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

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AHIA
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GOVERNMENTS COLLABORATING TO DELIVER QUALITY HEALTH FACILITIES

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Australasian Health Facility Guidelines

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01 INTRODUCTION

01.01 Preamble

PURPOSE OF GUIDELINE
This Health Planning Unit (HPU) has been developed for use by project staff - architects, planners, engineers, project managers and other consultants, and for end users, to facilitate the process of planning and design.

It is a revision of the HPU developed for NSW Health and issued for Australasian use in 2006. Its development has been informed by an extensive consultation process.

01.02 Introduction

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;
- Part D: Infection Prevention and Control;
- Part E: Building Services and Environmental Design; and
- Room Data and Room Layout Sheets (RDS/RLS).

The following related HPUs are available in Part B:

- HPU 170 Cardiac Angiography;
- HPU 500 Nuclear Medicine Unit;
- HPU 480 Positron Emission Tomography (PET);
- HPU 270 Day Surgery / Procedure Unit; and
- HPU 300 Emergency Unit.

ACRONYMS
The following imaging related acronyms are used in this HPU:

- ALARA – As Low As Reasonably Achievable;

- CT: Computerised Tomography;
- CR: Computed Radiography;
- CCU: Coronary Care Unit;
- DR: Digital Radiography;
- DSA: Digital Subtraction Angiography;
- ED: Emergency Department;
- ICU: Intensive Care Unit;
- MRI: Magnetic Resonance Imaging;
- NICU: Neonatal Intensive Care Unit;
- OPG: Orthopantomography;
- PACS: Picture Archive Computing System;
- PIS: Patient Information System;
- PET: Positron Emission Tomography;
- RIS: Radiology Information System;
- UPS: Uninterruptable Power Supply; and
- US: Ultrasound.

MEDICAL IMAGING MODALITIES

The role of the Medical Imaging Department is to provide assistance to clinical teams in deciding the direction to take in clinical management based on the manifestations of disease that can be viewed using Medical Imaging technology. Within the context of the individual patient's known condition, advice has to be timely and as accurate as possible.

This HPU addresses the following imaging modalities:

- general imaging;
- mobile imaging units;
- dental / oral radiology systems;
- fluoroscopy (also known as Radioscopy);
- ultrasonography;
- mammography;
- digital chest screening;
- CT;
- angiography and DSA; and
- MRI.

It also addresses models of care, image acquisition and storage, interventional and dispersed imaging units. Detailed descriptions of the various medical imaging modalities are provided in Section 02.03 Planning Models.

Cardiac angiography is addressed in HPU 170 - Cardiac Investigation Unit and details are excluded from this HPU. However, Cardiac Angiography may be incorporated into a Medical Imaging Unit.

Similarly, Nuclear Medicine (HPU 500), PET (HPU 480) are also separately addressed and may also be incorporated into an integrated Medical Imaging Unit.

01.03 Policy Framework

GENERAL

Policies for the provision of healthcare services are formulated in accordance with the following principles:

- appropriate service models that ensure a comprehensive service network throughout state and regional health jurisdictions;
- recognition of the diversity of our community and the needs of special groups within the community;
- deployment of resources in a fair and cost effective manner to optimise health outcomes;
- development and support for enhanced information systems to monitor, plan and evaluate healthcare services;
- safe and effective care that minimises risks for both staff and patients; and
- provision of a safe and efficient environment which minimises risk to all users of the facility.

LEGISLATION

For radiation licensing, registration of equipment, accreditation and radiation shielding requirements local statutory authorities should be consulted. Specific references are listed in the Reference section.

The NSW Radiation Control Act 1990 (amended 2002) and Radiation Control Regulations 2003 administered by the Environment Protection Authority (EPA). Areas of EPA responsibility include:

- licensing;
- registration; and
- accreditation.

Also see:

- NSW Government, 2002, The NSW Radiation Control Act 1990;
- NSW Government, 2003, Radiation Control Regulation 2003 (under the Radiation Control Act 1990);
- Queensland Government, 2010, Radiation Safety Standard HR003; and
- Queensland Government, 1999, Radiation Safety Regulation 1999.

01.04 Description

DESCRIPTION OF HEALTH PLANNING UNIT

The Medical Imaging Unit provides for radiological diagnostic and therapeutic radiological investigations. It may be a single integrated unit or some services may be dispersed. The most common modalities are:

- general radiology;
- fluoroscopy;
- ultrasound; and
- computed tomography.

Depending on the level of service and the clinical profile of the facility, the unit may also provide:

- OPG and other dental modalities in support of a facio-maxillary service;
- mammography;
- interventional angiography e.g. DSA suite; and
- MRI.

It is expected that there will be a need for some level of anaesthesia or sedation, particularly if the healthcare facility provides paediatric services. In addition, substantial interventional imaging may require nursing support and associated facilities including patient holding, preparation and recovery. In addition, unit design, should, where appropriate, meet all necessary criteria to reach accreditation standards with regard to design, safety and equipment and in order to access the Medicare Benefits Schedule.

IMPACT OF NEW TECHNOLOGIES

Medical Imaging is possibly one of the most rapidly developing and evolving specialties within the health care system. While general radiology still accounts for the bulk of the workload in terms of volume, the use of modalities using non-ionising radiation such as USand MRI are increasing exponentially in terms of their applications and safety factors – the ALARA principle. At the more complex end of the spectrum, the interventional / therapeutic work will continue to grow with expanding utilisation of CT in place of plain x-ray in many clinical situations (e.g. trauma, spinal injury, etc). This change in practice may impact on requirements for infection control, monitoring and resuscitation.

PATIENT CHARACTERISTICS

Patients range from fully ambulant outpatients to critically ill patients. Volumes and categories of patients impact on facility needs, layout and relationships with other units such as ED, ICU, Operating Unit and Ambulatory Care. Unit design and layout should accommodate the needs of a wide range of patients as listed below:

- mobile, independent patients;
- children – as patients and accompanying adult patients;
- ambulance patients on trolleys – from residential aged care facilities or other hospitals in the community;
- people, including frail aged, with limited mobility requiring mobility aids (crutches, walking aids and wheelchairs) and who need assistance to achieve the best position for imaging access;
- bariatric patients with cognitive disabilities;
- antenatal patients;
- patients in distress e.g. pain, breathlessness or confusion and patients with intravenous therapy, vital sign monitoring and other attachments;
- bed-bound, fully dependent patients including unconscious, ventilated or acutely ill patients requiring high levels of nursing and medical supervision and monitoring during transfer to, from and throughout their time in the Unit;
- patients requiring sedation or anaesthesia during the procedure and requiring recovery post-procedure; and
- neonatal and paediatric patients. Paediatric patients merit special consideration as a proportion of these may be acutely ill, may require specialist nursing care and are more likely to need some degree of anaesthesia / sedation and consequent recovery. It is likely that paediatric patients will be accompanied by parents during their stay,

02 PLANNING

02.01 Operational Models

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, seven days a week services. The hours of operation will impact on after-hours access to the service.

DETERMINING SERVICE CAPABILITY
A needs analysis and service plan underpins the process of determining the number and types of modalities to be included in the Medical Imaging Unit and the model of care. The service plan should be confirmed prior to the commencement of the capital planning process. Refer to individual jurisdiction policies/guidelines with regard to role delineation and service capability.
Considering the overall impact of medical imaging capability on other hospital services and facilities in terms of referral patterns. Being aware of what is available in the private sector particularly in rural areas in order to avoid unnecessary and costly duplication and under-utilisation of a modality.

CHANGES IMPACTING MEDICAL IMAGING SERVICE DELIVERY
Changes in service delivery include:

- increasing reliance on imaging studies to exclude disease, confirm diagnosis, monitor response to treatment;
- planning for centralised, coordinated response to changes in disease patterns e.g. pandemic planning;
- the changing / evolving role of imaging practitioners;
- the substitution of plain x-rays with CT in clinical situations such as cervical spine trauma and abdominal pain that is increasing CT utilisation;
- convergence of surgery and imaging and the emergence of combined technology units;
- rise of Ambulatory Care Centres and subsequent high volume, fast throughput of patients and required imaging services to/from after-hours GP centres;
- an increase in the entry points from ED to medical and surgical acute assessment units, Psychiatric Emergency Care Centres (PECCs) and primary care/GP services in association with fast track models in emergencies units;
- staffing issues: the limited number of radiologists available to perform interventional angiographic procedures and imaging procedures initiated by specialist Nurse Practitioners; and
- recent health reform agendas and associated recommendations where applicable.

EVOLVING ROLE OF THE RADIOLOGIST
The majority of diagnostic and interventional radiology has traditionally been performed on the basis of 'procedure provided as requested'. However, radiologists are increasingly functioning as members of multidisciplinary teams with a significant increase of their role in diagnosis, staging of disease and decisions regarding treatment. As such, communication is vital and medical imaging facilities should provide adequate facilities for consultations with patients in a private setting, interdisciplinary meetings and review of all data relevant to patient care (Knechtges 2007).
Also see Knechtges, P.M. & Carlos, R., 2007, The Evolving Role of the Radiologist within the Health Care System.

MODELS OF CARE - SERVICE DELIVERY AND FACILITY CONFIGURATIONS
A single consolidated Medical Imaging Unit with direct access to the ED and ready access to Ambulatory Care facilities is a well-supported model. However, there are other models which may be more suitable, depending on the size and defined service capability of the overall healthcare facility. These models include:

- a conventional fully integrated unit, that may include Nuclear Medicine, PET and Cardiac Angiography;
- a dedicated interventional unit;

- distributed imaging facilities where the service is provided in close proximity to the point of care rather than being within a centralised unit, for example Emergency Unit and Obstetric US Unit; and
- a combination of the above models of service delivery.

INTERVENTIONAL / COMBINED TECHNOLOGY UNITS

The increasing incidence and convergence of complex interventional and surgical procedures under radiological control are challenging the single consolidated Medical Imaging Unit model because of concerns over the optimum location of the Interventional Suite with regard to recovery and access to anaesthetists and trained recovery nursing staff.

The line between surgery in an Operating Unit and Interventional Imaging is blurring and intraoperative imaging is emerging to the point where Interventional Imaging could be considered as part of an Operating Unit sharing recovery etc. This generally results in a "split" department and careful consideration of all the implications, particularly for patient safety and staffing - anaesthetic, nursing and radiological is required. There is however, a considerable cost differentiation between the utilisation of Operating Unit and Imaging Unit for interventional work as the Operating Unit has an inbuilt high structural cost that should be taken into consideration as part of service planning.

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

EMERGENCY IMAGING

If collocation of Medical Imaging and the Emergency Unit cannot be achieved and if emergency workload and acuity justify, it may be appropriate to include selected modalities within the Emergency Unit. Major trauma centres may also have overhead gantries in their resuscitation rooms, although improvements to the quality of images produced using mobile x-ray units may reduce the use of the fixed solution.

