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DUBAI HEALTH AUTHORITY

DHA Health Facility Guidelines 2019

Part B – Health Facility Briefing & Design

260 – Medical Imaging Unit - General

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Executive Summary

This Functional Planning Unit (FPU) covers the requirements of a general Medical Imaging Unit which provides radiology and diagnostic investigations to patients. Depending on the level of service and the clinical service plan, the unit may also provide X-ray in addition to diagnostic screening (fluoroscopy), ultrasound, mammography, computed tomography (CT), magnetic resonance imaging (MRI) or interventional radiographic procedures such as angiography.

There are several models of service that include a unit managed by the hospital, a main unit with satellite units located in the hospital, an independent privately-owned facility within the hospital or a unit located off-site also known as a Radio-Diagnostic Centre. The Unit located in a hospital may be centralised, collocated with Emergency Unit or located with Nuclear Medicine and Radiotherapy in a comprehensive imaging suite.

The Medical Imaging Unit is arranged in Functional Zones depending on the scope of service and imaging specialties to be provided. Key considerations are structural support, access and services provisions for equipment selected.

The size of the general Medical Imaging Unit may vary dependent on the service plan, the imaging specialties to be included and the demand for services. Design Considerations address a range of important issues including construction standards, acoustics, privacy, space standards, safety and security and Building Services Requirements.

The Schedules of Accommodation are provided using references to Standard Components (typical room templates) and quantities for typical Units at Role Delineation Levels (RDLs) 2 to 6.

Further reading material is suggested at the end of this FPU but none are mandatory.

Users who wish to propose minor deviations from these guidelines should use the **Non-Compliance Report** (**Appendix 4 in Part A**) to briefly describe and record their reasoning based on models of care and unique circumstances. The details of this FPU follow overleaf.

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260. Medical Imaging Unit - General

1 Introduction

The general Medical Imaging Unit is a discrete facility of the hospital which provides radiology and diagnostic investigations. Depending on the level of service and the clinical service plan, the unit may provide X-ray in addition to diagnostic screening (fluoroscopy), ultrasound, mammography, computed tomography (CT), magnetic resonance imaging (MRI) or interventional radiographic procedures such as angiography.

The general Medical Imaging Unit may be co-located with or incorporate other specialties including Nuclear Medicine, PET and Oncology - Radiotherapy Units in a fully integrated imaging suite.

For radiation shielding requirement, it is governed and regulated by FANR (Federal Authority for Nuclear Regulation). A separate application and approval must be sought directly with FANR.

2 Functional and Planning Considerations

2.1 Models of Service

The Medical Imaging Unit may be provided as:

- As a single unit managed and operated by the hospital
- A main facility with satellite units located for ease of patient access under the management of the hospital
- An independent privately owned and operated facility, known as a 'Radio-Diagnostic Centre', providing a service to all hospital units and sharing support areas with the hospital. As this is a popular model of service delivery, this option needs to be identified early in the planning process in order to allow the associated space requirements, design issues and cost implications to be addressed

- An off-site 'Radio-Diagnostic Centre'; smaller hospitals that cannot justify a full Medical Imaging Unit, may consider access to off-site specialist services; this option needs to be identified during the planning phase, in particular, the location of the off-site services.

Diagnostic Imaging services can be provided in a variety of health facilities including Hospitals, Day Surgery Centres, Diagnostic Centres with other diagnostic specialties, and Outpatient care facilities such as polyclinics, specialty and dental clinics. Interventional imaging may only be performed in a hospital-based setting, or may also be performed in a surgical environment.

The general Medical Imaging Unit located within a hospital may be arranged in a variety of models, depending on the hospital's clinical services plan that may include:

- A comprehensive unit located adjacent to the Emergency Unit and with good functional links to Outpatient Units
- A unit integrated with Nuclear Medicine and/ or Radiotherapy
- A centralised unit with satellite imaging services for Emergency Unit, outpatient ultrasound, intraoperative imaging, cardiac angiography (Catheter Laboratories) or other interventional imaging specialties. As a compromise, Medical Imaging may be below or above the Emergency Unit with easy lift access. Care should be taken to avoid any potential problems in flood-prone areas.

2.1.1 Hours of Operation

The Medical Imaging Unit will normally operate 24 hours per day, seven days per week. Smaller units may operate on a long day basis with an after-hours emergency service, depending on the hospital's operational policy

3 Unit Planning Models

The planning of a Medical Imaging Unit will be dependent on the imaging specialties to be included and the operational model adopted.

