
CHPT-D	Change Cubicle – Accessible	Yes	4	Extra rooms will be planned at 2m2.
	Reporting Workstation		6	Busy services may require one station per x-ray and two per CT
WCPT	Toilet – Patient	Yes	1 x 4	Unless provided nearby.
STGN - 8	Store – General	Yes	8	
	Discounted Circulation		37%	

5.2 FUNCTIONAL RELATIONSHIPS / DIAGRAMS

The following diagram sets out the relationships between the various zones of the Medical Imaging Unit:
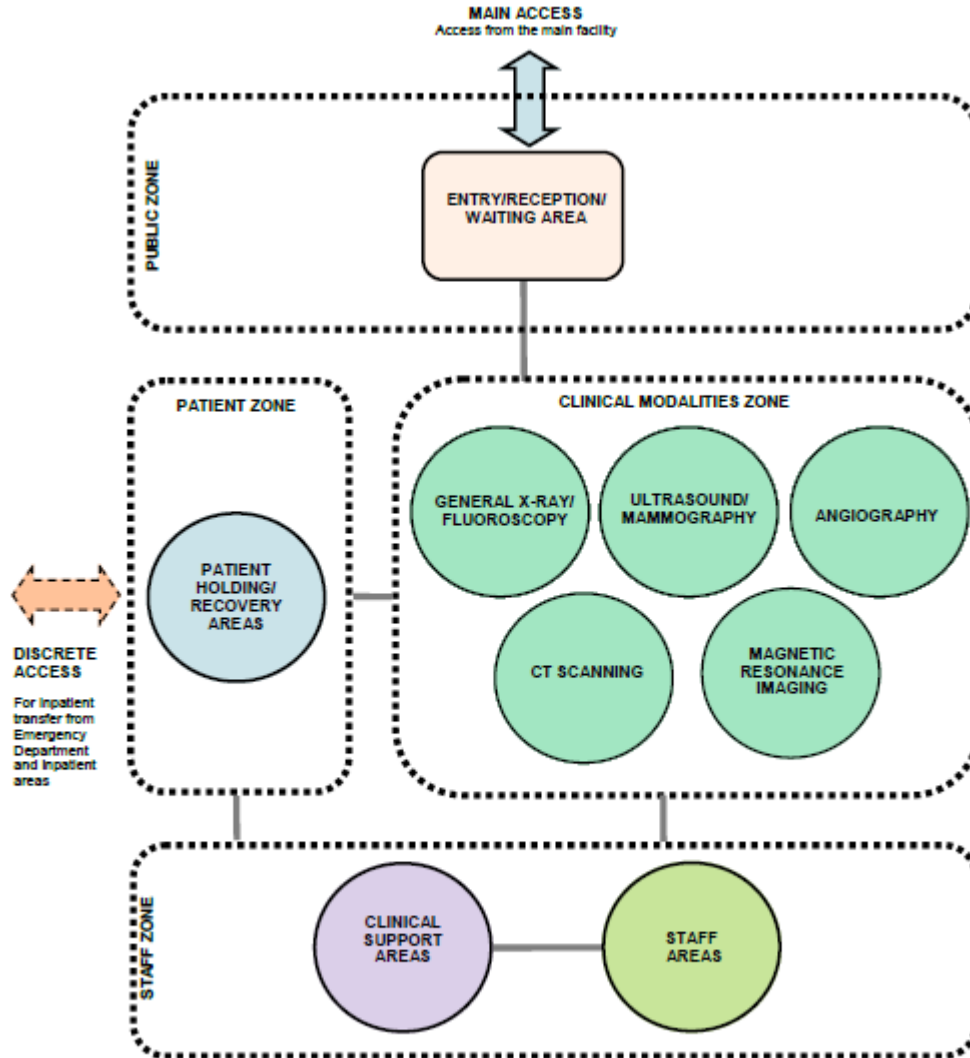
5.3 MRI SAFETY ZONES

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 (2017) MRI Safety Guidelines for further detail.

5.4   RADIATION REGULATORS - AUSTRALIA / NEW ZEALAND

ACT	ACT Health – Health Protection Service, Radiation Safety Contact: hps@act.gov.au / (02) 6205 1700 http://www.health.act.gov.au/public-information/businesses/radiation-safety
NSW	Environment Protection Authority – Hazardous Materials, Chemicals & Radiation Section Contact: radiation@epa.nsw.gov.au / (02) 9995 5959 http://www.epa.nsw.gov.au/radiation/
NZ	Ministry of Health, Office of Radiation Safety Contact: orsenquiries@moh.govt.nz http://www.health.govt.nz/our-work/radiation-safety
NT	Department of Health – Radiation Protection Contact: envirohealth@nt.gov.au / (08) 8922 7152 https://health.nt.gov.au/professionals/environmental-health/radiation-protection
Queensland	Department of Health – Radiation Health Contact: radiation_health@health.qld.gov.au / (07) 3328 9310 https://www.health.qld.gov.au/radiationhealth
SA	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@dhhs.tas.gov.au / (03) 6166 7256 http://www.dhhs.tas.gov.au/publichealth/radiation
Victoria	Department of Health & Human Services – Radiation Team Contact: radiation.safety@dhhs.vic.gov.au / 1300 767469 https://www2.health.vic.gov.au/public-health/radiation
WA	Radiological Council Contact: radiation.health@health.wa.gov.au / (08) 9388 4999 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, AusHFG Part B: Section 90, Standard Components, 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, 2016, Part B: HPU 170 Cardiac Investigations Unit, Australasian Health Facility Guidelines, AHIA, Sydney, NSW

- AHIA, 2016, Part B: HPU280 Oral Health Unit, Australasian Health Facility Guidelines, AHIA, Sydney, NSW

- AHIA, 2016, Part B: HPU300 Emergency Unit, Australasian Health Facility Guidelines, AHIA, Sydney, NSW

- AHIA, 2016, 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 GL2014_018 Wayfinding for Healthcare Facilities

- The Royal Australian and New Zealand College of Radiologists (RANZR) 2007, MRI Safety Guidelines, RANZCR, www.ranzcr.edu.au

- RANZCR Position Statement on Safety in Medical Imaging (2015)

- RANZCR Standards of Practice for Diagnostic and Interventional Radiology, Version 10.2 (2017).

5.6 FURTHER READING

- Basseal JM, Westerway SC. Advancing infection control in Australasian medical ultrasound practice. Australasian Journal Ultrasound Medicine 2017; 20: 26-27;

- IAEA Safety Standards for protecting people and the environment, Radiation protection and Safety of Radiation Sources: International Basic Safety Standards – General Safety Requirements Part 3, 2014;

- IAEA Radiation Protection of Patients
  http://www.rpop.iaea.org/RPoP/RpoP/content/index.htm