ORTHOPAEDIC IMAGING

If a high volume of work is generated by the healthcare facility's orthopaedic service, every attempt should be made to locate the Orthopaedic/fracture clinics as close as possible to Medical Imaging Unit. If this cannot be achieved, consideration may need to be given to a Satellite Imaging Unit.

OBSTETRIC ULTRASOUND

The need for dedicated perinatal US room/s remote from the main Medical Imaging Unit depends on the complexity, utilisation and throughput of the Obstetric Service. If provided, it is usually incorporated into the Maternity Ambulatory Care facilities. It is most likely restricted to facilities with a major Women's Health service.

02.02 Operational Policies

GENERAL

Operational policies/guidelines have a major impact on the capital and recurrent costs of healthcare facilities. The cost implications of proposed policies should be fully evaluated to ensure the most cost-effective and efficient design solutions are developed.

Operational policies and service specific guidelines vary from unit to unit depending on a wide range of factors but their development is crucial to defining how the unit operates within the healthcare facility, the health service as well as in adjoining health services from where patients may be referred. Users should define their own policies - refer to Part B Section 80 for further information. The following are policies specific to this Unit.

PRIVATISATION OF SERVICES

Increasingly, and especially in smaller facilities, consideration is being given to partial or full privatisation of Medical Imaging services. Some small healthcare facilities may rely on private practice for more sophisticated modalities and private practitioners may be contracted to provide facilities on the hospital campus.

These options need to be addressed early in the planning process as they may have considerable spatial, design and cost implications.

OFF-SITE SERVICES

In smaller or remote rural hospitals and Multipurpose Services that cannot justify comprehensive medical imaging services, access to off-site services such as CT scanning and MRI is an important consideration.

Consider the possibility of establishing teleradiology links with a larger centre.

ANAESTHESIA AND RECOVERY

Ascertaining the likely extent of anaesthetic requirements (general and sedation) in order to assess holding and recovery needs for patients - ensuring their safety, security and privacy, as well as equipment needs and medical servicing of rooms.

A combined holding / recovery area is the most efficient means of managing patients recovering from interventional procedures. Access to an interview or consultation room.

DARK ROOMS

'Best practice' is the removal of dark rooms, to be replaced by CR/DR, but achievability of this is impacted by funding to a service e.g. to remote, rural areas.

IMAGE ACQUISITION

Image acquisition may be conventional analogue plates, CR, direct acquisition (DR) or a mixture in units that are not fully digitised. At the time of the redevelopment a decision should be made to determine the system the unit plans to adopt. A decision regarding the conversion of films to digital format should be made based on a cost benefit analysis.

CR (CR) uses cassettes but viewing is done on a viewing monitor and the image can be enhanced by the operator to capture the best image before being stored onto the PACS network for reporting.

Direct radiography (DR) or (DX) is filmless x-ray image capture and removes the need to use cassettes, except in hybrid DR systems. Images appear directly onto the workstation monitor and this allows manipulation of the images.

Implementation of CR, DR or DX has implications for work processes. For example, radiographers can verify images at the time of exposure hence most of their work is done in the x-ray room. This has flow-on effects for unit layout.

Hard copy film brought in by a patient may be digitised and stored on the network and viewed from any computer with the necessary authorised access, however the diagnostic quality of digitised films is severely diminished, as is the ability to meaningfully manipulate and analyse content. Digital films may be printed using a laser printer.

PICTURE ARCHIVING AND COMMUNICATION SYSTEMS (PACS)

A PACS comprises computers or a network dedicated to the storage, retrieval, distribution and presentation of images. A full system can handle images from any modality from plain x-rays to PET. It can also handle scanned documents such as request forms, images from other disciplines e.g. Ophthalmology, Gastroenterology, Pathology, Clinical Photography and Operating Suites.

There are several models of image storage including:

- local PACS and RIS with provision of a server room 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 statewide spoke sites; and
- access to a statewide or National Archive.

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

PACS allows for rapid reporting, obviates the need for film transport between units thus minimising the risk of lost films and hence the need for re-examination, and can reduce / remove the need for hard copy film storage as existing hard copy film may be progressively digitised and stored into the system, although there are disadvantages in digitising film. Local policies around storage and / or digitisation of film apply.

If there is integration with the Hospital Information System (HIS), then order entry may be simplified and consistent.

It is important to recognise the difference a fully implemented PACS makes to work flows and to unit layout, particularly as a result of changed clerical duties and processes.

Satellite units, off-campus units, private practices and staff homes may all be linked into the system.

Inpatient and ambulatory care services and departments will view images but manipulation of images may be restricted.

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

MANAGEMENT OF BARIATRIC PATIENTS

Management of bariatric patients' needs to be carefully considered across all imaging services and facilities including the provision of patient amenities, chairs, hoists as well as suitable imaging equipment.
Bariatric specific equipment may include large bore CTs and MRIs, units with increased table loading capacity, height and width, and accessories.
Consider requirements for circulation space to allow the movement of patients onto equipment using hoists.

MANAGEMENT OF SCOPES

Scopes should not be processed in the Medical Imaging Unit but rinsed and returned to the SSU or Endoscopy Unit for processing in accordance with the guidelines of the Gastroenterological Nurses College of Australia (GENCA).
Also see:

- Taylor, A. (Chair) et al, 2010, Infection Control in Endoscopy; and
- Ellard, K. et al, 2006, Standards for Endoscopic Facilities and Services (3rd Ed).

PATIENT TRANSPORT

Planning to determine whether the Unit will have its own dedicated porter service or will use a central porter service.
In addition to circulation space, provide space for trolleys and beds in Medical Imaging Units in close proximity to the imaging rooms.
Storage and charging of powered bed movers requires additional space considerations.

PROVISION OF X-RAY VIEWING BOXES

Even if the hospital has PACS, there is likely to be a need to view old x-ray films retained for historical and research purposes or for films produced outside the hospital.
Increasingly, health services may substitute multiple fixed x-ray viewing boxes with mobile viewing boxes. This solution will continue to provide access but it can be shared across multiple services.

STAFFING

A staff establishment should be developed early in the planning process in order to assess the staff offices, workstations and amenities that would support the service requirements.
Staffing levels and mix depend on the size and configuration of the Unit, service profile, clinical needs, patient profile and staff availability. This HPU does not advise on staffing levels.

STAFF ESTABLISHMENT

Staffing may include:

- radiologists – full time, part time and visiting including. Clinical Director;
- radiology registrars and residents;
- radiographers – chief radiographer, radiographers and trainees;
- image technologists / practitioners;
- sonographers;
- physicists;
- engineers;
- nursing staff including nursing unit manager, clinical nurse consultant, nursing educators;
- PACS administrative support staff;
- porters; and
- clerical staff and secretaries.

02.03 Planning Models

GENERAL PRINCIPLES

The operational model chosen for the HPU will greatly influence the planning model adopted.

LOCATION

A centrally located, ground floor position is well supported for medical imaging, adjacent to the ED. It must be easily accessible for ambulatory patients and inpatients with identified routes of travel to remove old and install new equipment.

Locate the unit to ensure that transfer of inpatients and ambulance patients through public areas is avoided particularly those who are critically ill or severely traumatised.

If modalities such as angiography, CT, MRI are not located on the ground floor, a lift capable of transporting heavy, bulky equipment to the allocated space is required.

TRAFFIC FLOW

Direct horizontal or vertical access should be achieved between the Medical Imaging Unit and the ED 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 Imaging and Orthopaedics, Ambulatory Care Centres, Radiotherapy / Nuclear Medicine (where applicable). Patients will also move between the Medical Imaging Unit and Intensive Care and Coronary Care units. Appropriate routes need to be established to manage these patient flows.

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 ('loose fit') - (Rostenberg 2006).

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

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 the work flows and avoid junctions and bottle necks. Lean thinking theories support separation of the work flows of 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 ED, Operating Unit, ICU or Ambulatory Care Unit (outpatient clinics).

02.04 Functional Areas

FUNCTIONAL ZONES

The Medical Imaging Unit will consist of the following functional zones depending on operational policies and service demand:

- reception, waiting, amenities for ambulatory patients and visitors, clerical / administrative areas (typing, bookings);
- imaging rooms with access to patient change areas and toilets;
- image acquisition / processing workrooms (CR/DR processing, sonographer work space);
- viewing and reporting areas;
- PACS storage and work areas;
- clinical support areas including interview rooms, laser print room, preparation areas, storage, disposal and utility rooms;
- patient holding / recovery;
- film storage and film library; and
- staff office space and amenities including Staff Room, Change Rooms, Toilets, Meeting Rooms.

RECEPTION / WAITING

The area should be easily identified, well-designed, user-friendly and oversight the entry and waiting areas. A Child Play area may be included and access to public and accessible toilets is required.

The reception desk should be designed to assist in maintaining patient privacy while personal information is being exchanged.

Waiting should be restricted to ambulatory and wheelchair outpatients only and visitors; there should be no patients on beds / trolleys.

In large units, it may be preferable to limit the numbers of patients at the "front" and direct them to sub-waiting areas once patients have registered.

Seating considerations would include provision for patients with mobility issues, bariatric patients, ambulant patients and wheelchairs with access to power for recharging of electric wheelchairs. If this reception is used for nuclear medicine patients, a separate seating area is needed for patient waiting after isotope injections. Approximately one third of available seating should have arms and seat height of 500mm to allow patients with some disability (e.g. hip replacement) to get out of the seat easily. Some larger seats should be provided for bariatric patients.

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

Optional arrangements for change areas include:

- two dedicated cubicles per imaging room opening directly into that room; or
- a bank of cubicles located adjacent to the imaging rooms but not opening directly into the rooms. This option may be supported by a bank of lockers and separate male and female "changed" waiting areas so that patients are not confined to a cubicle. This latter option allows for more flexibility for wheelchair access and more efficient management of clean and soiled linen and call systems.

There is a need for a toilet attached to screening rooms and US rooms.

INTERVIEW / CONSULTATION ROOM(S)
Some rooms are required for patient assessment by medical and technical staff, procedure information and consents. These rooms should be readily accessible from reporting areas and imaging suites.

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

- general and screening rooms;
- US and mammography (and often CT);
- CT;
- interventional (DSA & Angiography); and
- MRI (and CT).

Each modality will be supported by a range of rooms as required, on a dedicated or shared basis as is most appropriate e.g. computer rooms, work / processing rooms, reporting rooms, preparation rooms, clean and dirty utilities and patient holding/recovery bays.

IMAGE ACQUISITION / PROCESSING WORKROOMS
Workrooms for processing and analysing images, documenting and communicating findings will be required for CR and/or DR x-ray systems (general x-ray) and ultrasound.