The location of Medical Imaging is important for easy access by emergency patients, ambulant patients and inpatients. The Medical Imaging Unit should ideally be located on the ground floor with direct access to the Emergency Unit (EU) unless satellite imaging is provided within the EU.

The relative location of Outpatients Unit should be considered in the planning stage due to the volume of outpatient referrals to the Unit. Refer to Functional Relationships in this section for ideal internal relationships to be considered during the planning stages.

3.1 Functional Zones

The Medical Imaging Unit may consist of the following Functional Zones depending on the Clinical service plan of the Unit and the services to be provided:

- Entry/ Reception areas incorporating:
  - Reception desk for patient registration and to act as an access control point
  - Waiting for a range of occupants including children, families, elderly, and patients with limited mobility
  - Consult room for patient assessment and review
  - Amenities – toilets, vending areas for refreshments
  - Offices and workstations for Unit management and clerical functions
- General X-ray and Screening areas:
  - General and digital X-ray rooms
  - Fluoroscopy rooms
  - Patient Change cubicles associated with each x-ray room
  - Access to patient amenities
  - Support areas including patient bed bays, handwashing bays, storage for linen, supplies

  These are the minimum required areas that would define the unit as a Medical Imaging Unit. Other modalities are optional depending on the service model.

- Dental/ Oral imaging:
  - OPG or CBCT or other Dental Imaging Room
  - Sub waiting facilities
- CT Scanning including:
  - CT Scanning rooms
  - Control, reporting and computer module equipment rooms
  - Patient Change cubicles associated with each scanning room
  - Patient Holding Bays and Sub waiting areas
  - Access to patient amenities
  - Support Rooms including bays for linen, handwashing, Clean and Dirty Utility rooms, Store rooms, Staff workstation, scrub-up for interventional procedures
- Ultrasound including specialty rooms such as paediatric and interventional
- Mammography rooms including interventional rooms
- Angiography/ Digital Subtraction Angiography (DSA) with:
  - Scanning, control, reporting and computer module equipment rooms
  - Anaesthetic induction rooms
  - Scrub-up rooms
  - Patient Change cubicles associated with each scanning room and Waiting areas
  - Patient Holding and recovery bed bays
  - Support rooms including bays for linen, handwashing, resuscitation trolley, Clean and Dirty Utility rooms, Store rooms, Staff workstation
- MRI suite with:
  - Scanning, control, reporting and computer module equipment rooms
  - Patient Change cubicles associated with each scanning room
  - Sub-waiting area with access to patient toilets
  - Patient Holding and recovery bed bays
  - Support rooms including bays for linen, handwashing, resuscitation trolley, Clean and Dirty Utility rooms, Store rooms
- Bone Densitometry (DEXA)
- Shared Support Areas including
  - Cleaner's room/s
  - Communications room
  - Digital Processing areas/ Laser Imager

- Store rooms for film, files, stationery, general consumables

- Staff Office and Amenities:
  - Offices for Unit Director, Senior Radiologist/s, Senior Radiographer/s, Nurse Manager and Supervisors
  - Workstations for clerical staff, PACS technical staff, general imaging staff
  - Staff Amenities including Staff Room, Change Rooms with Showers, Toilets, Lockers
  - Meeting Rooms.

These functional zones are described briefly below.

3.1.1 Entry/ Reception/ Waiting Areas

The Reception is the receiving hub of the unit where patients are first registered and should therefore ensure the security of the entire department through access control. Patient registration may include a booking and queuing system for effective management of patient bookings.

Waiting areas shall be divided into separate male and female/ family areas to meet cultural requirements and will require convenient access to public amenities. The Waiting areas should be designed for compliance with accessibility standards and be provided with a range of seating options for occupants of varying mobility including bariatric patients. Waiting areas should include provisions for prams and a play area for children. Bed waiting areas should be separated from the ambulatory patient waiting areas for patient privacy.

3.1.2 X-ray, Screening and Scanning Areas

3.1.2.1 General X-ray and Fluoroscopy

General X-ray rooms may be clustered with Fluoroscopy rooms in order to share support facilities. The General X-ray room equipment generally includes an upright stand for chest films. OPG and Mammography imaging equipment may be included in a General X-ray room where imaging equipment is not fully utilised. Additional equipment will require a slightly larger room.

If satellite imaging rooms are not provided in the Emergency Unit (EU), a minimum of one General X-ray room must be sized and located with rapid access for transfer of patients from Emergency Unit.