Where CR is used, one CR unit per two general rooms, centrally located and situated close to the x-ray rooms would generally be recommended.

The importing of images from other providers is increasingly required for analysis and hospital treatment of patients imaged elsewhere. Local operational policy and guidelines may require the provision of a film digitiser and a CD importing devise.

Although the provision of hard copy films is in decline they may still be required for some services. The provision of images on CD or DVD is increasingly being utilised in Medical Imaging Units. Many units now see the provision of a laser printer and a CD/DVD Burning device as a standard equipment provision to support this process.

VIEWING AND REPORTING ROOMS
Increasingly, reporting is usually via "soft copy" reading using high resolution viewing monitors. Traditional x-ray viewers are now rarely used.

Reporting stations need to be central with easy access from imaging suites (particularly US, CT, MRI).

Design of reporting areas should be conducive to productivity, comfort and efficiency with control of environmental conditions i.e. lighting, noise levels etc. – ideally individually at each reporting station.

The majority of current PACS workstations operate as standard in a three monitor configuration – with two image monitors and one text monitor with patient and RISs (PIS and RIS). Dictating equipment will also be required, possibly using voice recognition software that needs to be isolated from ambient noise.

It is also useful to consider how workstation monitors are mounted. The use of "pole" type supports that lift the monitors above the bench/desk and free up desk-space otherwise taken by the monitor stand should be considered. The reporting environment would meet OHS standards for the range of reporting postures.

If staff with dedicated offices wish to undertake reporting in their offices, they will require two viewing monitors to give better clarity for more accurate diagnosis, dimmable lighting etc.

Staff in shared offices and visiting medical staff need access to reporting stations.

PACS STORAGE AND WORK AREA

The PACS rooms will require adequate air conditioning and temperature sensors to address the heat load generation.

Some vendors / 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.

SUPPORT AREAS

Pathology Work Areas

Required in close proximity to areas performing interventional procedures such as biopsies and drainages. These include CT, US and mammography.

Equipment Storage

Required for storage of specialist equipment that may be infrequently used e.g. specialised chairs for speech pathology barium swallows, stands and supports for orthopaedic procedures.

Clean Utility

Provides a working stock of drugs and sterile supplies.

Bulk Storage

Additional bulk storage should be provided for pre-prepared contrast media that is supplied in bulk quantities, syringes for example.

Dirty Utility Room

Size and number required depends on the number and types of imaging modalities in the Unit. Their placement should minimise staff travel distances and take into account areas most likely to require a dirty utility e.g. screening room (fluoroscopy), patient holding / recovery.

Resuscitation Trolley Bays

In large units, more than one trolley is needed. Define trolley bay locations which may include the angiography, MRI, and recovery.

Disposal Room

Large amounts of recyclable plastics, glass, paper and cardboard are generated by Medical Imaging Units. Appropriate recycling facilities should be available throughout the department as well as bulk storage of waste and recycling.

PATIENT HOLDING / RECOVERY AREAS

There is a need for a patient holding / recovery area including nursing supervision and support areas located centrally to the imaging rooms. This provides a suitable area for ambulant patients requiring preparations prior to procedures e.g. CT, as well as an observation area for patients who have undergone an interventional imaging procedure and are recovering from anaesthesia / sedation. Some patients may be in the unit for periods of up to four hours during the course of an examination or series of examinations.

The number of holding bays required depends on the number and mix of imaging modalities. There should be a minimum of two bed spaces per interventional room for routine purposes. A CT room requires an allocation of three bed spaces. MRI bed spaces may be located separately, within the MRI suite or patients may wait in the main holding area for patients awaiting discharge or transfer back to inpatient units, other hospitals and or residential aged care facilitys.

FILM STORAGE AND FILM LIBRARY

Hard copy storage requires a room with static shelving and should ideally be located near the main Reception/Clerical Area for ease of retrieval. Size depends on operational policy re: culling, retention, destruction and archiving and may be progressively reduced as films are culled or digitised as per local operational policies. Provide for retention of hard film in accordance with each jurisdiction's retention and storage legislation.

Storage for archived film may be required. It may be outside the Medical Imaging Unit, and should be properly secured by an appropriate electronic management system to protect films against loss or damage. Film to be retained for teaching and research purposes may be housed in a Film Library.

STAFF OFFICES AND AMENITIES

A modest number of offices will be provided to Unit Managers (Director, Chief Radiologist, Chief Radiographer, Nursing Unit Manager) in accordance with relevant jurisdictional office accommodation policy. Other office space for specialists, registrars, VMOs, clerical officers, IT support etc., will be configured as workstations. Note that these areas are in addition to dedicated viewing and reporting rooms. The number of workstations will be determined by the staff profile. Desks may not necessarily be allocated.

A staff room, change facilities, property bay, toilets will be provided. Sizing of these areas should be adjusted to cater for the staff profile.

Meeting rooms are provided for teaching and administrative functions.

02.05 Functional Relationships

EXTERNAL

The Medical Imaging Unit has a range of functional relationships with other services.
Ensure ready access to:

- ED; and
- Ambulatory Care areas - particularly orthopaedic and surgical clinics.

Provide effective horizontal or vertical links between Medical Imaging Unit and:

- ICU / CCU;
- Surgical / Orthopaedic Inpatient Units;
- Radiotherapy / Nuclear Medicine where applicable;
- Pathology; and
- transport arrival points.

INTERNAL

Planning of the HPU is complex and requires the correct relationships to be achieved between the functional zones listed previously.

The Central Reception Area should feed into change, sub-wait and patient holding / recovery areas, in which patients prepare for their examination. These areas should not be visible from reception.

Examination and procedural imaging rooms will be grouped by modality with their specific support areas immediately adjacent. Some support areas may be shared between modalities, utilisation requirements and functional relationships permitting e.g. utilities, linen bays, toilets, holding bays, reporting areas etc. Appropriate sharing of spaces is encouraged. Typical groupings of modalities are discussed in Section 02.01 Operational Models. Rooms in which procedural work is undertaken should have appropriate access routes to recovery areas.

Staff offices and a central reporting area should be located away from areas of high clinical activity and not be accessible by patients. Staff amenities will be used by all staff, but change facilities are most likely to be accessed by staff involved in procedural imaging.

Support areas should be located centrally to imaging areas and require access for delivery of bulk supplies and removal of waste.

Consider the proximity of 24-hour and eight-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.

02.06 Imaging Modalities

The following sections provide a brief description of the modalities addressed in this HPU.

GENERAL RADIOLOGY

General radiology may encompass conventional analogue image acquisition, CR (CR) or direct (digital) radiography (DR), or any combination of same if the unit is not fully digitised.

Tomography may still be performed in small centres but in general, tomography is no longer performed. Where volumes are low, an OPG unit may be added to the general room equipment. This necessitates identification of a position for the OPG unit when planning the room.

Each room is likely to contain an upright bucky stand and control area. Ensure that the position of the control cubicle enables visual observation of the patient for all modalities.

If an imaging service is not also provided in the Emergency Unit, ensuring that imaging rooms are accessible for the management of patients from ED when calculating the number of rooms required in an imaging unit. All rooms require bed access and at least one room should have access to equipment to manage bariatric patients.

COMPUTERISED TOMOGRAPHY (CT SCANNING)

CT is increasingly being used instead of plain x-rays in clinical situations such as cervical spine trauma and abdominal pain and 'virtual. (Fajardo 2006).

In larger Medical Imaging Units, one CT room should be sized to allow for interventional procedures and serviced for general anaesthesia.

A Control Room may service two or more rooms if well designed. Access to space for the preparation for set-up and review of biopsy slides.

Access for beds and trolleys holding and recovery of patients requires consideration for this clinical service speciality. Consideration needs to be given to support equipment – chillers, computer equipment etc. required with mega slice scanners e.g. 256 or 320 slice.

Also see Fajardo, L.L., et al, 2006, Business Plan to Establish a CT Colonography Service.

DENTAL / ORAL RADIOLOGY

There will be a range of procedures to supporting dental, trauma and facio-maxillary services.

Wall-mounted intra-oral x-ray units in Dental Surgeries are addressed in HPU 280 – Oral Health Unit. Units supporting facio-maxillary service, with/without cephalometry include OPG (OPG), a method of obtaining films of the upper and lower teeth-bearing jaws. Utilisation patterns and the clinical services provided determine whether it can be incorporated into a General Room or whether it needs its own dedicated space.

The use of OPG should also consider the inclusion of a Lateral Cephalometric Unit (facio-maxillary). For specialised facial / dental panoramic imaging services, the use of Cone Beam CT is becoming increasingly popular and should be considered.

MAMMOGRAPHY

Diagnostic mammography, as opposed to screening, is usually provided if the healthcare facility provides a breast service (clinics, surgery etc).

The Mammography Room should be sized to support a QA process being undertaken, bed access and the need for prone positioning for some biopsy procedures. All rooms should be sized for procedural work. The room should be located adjacent or with ready access to an US Room for fine needle biopsies.

Change Rooms should be discreet and access to an Interview Room.

It is unlikely that a general hospital will house a screening service as part of BreastScreen Australia but there may be exceptions. This needs to be ascertained as it may affect facility requirements and functional relationships.

DIGITAL CHEST UNIT

Digital chest screening is the modality of choice for a major healthcare facility with a high volume chest imaging component or where a formal chest screening service is part of the service profile.

ULTRASONOGRAPHY

Sonography is a non-invasive imaging modality that is useful in many areas of medicine including surgery, obstetrics, cardiology (echocardiography) and vascular. In the latter two specialties, the work may be done

in specialty units or may be provided in an integrated unit as part of an Ambulatory Care Centre. They are rarely part of a Medical Imaging Unit.

One US room should be sized to allow for interventional procedures with bed access. Piped gases and suction should be installed, coupled with access to piped or bottled anaesthetic. The provision of access to a preparation area for set-up and review of biopsy slides etc would support this service. This may be combined with a Mammography Preparation Area.

Access to a toilet and drinking water is required as procedures often require the patient to have a full bladder.

When planning an US unit, care should be taken over its proximity to the fringe field of an MRI scanner, as fields as low as 0.5 Gauss may upset the functioning of the ultrasound.

FLUOROSCOPY (ALSO KNOWN AS RADIOSCOPY)

The functions of the Screening (Fluoroscopy) Room involve the administration to the patient of a contrast media which outlines an organ or system, and subsequent radiological examination utilising fluoroscopic equipment.

Procedures may be general or specialised. With the general decline in use of barium contrast studies and advances in equipment technology, general screening and angiography may sometimes be appropriately combined in one room.

Provide facilities for barium preparation and a toilet / shower. For maximum flexibility, the latter should be able to be accessed from both inside the room and from the external corridor.