Fluoroscopic radiographic imaging procedures involve administration of contrast media to the patient and the timed use of a fluoroscopic imaging system along with sequential repositioning of the patient. The Fluoroscopy room requires a preparation room for barium mixtures and an adjacent toilet/ shower that may be accessed from inside the room or from the external corridor.

Fluoroscopy may be combined with an Angiography room, due to the decreasing incidence of barium usage. The room should include services for anaesthesia.

3.1.2.2 Orthopantomography (OPG)

OPG is an orbital X-ray of the upper and lower jaws, displaying teeth on a single film, used in dental, trauma, and facio-maxillary services. This equipment may be incorporated into a General X-ray room, a separate bay or within the Dental Unit

3.1.2.3 Computerised Tomography (CT Scanning)

CT Scanning uses X-ray and computer technology to create detailed digital images, both two and three dimensional. CT scanning equipment consists of a rotating ring inside a gantry with a sliding table for the patient. Multiple images are taken in slices which are combined using computer technology. The CT Scanning room will have an associated Control Room and computer equipment room.

Refer to the Standard Component for CT Scanning for detailed room requirements. A Control Room may service 2 rooms. The room should include services for general anaesthesia and be sized for interventional procedures. A bed/ trolley bay adjacent to each room is required for staff observation of waiting patients.

3.1.2.4 Angiography/ Digital Subtraction Angiography (DSA)

Angiography involves x-ray imaging the inside of blood vessels using an injection of contrast media. Simple angiography procedures such as peripheral studies can be done on fluoroscopy equipment.

Digital Subtraction Angiography (DSA) refers to a process where contrast media is injected into a vessel in the area being examined. Images are taken of the blood vessels before and after injection with contrast media. The pre-contrast images are subtracted from the post contrast images by computer resulting in clear blood vessel images.

Procedures using this type of imaging include angiography, angioplasty, arterial and venous stents, biliary and renal artery imaging. DSA procedures are becoming less popular in favour of CT scanning due to the ability to produce 3D images of vessels using a less invasive procedure. These procedures may also be performed in a surgical or day-surgical environment depending on the operational model.

3.1.2.5 Mammography

Mammography imaging or breast screening may be included for diagnostic purposes according to the hospital's operational policies. Mammography rooms should provide sufficient area for interventional procedures such as needle biopsy that may require bed access and prone positioning. Mammography should be located adjacent to an Ultrasound Room for fine needle biopsies. Change Rooms should be accessible directly from the Mammography room and an Interview Room will be required in close proximity. Privacy curtains to shield examination area should be provided.

3.1.2.6 Stereotactic Biopsy

Optionally, Stetrotactic Biopsy may be provided in the same room or in a separate room to Mammography. Stereotactic Biopsy occurs for mammography guided breast biopsy procedures for calcified breast lesions without an obvious associated mass detected either by ultrasound or mammogram. Privacy curtains to shield examination area should be provided.

3.1.2.7 Magnetic Resonance Imaging (MRI)

MRI scanning is a non-Invasive procedure using large magnets combined with radio waves and a computer to receive signals from atoms in body tissue creating detailed cross section images of organs and vessels. MRI does not use ionizing radiation.

The location of the MRI is important to restrict access, protect the magnetic field from interference and reduce the extent of electro-magnetic shielding required. Specifically, the MRI should be located:

- With good external access for installing and servicing the equipment; this may be achieved through an accessible side panel or wall
- Distant to any moving metal objects that may cause interference such as lifts, passing cars, construction equipment

The MRI should not be located below a helipad or next to a sub- station

Facilities required in the MRI suite include:

- Patient change rooms with lockers for personal property (personal property particularly items with a metallic content must not be taken into the MRI room including watches, credit cards and keys)
- An Interview Room for patient discussion
- Storage for equipment (non-metallic)
- Control Room
- Equipment Room

Planning and design should consider the following:

- Structural assessment is required to ensure the floor/ slab will accommodate the MRI weight
- The MRI unit and the associated magnetic field must be fully contained within the room,

according to the equipment selection and specifications, that will require liaison with the equipment supplier

- The MRI room will require magnetic shielding and radiofrequency shielding, to be determined in conjunction with the equipment supplier, according to the machine specifications
- Access control is required to the MRI suite, the MRI room and the support areas within the suite to ensure authorised entry. Recommended exclusion zones are divided into four stages including:
  - Zone 1: Entrance which may be shared with the overall Medical Imaging Unit
  - Zone 2: MRI, Reception, sub-waiting, waiting which may be shared, patient screening, toilet and change room
  - Zone 3: MRI post-changing, patient preparation, recovery, control and equipment rooms
  - Zone 4: MRI Scanning room
- Equipment and fittings in the room including emergency equipment such as fire extinguishers and gas bottles need to be constructed of non-ferrous material

MRI rooms are to comply with Standard Components, refer to Standard Component – MRI Scanning Room, Room Data Sheet and Room Layout Sheet. Where there is more than one MRI, zones 1, 2 and 3 may be combines for both MRI's, but zone 4 is separate.

3.1.2.8 Ultrasound

Ultrasound is a non-invasive procedure using high frequency sound waves for diagnostic purposes. This permits the use of ultrasound for various types of tissue and organs and is particularly useful in obstetrics, digestive system, renal, cardiac and vascular scanning. Ultrasound does not use ionising radiation and does not require radiation shielding.

Ultrasound examinations may be done in the Medical Imaging unit, in specialist units or at the patient location, as the equipment is mobile. Ultrasound imaging may involve interventional procedures and room size may need to accommodate additional procedures and access for

patients on a bed/ trolley. Ultrasound rooms require close access to drinking water and a toilet for particular scanning procedures. Privacy curtains to shield examination area should be provided.

3.1.3 Support Areas

3.1.3.1 Preparation Room

The Preparation Room is provided for preparation of contrast media solutions, storage of medications and sterile supplies. The room should be sized to accommodate the quantity of supplies required. The Preparation Room, if conveniently located, may serve several imaging rooms. The Preparation Room shall comply with requirements identified in Standard Components.

3.1.3.2 Image Processing Areas

For digital imaging systems, traditional film-based processing areas are replaced by workrooms for viewing and checking of digital images. The workrooms should be located in close proximity to the imaging rooms and sized appropriately for the numbers of workstations required.

3.1.3.3 Digital Image Storage

For digital imaging applications, there will need to be an area for the PACS (Picture Archiving and Communications System) servers.

A room for filing of patient films may be provided for patient‘s own films and historic films for research purposes. The film store may be located close to the Reception/ administration areas.

Secure storage areas for archived film may be remote to the Imaging Unit. Film storage areas must provide a suitable environment to protect films from deterioration and damage.

3.1.4 Staff Areas

3.1.4.1 Offices and Workstations

Offices and workstations may be provided for the Unit Director/ Manager, Senior Radiographer, Senior Radiologist and Nurse Manager of the Unit, located in a discreet staff accessible area.

The number of offices required will be determined by the clinical service plan, dependent on the role and size of the unit.

3.1.4.2 Reporting Rooms

Picture Archiving Communications Systems (PACS) reporting areas will include Radiologist workstations for viewing and reporting on procedures using high resolution medically qualified diagnostic monitors on which images can be manipulated. A minimum of two linked monitors are required, occasionally four screens are provided.

In addition to the reporting monitors, a dedicated computer will be required for access to the Patient Information System and a system for dictating reports.

Locate reporting areas in a quiet area with ready access to the imaging rooms. Several workstations may be located in one room but will need to be visually and acoustically separated.

3.1.4.3 Staff Amenities

Staff will need access to the following:

- Toilets, shower and lockers
- Staff room with beverage facilities
- Meeting room/s for meetings, education and training.

4 Functional Relationships

4.1 External Relationships

The Medical Imaging Unit will have a close relationship with the following:

- The Main Entrance of the facility
- Emergency Unit
- Critical Care Units (ICU/ CCU/ HDU)
- Operating Unit for intra-operative imaging
- Inpatients Units

- Outpatients Units for the volume of patients requiring diagnostic testing
- Radiotherapy/ Oncology for regular patient investigations associated with treatment

The optimum external relationships demonstrated in the diagrams below include:

- Visitors access from a main circulation corridor with a relationship to the Main Entrance
- Separate entry and access for inpatients, critical care units and Medical Imaging Unit
- Access for service units such as Supply and Housekeeping via a service corridor

According to these guidelines, Medical Imaging may be located in the basement of facilities providing such services.

4.2 Internal Relationships

Internally, the Medical Imaging Unit will be arranged in functional zones. The entrance to the unit will provide access control with a Reception. Imaging and scanning areas will be located in clusters along with related support facilities such as holding, sub-waiting areas and change rooms for patients. Support areas such as reporting, and processing will be located conveniently to the imaging areas and may be shared. Staff areas may be located in a discreet and staff only accessible area.