The room should have piped oxygen and suction points that would also support general anaesthesia, although mobile anaesthetic trolleys may be most appropriate unless large volumes of paediatric patients are expected.

DIGITAL SUBTRACTION ANGIOGRAPHY

DSA enables a full spectrum of vascular and non-vascular procedures including angiography, angioplasty, arterial and venous stents, biopsy and drainage procedures, and biliary and urologic procedures.

Simple angiography involves injection of a radiographic contrast agent into a blood vessel so that vascular structures are enhanced and revealed together with surrounding bony and soft tissue structures. It is used for simple peripheral studies and can be done on a fluoroscopy table.

With DSA, a contrast agent is administered directly, via a catheter, into an artery close to the area to be examined. The subtraction of a pre-contrast mask suppresses interfering structures from the image so that the arteries become clearly defined.

A bi-pane unit for neurological procedures may require a larger room.

Adequate additional storage space is required in the immediate vicinity for catheters and other medical stock. The room should be able to support the use of anaesthesia.

Refer to Part D Infection Prevention and Control for scrub sink requirements.

MAGNETIC RESONANCE IMAGING

MRI encompasses a range of magnetic field strength units that operate in restricted areas. Consider this in planning the unit to ensure strict adherence to identified safety precautions. With MRI utilisation continuing to increase, consider future inclusion and expansion of such units when planning a facility.

Children and patients who may be claustrophobic may require anaesthesia or sedation. This may be administered in the adjoining preparation room.

Careful consideration of the position of the MRI is required in order to minimise the shielding required (and the related cost) i.e. do not locate a helipad above it or locate the MRI next to a sub-station or lift well.

MRI requires its own suite for access control and protection of/from the magnet (fringe field), and preparation/nursing support areas. It needs ready access to a small interview room for patient consents and explanations. Storage is required for MRI compatible (non-ferrous) equipment and lockers for patients' property that may interfere with or be damaged by the magnet such as credit cards and keys.

Design considerations should also include:

- floor / slab structurally capable of carrying the weight of the MRI;
- good external access for the installation of the MRI. This may be less expensive if done through a removable side panel rather than dismantling the RF shielded door;
- room size / shape should be able to contain the five Gauss magnetic field with the room;
- access control designed in, so that the four zones of control are accommodated, with only authorised staff entering the MRI room;
- other moving ferrous objects which can interfere are lifts, cars moving through car parks, construction sites; and

- need to ensure that emergency equipment such as fire extinguishers and medical gas bottles in the vicinity are not made of magnetic iron.

The safety zones as described within American College of Radiologists white paper should be considered when designing access to ensure only authorised staff enter the MRI room (ACR 2007).
MRI has unique radiofrequency (RF) shielding requirements essential to create a "quiet" RF environment. Additional and separate magnetic shielding may be required to contain the magnetic fields. It should be noted that magnetic shielding design is best provided by the vendor as it is usually quite specific to the particular machine. Allowance for such design should be included in the installation budget. The mandatory requirement for RF shielding should be in the design considerations and to clearly distinguish between this requirement and any additional structural magnetic shielding that may be required. Ensure that all ancillary medical devices are MRI compatible i.e. of non-ferrous material (ACR 2007).
Also see:

- Amis,E.S et al, 2007, Radiation Dose in Medicine;
- Herrmann, T.L. et al, 2012, Best Practices in Digital Radiography; and
- Barkovich, A.J. et al, 2004, Magnetic Resonance (MR) Safety, Combined Papers of 2002 and 2004.

ENDOSCOPIC RETROGRADE CHOLEOPANCREATOGRAPHY (ERCP)
ERCP Units are typically part of a Day Surgery complex, or Endoscopy suite if this is located separate from Day Theatres. These services are generally supported by Medical Imaging for staffing and equipment management.

MOBILE IMAGING EQUIPMENT
Mobile units may include general x-ray units, image intensifiers or US units.
Their use and provision should be defined in the Service Plan / Functional Brief as their size, storage needs and mobility will impact on space needs and staffing to support a mobile service.
General units can be parked in the Medical Imaging Unit for deployment around the facility. Some dedicated units may be allocated for:

- Operating Unit - general and image intensifier;
- NICU - general and US II;
- ICU - general and US II; and
- ED - general (if no satellite) and ultrasound.

Locations need to be determined so that the appropriate parking bays, fittings, protective aprons, power etc. can be provided in outlying units.
It is expected that images are digital or CR system and therefore available on the PACS system, so no processing facilities should be required - in the Operating Unit for example. However these units may require viewing stations for better clarity of images.
Although there are no radiation screening requirements and they are identified currently ALARA principles are appropriate for inpatient mobile x-ray services including use of distance as a screen, mobile screens, and lead aprons.

COMPUTED AND DIGITAL RADIOGRAPHY (CR & DR)
Computed radiology is replacing traditional film processing as a means of capturing an image. Cassettes are still used but viewing is done on a CR viewing monitor and the image can be enhanced by the operator to capture the best image before being stored onto the PACS network for reporting.
CR does away with the use of cassettes altogether and images appear directly onto the workstation monitor and allow manipulation of the images.
Hard copy film brought in by a patient may be digitised and stored onto the network and as images can be viewed from any computer with the necessary authorised access there is no need for traditional x-ray viewing boxes. However, it may be appropriate to locate a viewing box in the Ambulatory Care Centre for use until such time as the films can be digitised.

03 DESIGN

03.01 Accessibility

ENTRIES
Provide only one point of access to the Unit for outpatients and visitors to the Unit that can be overseen by Reception. A shop front entrance may be highly attractive to outpatients in a competitive market environment.
Wherever possible there should be separate discreet entry for patients on beds / trolleys from the ED, ICU, inpatient units, ambulance and hospital transport service to provide privacy for inpatients away from public scrutiny and to optimise workflows. This entry may also serve as a dedicated staff access particularly for staff movements to and from outlying units and after hours.
Consider the most appropriate means of entry for outpatients brought in by ambulance e.g. from a residential aged care facility.
Address access requirement for large equipment and determine a "back-of-house" access for supplies delivery and waste removal.

03.02 Parking

Visitors will use public car parks with access to drop-off and disabled car spaces.
Short term parking may be required for patient transport vehicles.
For staff parking, refer to Part C, Section 790 for further information.

03.03 Disaster Planning

Each unit will have operational plans and policies detailing the response to a range of internal and external emergency situations.
Consider issues such as the placement of emergency alarms, the need for emergency or UPS to essential clinical equipment / imaging machines, electronic sensor taps, services such as emergency lighting, telephones, duress alarm systems and computers and the emergency evacuation of patients, many of whom will require assistance.
In addition to imaging equipment, items such as duress alarms and central computer require connection to an uninterrupted power supply and a generator to provide continuous power between the time of power failure and the time it takes the generator to kick in - otherwise systems have to be re-set and/or don't function during a power failure - the importance of a UPS may not be appreciated during procurement / construction.
Refer to Part B, HPU 80 (General Requirements) and Part C (Design for Access, Mobility, OHS and Security) for further information.
The following should be considered in the design of emergency equipment, systems and procedures:

- should be designed to facilitate orderly shutdown of information systems to protect against data loss;
- fire suppression should be provided in data centres; and
- digital records should not only be backed up on site, but also remotely for added security to provide service redundancy.

03.04 Infection Control

GENERAL
The following aspects of planning and design contribute to the implementation of effective infection prevention and control measures and are relevant within the context of this HPU:

- hand hygiene facilities;
- linen handling;

- separation of clean and dirty work flows;
- storage;
- waste management; and
- surface finishes.

Refer to Part D and to individual jurisdiction policies and guidelines.
Provide hand wash basins in all imaging rooms and clinical support areas.
Consider the provision of a segregated waiting space for known infectious patients.

03.05 Environmental Considerations

ACOUSTICS
Ensure acoustic privacy of all imaging rooms, interview rooms, patient reception and especially in reporting areas.

NATURAL LIGHT
Although imaging rooms are usually windowless, attempt to provide natural light wherever possible as it contributes to a sense of wellbeing and minimises the stress of the unknown or a potentially uncomfortable or painful procedure.
In staff areas, the Staff Rooms and offices provide access to natural light and also, preferably, a pleasant outlook.

TEMPERATURE AND HUMIDITY
Control of heat and humidity is critical in equipment/computer areas. As the heat load for equipment is high, provision of individual heat sensors for each of the above areas can assist with room temperature regulation.
Given the large diversity of heat outputs from imaging equipment, individual room temperature control may be easier with multiple small air conditioner units rather than a few large capacity ones.
Refer to manufacturer's specifications for technological requirements of equipment.
Also consider patient comfort particularly if uncovered during an investigation.

PRIVACY
Provide visual privacy for patients, particularly where they are unclothed in rooms and waiting spaces.
Consider locations of privacy screens.
Ensure acoustic privacy to protect the confidentiality of patient conditions/discussions and instruction regarding examinations.
Discrete sub-waiting areas could be provided as necessary for patients wishing or needing to be separated.

INTERIOR DESIGN
Despite its clearly technical nature, where possible avoid a sterile clinical environment by judicious use of colour, furnishings and artwork.

SIGNAGE
The orientation of people to and within healthcare facilities, and even safety and security issues are greatly assisted or hampered by the quality and location of signage which may be directional, used as a means of identification and/or statutory.
All signage should be easily understood by staff and the general public whether patients or visitors, and where necessary and 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.
Also see Department of Health, NSW, 2009, Technical Series 2 - Wayfinding for Health Facilities.

03.06 Space Standards and Components

ROOM SIZES AND CONFIGURATION
Imaging rooms should be sized and proportioned - usually rectangular - to suit the equipment to be installed, provide a safe working environment and allow the 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.

For maximum flexibility, all rooms should enable bed/trolley access so that bed patients do not have to wait for the appropriate room.

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 Part C – Section 730 – Human Engineering in addition to OHS related guidelines.

ERGONOMICS

Design and build in such a way that patients, staff, visitors and maintenance personnel are not exposed to avoidable risks of injury.

Badly designed recurring elements such as height, depth and design of workstations and counters, shelving and the layout of critical rooms have a great impact on the OHS of staff as well as the welfare of patients. Inherent in this is the capacity to safely treat bariatric patients.

Refer to Part C Section 730.12 under Access and Mobility for more details.

ACCESS AND MOBILITY

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

Refer to Part C – Design for Access, Mobility, OHS and Security - Section 730 for details.

Also see Standards Australia, 2010, AS 1428 (Set)-2010 Design for access and mobility Set (SAI Global).

BUILDING ELEMENTS

Building elements include walls, floors, ceilings, doors, windows and corridors and are addressed in detail in Part C – Section 710 - Space Standards and Dimensions.

Special consideration should be given to the width and height of doorways to ensure delivery and removal of equipment is not impeded or prevented and that patient trolley and bed movement is not hampered.

Where windows are provided in imaging rooms, they should be fitted with operator controlled screening and be radiation shielded where necessary.

Refer Part C for information.

03.07 Safety and Security

RISK / HAZARD MANAGEMENT

Consideration of safety and security risks should begin during the planning and design phase of a healthcare facility and should continue to be considered during the construction, use and post occupancy stages.

By adopting a risk management approach, many safety and security related hazards can be eliminated or minimised at the planning stage before work even begins, reducing the likelihood of adverse incidents occurring.

OHS or similar legislation requires planners and designers to identify, assess and control risks and to do this in consultation with stakeholders, including staff.

Also refer to:

- Part C, Section 790 – Safety and Security Precautions; and
- Standards Australia, 2009, AS/NZS 3100:2009 Approval and Test Specification - General Requirements for Electrical Equipment (SAI Global).

SAFETY

Enhance safety through design, the methods of construction and use of materials, and also through choice of the fittings, fixtures and equipment.

Consider the following specific safety issues:

- exposure to radiation and other chemicals;
- manual handling from trolley to table and vice versa;
- after-hours isolation; and

- risks associated with the MRI magnetic field.

Locate "in-use" warning lights outside all imaging rooms. These may be manual or automatic operation. For OHS reasons, consider installing ceiling-mounted lifters in rooms dealing with non-ambulant patients. Refer to

- local OHS legistlation;
- Part C for further information; and
- Environmental Protection Authority for radiation safety standards.

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
- patients' property - own locker or use of basket that stays with the patient during examination.

Also refer to:

- Section 5, Security Systems of TS11- Engineering Services & Sustainable Development Guidelines; and
- Department of Health, NSW, 2013, Technical Series TS11 - Engineering Services & Sustainable Development Guidelines.

RADIATION SAFETY AND PROTECTION
For radiation safety and protection refer to references noted at clause 440.005.010.
Note that many elements of radiation safety requirements are regulatory in nature and not subject to physical design considerations. However planners need to be aware of the various regulations.
Also see:

- NSW Government, 2003, Radiation Control Regulation 2003 (under the Radiation Control Act 1990);
- Queensland Government, 2010, Radiation Safety Standard HR003;
- Queensland Government, 1999, Radiation Safety Regulation 1999; and
- Amis,E.S et al, 2007, Radiation Dose in Medicine.

03.08 Finishes

GENERAL
Finishes in this context refers to walls, floors, windows and ceilings.
Also see Australasian Health Infrastructure Alliance (AHIA), 2010, Part C - Design for Access, Mobility, OHS and Security, Space Standards and Dimensions.

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.

CEILINGS
See Part C of the Guidelines for more information.
Also see Australasian Health Infrastructure Alliance (AHIA), 2010, Part C - Design for Access, Mobility, OHS and Security, Space Standards and Dimensions.

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.

03.09 Fixtures, Fittings & Equipment

Refer to :
Part C, Section 710; and
Room Data Sheets (RDS) and Room Layout Sheets (RLS).

03.10 Building Service Requirements

GENERAL
Each piece of imaging equipment has specifications for optimal installation advised by the manufacturer. These specifications should be reviewed for each equipment item selected to ensure the general building services requirements support optimal installation.
In addition to topics addressed below, refer to Part E of the Guidelines and TS11 Section 5 (Security Systems).
Also see:

- Department of Health, NSW, 2013, Technical Series TS11 - Engineering Services & Sustainable Development Guidelines; and
- AusHFG Part E: Building Services and Environmental Design.

CONSTRUCTION
In terms of construction, address the following requirements:

- provide door entry width and heights and corridor widths to enable the removal of old equipment and the delivery and installation of new equipment in the future;
- ensure that floor structures meet load requirements for equipment, patients and personnel;
- ensure that no conduits are laid in the vicinity of expected core holes;
- provide cable trays, ducts or conduits in floors, walls and ceilings as required for equipment installation;
- ensure that ceiling heights suit the equipment, but should not be less than 3000 mm - for ceiling tube mount installations;
- ensure air-conditioning is able to manage the heat loads of the equipment being installed;
- provide properly designed, rigid support structures located above the finished ceiling for ceiling-mounted equipment needs;
- ensure that the range of movement for ceiling suspended x-ray tubes is sufficient to cover patients on mobile trolleys;
- consider a unistrut or equivalent ceiling for ease of installation, service and remodelling;
- design lighting so that it does not obstruct ceiling-mounted tube stands;
- preference for dimmable lighting in imaging rooms and reporting rooms; and
- design x-ray control screens so that they do not obstruct equipment positioning and ceiling-mounted tube stands.

The above ceiling space requirements are important given the quantity of equipment to be accommodated. This includes air conditioning, vents, cable runs, plumbing, unistruts for x-ray gantries etc.
X-ray control screens should be full ceiling height to facilitate the running of data cables to the control bench.

RADIATION PROTECTION
Medical imaging (ionising) equipment requires radiation protection. Plans and specifications should be assessed by a Radiation Services consultancy and reviewed by an Accredited Consultant Radiation Expert (CRE).
The radiation protection assessment specifies the type, location and amount of radiation protection required according to final equipment selection and layout.
Incorporate radiation protection requirements into the final specifications and the building plans. Radiation signage is required at the door entry.

AIR HANDLING SYSTEMS
Provide separate air conditioning systems to control rooms to accommodate fluctuating air conditioning equipment loads.

Carefully consider 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 conditioning system operation.

CALL SYSTEMS

Systems comprise:

- nurse call located in or near change cubicles, patient-use toilets and showers and at every holding/recovery bay;
- staff assist and emergency call - in every imaging room, in the Holding/Recovery area and corridor/s;
- duress systems, both fixed and mobile; and
- a call button / intercom system - for occasions when reception is unattended.

Locate enunciator panels in corridors for optimum viewing. These should be non-scrolling.
Consider exactly where calls are enunciated, particularly in times of reduced staffing such as night shift.

ELECTRICAL SERVICES

Provide three phase power for x-ray generating rooms for specific equipment needs.
Cardiac protect rooms that are intended, or may be utilised, for cardiac interventional procedures.
Body protect all other areas where patients may reasonably be expected to be connected to medical electrical equipment. This would include recovery areas, holding bays and all examination scanning and treatment rooms.

INFORMATION TECHNOLOGY AND COMMUNICATIONS

Systems may include:

- wireless technology;
- voice / data cabling for phones and computers;
- dictation system for reporting and / or voice recognition system;
- high speed network for digital and CR equipment;
- videoconferencing capacity / teleradiology;
- Patient (or Hospital) Information System (HIS);
- RIS ideally linked to the PIS;
- electronic medical records;
- picture archiving computer system (PACS);
- server rooms; and
- communication rooms / closets.

RADIOLOGY INFORMATICS

Imaging or Radiology Informatics replaces the term 'PACS' to reflect the importance of all ICT relevant to radiology e.g. PACS, RIS, CIS, HIS, individual electronic health record (IEHR), external access (teleradiology), information flows to support effective clinical workflows, etc.
A RIS (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 HIS (Hospital Information Systems) and is critical to efficient workflow to radiology practices.

MEDICAL GASES

Provide:

- oxygen and suction to all imaging rooms and holding / recovery bays;
- medical air, nitrous oxide (if used) and scavenging in all rooms where general anaesthesia is delivered;
- a medical gas alarm system within the Unit to alert staff to diminished capacity or potential failure, as well as to indicate the need to change gas bottles; and
- an MRI warning label fixed to all portable ferrous oxygen cylinders.

04 COMPONENTS OF THE UNIT

04.01 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* 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;

- *non-standard components* which are unique rooms that are usually service-specific and not common.

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

The current Standard Components can be found at: www.healthfacilityguidelines.com.au/standard-components

04.02 Non-Standard Components

BAY – DRINKING FOUNTAIN
Description and Function
Either a plumbed water cooler or a freestanding bottled water cooler, to enable patients requiring a full bladder for examinations to have a drink.

Location and Relationships
Located in the waiting area, but not immediately next to planned seating.

Considerations
A waste receptacle is required for disposal cups. Consider storage requirements of large water bottles, versus maintenance requirements on a plumbed water fountain.

CURRENT FILM STORAGE
Description and Function
A large store room for holding current films that have not been digitised or are too recent for culling. Shelving may be static or compactus, depending on the volume of films expected to be stored.

Location and Relationships
It is suggested that this area be located close to the Unit's main clerical areas, from which the films may be easily accessed.
Given that CR and DR imaging is gradually reducing the need for hard copy film storage, this area should be considered a soft expansion space for future modality requirements and planned accordingly.

Considerations
Compactus shelving is more space efficient than static shelving, however the weight of compactus shelving can be a OHS risk for staff.

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 Workbase 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.

TRANSPORT STAFF WORKBASE
Description and Function
This is an optional space. If provided, include linen supply, portable oxygen cylinder storage and bench / sink for wiping down trolleys. A larger space is needed at facilities with 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.

LASER PRINTING / DIGITISER ROOM
Description and Function
A room containing a laser printer for creating hard copy films of digital images, as well as a digitiser for converting hard copy films into digital images.

Location and Relationships
This room should be located in a central support area, in proximity to the clerical workroom.

Considerations
The suggested location for the digitiser is appropriate for infrequent image scanning. However, if the Unit plans a project to convert its collection of hard copy film to digital storage, the digitiser may be better located in the clerical workroom, if only temporarily.

SHOWER / TOILET ACCESSIBLE
Description and Function
An accessible toilet, enlarged by 1m2 to accommodate an emergency shower area for patients unexpectedly soiled as a result of a fluoroscopy examination.

Location and Relationships
Adjacent to the fluoroscopy screening room with dual access to the fluoroscopy room and the corridor. P

Considerations
A dual access locking system is required.

PATIENT LOCKER BAY
Description and Function
A locker area for secure storage of patient clothes / 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.

COMPUTED RADIOLOGY (CR) PROCESSING & VIEWING WORKROOM
Description and Function
A CR Processing and Viewing Workroom is required for a CR system.
In this room phosphor plates (cassettes) are processed and the image is viewed on a computer monitor. Radiographers can enhance the image before storing.

This workroom replaces Dark Room and Daylight functions for processing general films.

Location and Relationships
Locate immediately outside the General Radiology Rooms 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 multiplate 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 imaging room and workroom.

DIGITAL RADIOGRAPHY (DR) VIEWING WORKROOM
Description and Function
A DR Viewing Workroom is where radiographers can view and manipulate images. There is no requirement for equipment to process cassettes.

Location and Relationships
Locate immediately outside the General Radiology Rooms with access from each room.

Considerations
Provide temperature control and ventilation.
The following equipment for two radiographer workstations can service four general rooms:

- computers for entering patient information - one per workstation;
- monitors for viewing images - one per workstation; and
- storage for manuals.

REPORTING ROOMS (GENERIC REPORTING WORKSTATION DESCRIPTION FOR ALL DISCIPLINES)
Description and Function
Reporting workstations are for radiologists reporting on procedures using high resolution (LCD) monitors on which, unlike traditional x-ray viewers, images can be manipulated. A minimum of two linked monitors are required but occasionally four.
In addition to the reporting monitors, a dedicated computer is required for access to the PIS and a system for dictating reports.
In the future, these three functions may be integrated into a single computer system with appropriate software.

Location and Relationships
Provide ready access from the imaging rooms but in a quiet location. Several workstations may be located in the one room but cubicles need to be visually and acoustically separated.

Considerations
Ensure:

- ergonomic design of the workstation to accommodate the monitors;
- appropriate temperature control to minimise risk of equipment failure;
- adequate ventilation; and
- acoustic management to ensure quality of voice recordings.

For each cubicle provide individual temperature controls and dimmable lighting.

ULTRASOUND ROOM – PROCEDURES
Description and Function
An enlarged US room in which interventional procedures can be performed, including US guided insertion and placement of medical devices, and US guided biopsy. When not in use for interventional work, this room may be used for routine imaging.

Location and Relationships
The room should have an appropriate route to transfer patients to the designated recovery area post procedure.

Considerations
Full anaesthesia services should be provided, including piped oxygen, piped or bottled anaesthetic gases and a scavenging system.
The door way should be capable of accommodating a patient on a bed or trolley.

SONOGRAPHER WORKROOM
Description and Function
The Sonographer Workroom 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 occur in a separate, quiet area. Benching is required for workstation viewing.

Location and Relationships
The workroom should be located in close proximity to US rooms.

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

ULTRASOUND / MAMMOGRAPHY 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 the US and mammography services. The room may also be used for set up of US or mammogram interventional procedures.

Location and Relationships
This room has direct access to the mammography room and the reporting room.

Considerations
Provide sufficient bench space for relevant laboratory equipment.

COMPUTER ROOM (PACS SERVER ROOM, CT COMPUTER ROOM, ANGIOGRAPHY MACHINE ROOM, MRI COMPUTER ROOM)
Description and Function
Computer, machine or server rooms are required for PACS, CT, Angiography 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 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.

MRI SCANNING ROOM
Description and Function
This is a discrete room for MRI scanning which is part of the MRI suite including dedicated patient change, preparation and recovery, control room, reporting room and utility areas.
Useful references in planning MRI scanning rooms and related support areas are provided below.

Location and Relationships
The MRI suite is generally a discrete component within the imaging environment, although collocation with CT is appropriate if shielding is carefully planned.

Considerations
Design, install and fit out equipment and shielding in accordance with manufacturer's instructions.
Lead lining is not required. The room is enclosed in a RF shielded cage with RF shielded observation window and door. Ensure adequate magnetic fringe field for stronger magnets.
Fittings should be minimal and MRI safe. Provide non-ferrous equipment including resuscitation trolley.
An intercom system is essential to allow communication between the scanning room and control room.
Provide uninterruptible power supply. Provide quenching and safety equipment in case of malfunction or break-down.
Signage and protocols will be in place to inform patients and visitors of the risks associated with pacemakers, prostheses, credit cards, computer discs, watches etc. Consideration may be given to the installation of a metal detector.
Consider installing a music system in the scanning room to ease patient anxiety. Also see:

- United States Department of Veterans Affairs, 2008, TIL - Design Guides (PG-18-12);
- Department of Health, NHS Estates, 2001, Facilities for Diagnostic Imaging and Interventional Radiology; and
- Standards Australia, 2005, AS/NZS 3200.2.33:2005 Medical Electrical Equipment - Particular Requirements for Safety - Magnetic Resonance Equipment for Medical Diagnosis.

MRI CONTROL ROOM
Description and Function
The MRI scanner is remotely operated from the MRI control room. It will accommodate approximately three permanent staff plus visiting staff. It will contain MRI operating console, workstations, seating for permanent staff.

Location and Relationships
The MRI control room is immediately adjacent to the MRI scanning room, with an observation window that affords a clear view of the patient.

Considerations
Example layouts show where MRI and CT control rooms are adjacent, the MRI control room could be enlarged and integrated with the CT control.

FILM STUDY / LIBRARY
Description and Function
A quiet room in which staff may review historical films, review journals, assemble small teaching groups etc.
Functional requirements are 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.

STAFF CHANGE ROOM
Description and Function
Change, toilet, showering and locker facilities for staff working in Units with large interventional workload.
The size of change rooms should be adjusted according to the number of staff working in the Unit.

Location and Relationships
The Staff Change Room will be located in the staff only area. There should be easy access to interventional imaging rooms.
Consider whether change rooms can be shared with other Units.

AX APPENDICES

AX.01 Schedule of Accommodation

A Schedule of Accommodation follows for a Medical Imaging Unit

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.

All other rooms are non-standard and will need to be briefed using relevant functional and operational information provided in this HPU.

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.

ENTRY / RECEPTION / CLERICAL

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 Level 2	Qty x m2 Level 3	Qty x m2 Level 4	Qty x m2 Level 5	Qty x m2 Level 6	Remarks
WAIT-20	Waiting	Yes	Share	Share	1 x 20	1 x 35	1 x 45	1.2 m2 per seat, 1.5m2 for w/chair. Respectively 15, 25 & 35 seats/ wheelchairs
BWD-1	Bay - Water Dispenser	Yes			1 x 1	1 x 1	1 x 1	
BVM-3	Bay - Vending	Yes			1 x 3 (o)	1 x 3 (o)	1 x 3 (o)	
PLAP-10	Play Area - Paediatric, 10m2	Yes			1 x 10 (o)	1 x 10 (o)	1 x 10 (o)	4-5 places for children
WCAC	Toilet – Accessible, 6m2	Yes	Share	Share	1 x 5	1 x 5	1 x 5	Unless available nearby
WCPU-3	Toilet - Public, 3m2	Yes	Share	1 x 3	2 x 3	2 x 3	2 x 3	Unless available nearby
RECL-10	Reception / Clerical	Yes	Share	Share	1 x 10	1 x 12	1 x 12	1, 2 & 2 staff
OFF-3P	Office -Shared	Yes	Share	1 x 9	1 x 12	1 x 15	1 x 20	Clerical staff. May need larger area if they also combine booking system for the facility/AHS
	Current Film Storage		Share	1x30 (o)	1 x 50 (o)	1 x 70 (o)	1 x 100 (o)	Check need according to use of PACS and film management policy
CONS	Consult Room	Yes	Share	1 x 12	1 x 12	2 x 12	2 x 12	Number dependent on volumes and patient requirements
BMEQ-4	Bay - Mobile Equipment, 4m2	Yes	Share	1 x 4	2 x 4	3 x 4	4 x 4	For mobile units depending on policy re decentralising
	Trolley / Wheelchair Park		Share	1 x 5	1 x 6	1 x 10	1 x 12	Smaller area required if porter service provided by central Transport Unit
	Transport Staff Workbase		Share	Share	1 x 4 (o)	1 x 6 (o)	1 x 8 (o)	Not required if porter service provided by central Transport Unit.

Note: Transport Staff Workbase / Trolley Park if provided will need linen supply, portable oxygen cylinder storage and equipment to wipe down trolleys.

SUPPORT AREAS

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 Level 2	Qty x m2 Level 3	Qty x m2 Level 4	Qty x m2 Level 5	Qty x m2 Level 6	Remarks
CLRM-5	Cleaner's Room, 5m2	Yes	Share	Share	1 x 5			A separate cleaners room is scheduled for MRI if no collocated with Medical Imaging
	Laser Printing / Digitiser Room				1 x 6			This may be included as work space in the radiographers
	PACS Server Room			1 x 10	1 x 12			
STGN-9	Store - General	Yes		1 x 9	1 x 9			Bulk stock e.g. contrast media, CT syringes, bulk items related to patient care
STSS_12	Store – Sterile Stock, 12m2	Yes		1 x 12	1 x 12			Bulk clinical sterile stock
STGN-9	Store – General	Yes		1 x 9 (o)	1 x 9 (o)			Dependent on service/site storage management of hard film
STGN-9	Store – General	Yes		1 x 9 (o)	1 x 9 (o)			For optical discs
OFF-S9	Office – Single Person, 9m2	Yes		1 x 9 (o)	1 x 9 (o)			Optional. PACS Operations/Management Team
DISP-8	Disposal Room, 8m2	Yes	Share	1 x 8	1 x 8			

GENERAL X-RAY & FLUOROSCOPY (SCREENING)

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 Level 2	Qty x m2 Level 3	Qty x m2 Level 4	Qty x m2 Level 5	Qty x m2 Level 6	Remarks
GENXR	General X-Ray	Yes	1 x 35	1 x 35	2 x 35	3 x 35	4 x 35	Includes Control console space. Number of rooms adjusted to suit service plan
SCRN	Screening Room (Fluoroscopy)	Yes		1 x 36 (o)	1 x 36 (o)	1 x 36 (o)	1 x 36 (o)	Includes Control & area for contrast media prep. Number of rooms adjusted to suit service plan
ENS-ACC	Ensuite - Accessible			1 x 6	1 x 6	1 x 6	1 x 6	Dual access from fluoroscopy room and corridor
CHPT	Change Cubicle - Patient, 2m2	Yes	1 x 2	2 x 2	3 x 2	4 x 2	5 x 2	1 cubicle per imaging room. Less required if centralised
CHPT-D	Change Cubicle - Accessible, 4m2	Yes	1 x 4	2 x 4	3 x 4	4 x 4	5 x 4	1 cubicle per imaging room. Less required if centralised
WCPT	Toilet - Patient, 4m2	Yes			1 x 4	1 x 4	1 x 4	
WAIT-SUB	Waiting – Sub (For Centralised Cubicles)	Yes			2 x 5 (8 seats)	2 x 8 (10 seats)	2 x 10 (14 seats)	Required if Change Cubicles are centralised. Separate male & female patients.
	Patient Locker Bay (For Centralised Changed Waiting)				1 x 1 (o)	1 x 2 (o)	1 x 2 (o)	Operational process may be for patients to take clothes/possessions with them
PBTR-H-9	Patient Bay - Holding, 9m2	Yes		1 x 9	2 x 9			Recovery bays. For Level 5 & 6 refer to combined general nursing holding/recovery unit.
BLIN	Bay - Linen	Yes		1 x 2	1 x 2	1 x 2	2 x 2	
BPPE	Bay - PPE	Yes	1 x 0.5	2 x 0.5	3 x 0.5	4 x 0.5	5 x 0.5	Storage outside of modality room for Lead Apron
	Computed Radiography (CR) Processing Workroom			1 x 20	1 x 20	1 x 30	1 x 40	Adjacent to control rooms.
	Digital Radiography (Dr) Processing Workroom			1 x 16	1 x 24	1 x 30	1 x 40	For DR system – 8m2 per Imaging Room for equipment & workstations. Adjacent to control rooms
DTUR-10	Dirty Utility	Yes		1 x 10 (o)	1 x 10 (o)	1 x 10 (o)	1 x 12 (o)	Disposal of contrast media, dirty linen storage. May be shared with other modalities
BRES	Bay - Resuscitation	Yes			1 x 1.5 (o)	1 x 1.5	1 x 1.5	

ULTRASOUND AND MAMMOGRAPHY

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 Level 2	Qty x m2 Level 3	Qty x m2 Level 4	Qty x m2 Level 5	Qty x m2 Level 6	Remarks
WAIT-SUB	Waiting - Sub, 5m2	Yes		1 x 5	1 x 8	1 x 10	1 x 10	Size according to activity data. Assumed patients are waiting and are changed
	Patient Locker Bay (For Centralised Changed Waiting)				1 x 1 (o)	1 x 2 (o)	1 x 2 (o)	Operational process may be for patients to take clothes / possessions with them.
ULTR	Ultrasound	Yes		1 x 14 (o)	2 x 14	2 x 14	2 x 14	Number of rooms adjusted to suit service plan.
	Ultrasound - Procedures					1 x 20	1 x 24	For interventional procedures. Recovery from US procedures is recommended to be in the combined holding / nursing recovery area for all interventional imaging procedures.
CHPT	Change Cubicle - Patient, 2m2	Yes		1 x 2 (o)	1 x 2	2 x 2	2 x 2	Total 1 cubicle per US room (including accessible).
CHPT-D	Change Cubicle – Accessible, 4m2	Yes		1 x 4 (o)	1 x 4	1 x 4	1 x 4	Total 1 cubicle per US room.
DTUR-10	Sonographer Work Room			5.5	5.5	5.5	5.5	Per person. Benching. Minimum size 8m.
XRRR	X-Ray Viewing & Reporting Room			Use PACS reporting workstation	1 x 8	1 x 12	1 x 12	1 workstation per 2 rooms. Adjust size accordingly. Altrasound and Mammography.
MAMMO	Mammography	Yes			1 x 16	1 x16	1 x 16	Mammography room – Not all Units offer a mammography service. Inclusion of areas for mammography is subject to the service plan. Number of rooms adjusted to suit service plan.
CHPT	Change Cubicle - Patient, 2m2	Yes			1 x 2	1 x 2	1 x 2	Mammography room – Not all Units offer a mammography service. Inclusion of areas for mammography is subject to the service plan. Number of rooms adjusted to suit service plan.
CHPT-D	Change Cubicle – Accessible, 4m2	Yes			1 x 4	1 x 4	1 x 4	Total 2 cubicles per Mammography room.
	Ultrasound / Mammography Prep Room / Lab					1 x 10	1 x 10	Direct access to mammography and reporting rooms.

ANGIOGRAPHY / DSA

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 Level 2	Qty x m2 Level 3	Qty x m2 Level 4	Qty x m2 Level 5	Qty x m2 Level 6	Remarks
ANIN	Anaesthetic Induction Room	Yes			15 (o)	15 (o)	15 (o)	More common alternative is anaesthetic induction in the angiography room.
SCRB-6	Scrub-Up / Gowning, 6m2	Yes			1 x 6	1 x 6	1 x 6	2 scrub stations. May be shared between Angiography Rooms if design permits.
ANSS	Angiography Sterile Store / Set-Up Room	Yes			1 x 16	1 x 18	1 x 24	
ANPR	Angiography Room	Yes			55	55	55	Number of rooms adjusted to suit service plan. This is consistent with HPU 170 Cardiac Investigations Unit Angiography Room.
ANCRT	Angiography Control / Reporting Room	Yes			1 x 14	1 x 14	1 x 14	
	Computer Equipment / Machine Room				1 x 6	2 x 6	3 x 6	1 per Angiography Room. Refer to specifications for equipment type.
BPPE	Bay – PPE	Yes			0.5	0.5	0.5	No dependent on number of Angiography / DSA rooms. Accommodates lead aprons.
SDTUR-S	Dirty Utility – Sub, 8m2	Yes			1 x 8 (o)	1 x 8 (o)	1 x 8 (o)	May be shared with other modalities in smaller units. Not in level 5 & 6 services where instruments require cleaning prior to sterilising.
XRRR	X-Ray Viewing & Reporting Room	Yes			1 x 8	1 x 12	1 x 16	Adjust as necessary. Angiography
BRES	Bay - Resuscitation	Yes			1 x 5 (o)	1 x 5 (o)	1 x 5 (o)	May be shared with recovery areas recovery trolley.
BLIN	Bay – Linen	Yes			1 x 2 (o)	1 x 2 (o)	1 x 2 (o)	May access allocated linen trolleys.
STGN-8	Store - General, 8m2				1 x 8 (o)	1 x 8 (o)	1 x 8 (o)	If a stand-alone service only for films/ CDs/ videos – this can be shared space.

Note: Change facilities located in Patient Holding / Recovery or Day Surgery Unit as per operational policy.

CT SCANNING

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 Level 2	Qty x m2 Level 3	Qty x m2 Level 4	Qty x m2 Level 5	Qty x m2 Level 6	Remarks
CTPR	CT Scanning	Yes		1 x 45 (o)	1 x 45	2 x 45	2 x 45	Mammography room – Not all Units offer a mammography service. Inclusion of areas for mammography is subject to the service plan.
CTCR	CT Control Room	Yes		1 x 12	1 x 12			
CTCR	CT Control Room - Shared	Yes				1 x 20	1 x 24	
ANPR	CT Computer Room			1 x 10 (o)	1 x 10 (o)	2 x 10 (o)	2 x 10 (o)	Dependent on equipment selected.
XRRR	X-Ray Viewing & Reporting Room	Yes		1 x 9	1 x 9	1 x 9	1 x 9	One workstation per two CT Scanning Rooms.
CHPT-D	Change Cubicle - Accessible, 4m2	Yes		1 x 4	1 x 4	2 x 4	2 x 4	1 per CT room.
WAIT-SUB	Waiting	Yes		2 x 4 (6 seats)	2 x 5 (8 seats)	2 x 8 (10 seats)	2 x 8 (10 seats)	Optional. Shared for MRI and CT and provides male/female separation.
WCPT	Toilet - Patient, 4m2	Yes				1 x 4	1 x 4	
PBTR-H-6	Patient Bay - Holding, 6m2	Yes		1 x 6	1 x 6	2 x 6	2 x 6	1 outside each CT scanning 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	1 x 1	Shared between MRI and CT.
CLUR-8	Clean Utility – Sub, 8m2	Yes			1 x 8	1 x 8	1 x 8	May be shared by MRI and CT and other modalities.
DTUR-8	Dirty Utility – Sub, 8m2	Yes			1 x 8 (o)	1 x 8 (o)	1 x 8 (o)	May be shared with other modalities.
SCRB-6	Scrub-up/ Gowning, 6m2	Yes			1 x 6	1 x 6	1 x 6	2 stations. May be shared between rooms.
BHWS-B	Bay – Handwashing, Type B	Yes			1 x 1	1 x 1	1 x 1	Part of preparation area.

Note: CT Scanning Room - Size may be increased to contain computer cabinets thus eliminating need for separate computer room although this needs to be considered carefully due to the heat load produced by the CT Scanner and computer cabinets and the need for adequate air-conditioning.

MRI

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 Level 2	Qty x m2 Level 3	Qty x m2 Level 4	Qty x m2 Level 5	Qty x m2 Level 6	Remarks
ANIN	Anaesthetic Induction Room	Yes			1 x 15	1 x 15	1 x 15	Include small staff base/clean utility and 1 patient trolley/bed bay per room. Also used for recovery
BHWS-B	Bay – Handwashing, Type B	Yes			1 x 1	1 x 1	1 x 1	Part of preparation area.
	MRI Scanning Room				1 x 42	1 x 42	1 x 42	Size will depend on equipment selected.
	MRI Control Room				1 x 14	1 x 14	1 x 14	Must oversee and control entry into magnet room.
	MRI Computer Room				1 x 10	1 x 10	1 x 10	
	MRI Reporting Room				1 x 9	1 x 9	1 x 9	
CHPT	Change Cubicle - Patient, 2m2	Yes			1 x 2	1 x 2	1 x 2	
CHPT-D	Change Cubicle – Accessible, 4m2	Yes			1 x 4	1 x 4	1 x 4	
BLIN	Bay - Linen	Yes			1 x 2	1 x 2	1 x 2	Optional if stand-alone unit.
	Patient Locker Bay	Yes			1 x 1	1 x 1	1 x 1	
WAIT-SUB	Waiting - Sub, 5m2	Yes			1 x 5	1 x 5	1 x 5	
WCPT	Toilet - Patient, 4m2	Yes			1 x 4	1 x 4	1 x 4	
	Bay – Wheelchair Park/ Trolley Park				1 x 6	1 x 6	1 x 6	
BRES	Bay - Resuscitation	Yes			1 x 1.5	1 x 1.5	1 x 1.5	Non-ferrous construction
	Store - Dewar Tank				Remote areas only	Remote areas only	Remote areas only	Must provide easy access into MRI room for top-up using Dewar.

Note: One MRI room only assumed for the purposes of this HPU but may be a suite of two or more MRI rooms.

PATIENT HOLDING / RECOVERY

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 Level 2	Qty x m2 Level 3	Qty x m2 Level 4	Qty x m2 Level 5	Qty x m2 Level 6	Remarks
PBTR-H-9	Patient Bay - Holding, 9m2	Yes			9	9	9	At least two patient holding / recovery bays per interventional room are required (three bed spaces for CT), 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 Staff Station. They may be used for preparation
SSTN-10	Staff Station, 10m2	Yes			1 x 10	1 x 10	1 x 10	
CLUR-12	Clean Utility / Medication Room	Yes			1 x 10	1 x 10	1 x 10	
BLIN	Bay - Linen	Yes			1 x 2	1 x 2	1 x 2	
BRES	Bay - Resuscitation	Yes			1 x 1.5	1 x 1.5	1 x 1.5	
DTUR-S	Dirty Utility - Sub, 8m2	Yes			1 x 8	1 x 8	1 x 8	
STEQ-14	Store - Equipment	Yes			1 x 12	1 x 12	1 x 12	
	Discounted Circulation %				35%	35%	35%	

STAFF OFFICES AND REPORTING

| AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 Level 2	Qty x m2 Level 3	Qty x m2 Level 4	Qty x m2 Level 5	Qty x m2 Level 6	Remarks
OFF-S12	Office - Single Person, 12m2	Yes				1 x 12	1 x 12	Director
OFF-S9	Office - Single Person, 9m2	Yes	1 x 9	1 x 9	9	9	9	Chief Radiologist
OFF-S9	Office - Single Person, 9m2	Yes			1 x 9	1 x 9	1 x 9	Chief Radiographer
	PACS Reporting Workstation			5.5	5.5	5.5	5.5	Number of spaces as per staff establishment.
	Office - Workstation, 5.5m2					5.5	5.5	Number of spaces as per staff establishment.
OFF-S9	Office - Single Person, 9m2	Yes			1 x 9 (o)	1 x 9	1 x 9	NUM
	Office - Workstation, 5.5m2				5.5	5.5	5.5	Number of spaces as per staff establishment for Transcription
	Office - Workstation, 5.5m2				5.5	5.5	5.5	Number of spaces as per staff establishment for IT & Administration

Note: Offices / workstations will be based on Staff Establishment. Sizes based on NSW Health Directive - PD2005-576 - Office Accommodation.

STAFF AREAS

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 Level 2	Qty x m2 Level 3	Qty x m2 Level 4	Qty x m2 Level 5	Qty x m2 Level 6	Remarks
	Film Library / Study					1 x 20	1 x 20	5 places
SSPS-8	Store - Photocopy / Stationery, 8m2	Yes				1 x 8	1 x 8	
MEET-L-20	Meeting Room, 20m2	Yes				1 x 20	1 x 20	
MEET-L-30	Meeting Room, 30m2	Yes				1 x 30	2 x 30	Access to larger meeting room.
SRM-15	Staff Room	Yes			1 x 15	1 x 20	1 x 25	Depending on Staff Establishment. Shared staff room for small Units.
PROP-2	Property Bay - Staff	Yes			1 x 2			Numbers dependent on staff establishment.
SHST	Shower - Staff, 3m2	Yes	1 x 3 (o)	1 x 3 (o)	1 x 3 (o)			Numbers dependent on staff establishment.
WCST	Toilet - Staff, 3m2	Yes	2 x 3	2 x 3	2 x 3	3	3	No. dependent on peak staffing numbers. Easily accessible if main change rooms remote.
CHST-10	Change Room - Staff (Male / Female)	Yes				1 x 14	1 x 14	1 Shower, 2 WCs plus lockers. Required for facilities with high interventional workload.

AX.02 Functional Relationships / Diagrams

The following diagram sets out the relationships between zones in Front of House:
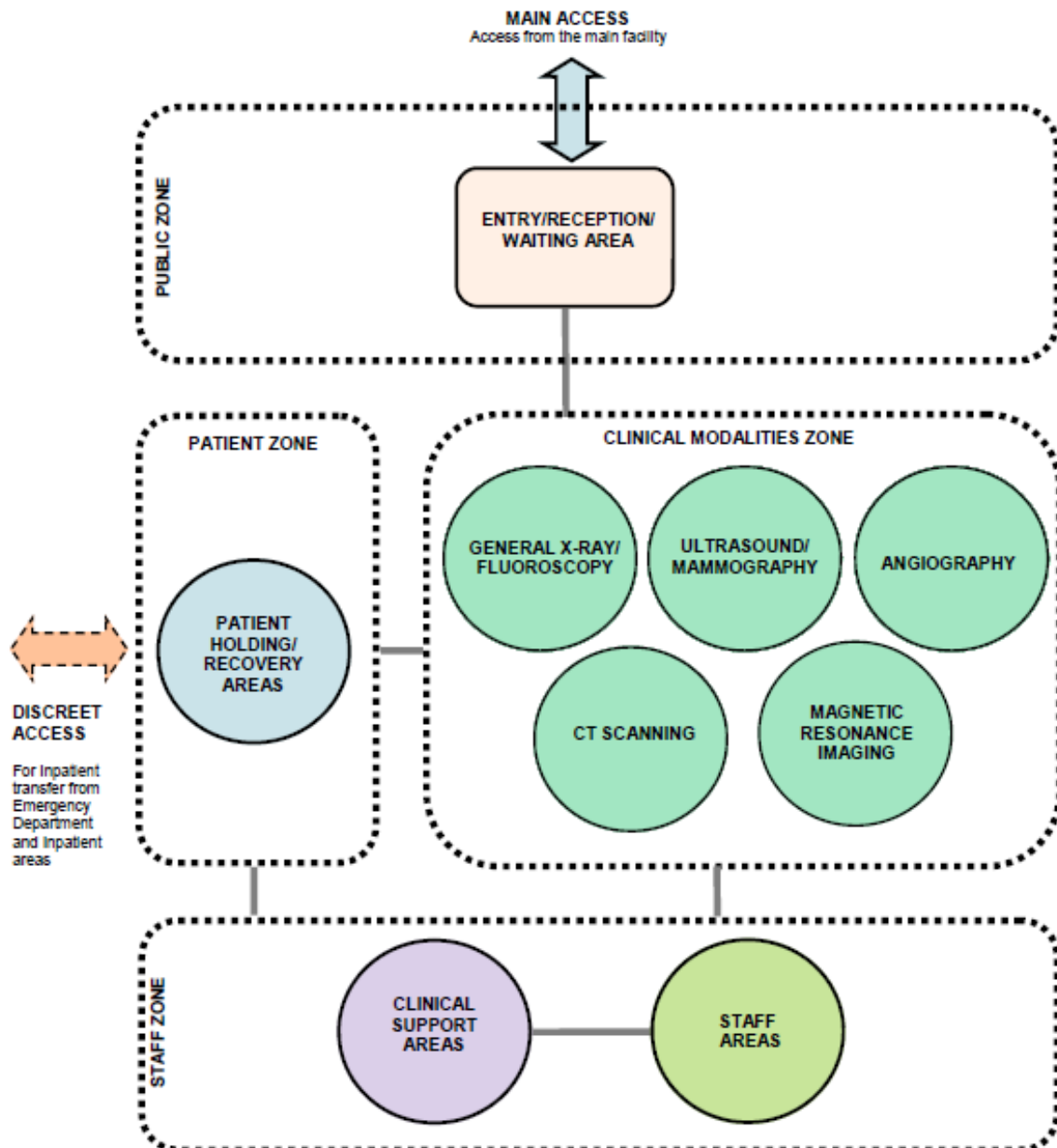
AX.03 Checklists

Refer to the Planning Checklists at the ends of Parts A, B, C and D.

AX.04 References

The following references and further reading are specific to various aspects of medical imaging. General references are presented in a separate "Generic Reference' document.

CLINICAL PRACTICE AND DESIGN GUIDELINES

- American College of Radiology (ACR) 2007, Resolution 42: Practice Guideline for Digital Radiography, viewed 10 September 2009,
- Department of Veterans Affairs 2008, MRI Design Guide, by Department of Veterans Affairs; and
- NHS Estates 2001, Facilities for diagnostic imaging and interventional radiology, NHS Estates.

RADIATION SAFETY AND PROTECTION

- American College of Radiology 2007, 'ACR Guidance Document for Safe MRI Practices', American Journal of Radiology, no. 188, pp. 1-27;
- 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;
- E Kanal, et al. 2002, ACR White Paper on MR Safety, AJR, vol. 178, pp. 1335 – 47;
- FG Shellock & JV Crues 2004, MR Procedures: Biologic Effects, Safety, and Patient Care, Radiology, vol. 232, pp. 635 – 52;
- Royal Australia and New Zealand College of Radiologists (RANZR) 2004, RANZR MRI Safety Guidelines, RANZCR, www.ranzcr.edu.au/ viewed January 2006
- Royal Australian and New Zealand College of Radiologists (RANZR) 2007, MRI Safety Guidelines, RANZCR, www.ranzcr.edu.au and
- NSW Department of Environment and Climate Change 2008, Draft Guideline 7: Radiation shielding design assessment and verification requirements, NSW Government.

ORGANISATIONS / WEBSITES

- Australian Institute of Radiography, viewed 22 January 2010, http://www.air.asn.au
- Medical Imaging Nurses Association, viewed 22 January 2010, http://www.minanational.com and
- Royal Australian and New Zealand College of Radiologists, viewed 22 January 2010, http://www.ranzcr.edu.au

BOOKS AND ARTICLES

- Brettle, DS 2007, Display considerations for hospital-wide viewing of soft copy images, British Journal of Radiology, vol. 80, pp. 503-7;
- Causer, D, et al. 2005, Recommendations for a Technical Quality Control Program for Diagnostic X-Ray Equipment, Australasian College of Physical Scientists and Engineers in Medicine, Perth;
- Chan, S 2006, 'Strategy development for anticipating and handling a disruptive technology', Journal of the American College of Radiology, vol. 3, pp. 778-86;
- Doi K 2005, 'Current status and future potential of computer-aided diagnosis in medical imaging', The British Journal of Radiology, vol. 78, pp. S3-S19;
- Fajardo, LL, et al. 2006, 'Business plan to establish a CT colonography service', American College of Radiology, vol. 3, pp. 175-86;
- Junk, R, Gilk, T (contributed by), revised 2007, Safety Considerations in the Design of Magnetic Resonance Imaging, AIA Best Practices;
- Knechtges, PM & Carlos, RC 2007, 'The evolving role of radiologists within the health care system', American College of Radiology, vol. 4, pp. 626-35;
- Latimer, HS, et al. n.d., 'Are we super sizing health care', KSA Outlook, no. 34;
- Meehan, MJ & Whelton, DG 2004, 'Planning and developing a diagnostic imaging center', Journal of the American College of Radiology, vol. 1, no. 12, pp. 916-25;
- Pooley, RA & Felmlee, JP 2004, 'MRI site planning adventures', Journal of the American College of Radiology, vol. 1, no. 11, pp. 871-3;
- Rostenberg, B & Horii, SC 2006, The architecture of medical imaging: designing healthcare facilities for advanced radiological diagnostic and therapeutic techniques, John Wiley & Sons, Hoboken, N.J;
- Rostenberg, B 2009, Converging interests: The merging of surgery and imaging influences design, Health Facilities Management, vol. 9, no. 22, pp. 47-50;

- Seibert, JA 2007, Digital radiography: CR versus DR? Time to reconsider the options, the definitions, and current capabilities, Supplement to Applied Radiology, vol. December 2007, viewed 10 September 2009, www.appliedradiology.com and
- Siddiqui, KM, et al. 2006, 'Design and ergonomic considerations for the filmless environment', Journal of the American College of Radiology, vol. 3, no. 6, pp. 456-67.

AX.05 Further Reading

This clause is currently under review / not applicable, but has been included for consistent HPU clause numbering.