The Medical Imaging Unit should have a clear one-way flow of patients from entry, holding, imaging procedures, to recovery and then exit, for both ambulant and bed/trolley patients.

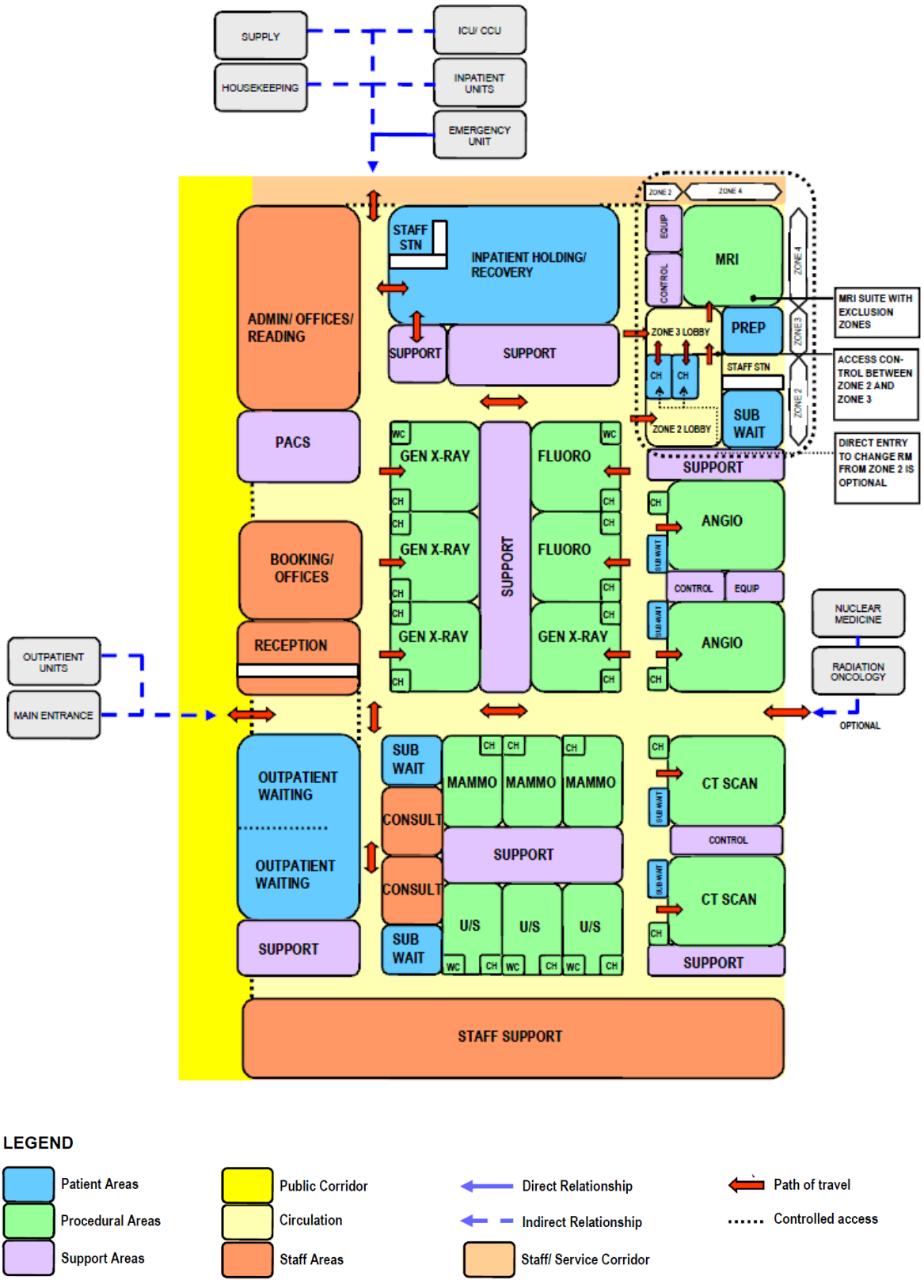
The optimum internal relationships demonstrated in the diagrams below include the following:

- Reception at the entrance providing access control, with Waiting and amenities.
- Imaging areas arranged into zones including general X-Ray, Fluoroscopy, CT Scanning, Angiography and MRI
- Patient areas including bed bays and Recovery centrally located convenient to Interventional and Scanning Rooms for sharing between imaging modalities

- Support areas located centrally to imaging rooms and adjacent to areas of need for staff and patient convenience
- Staff areas located in a discreet zone at the Unit perimeter

4.3 Functional Relationship Diagrams

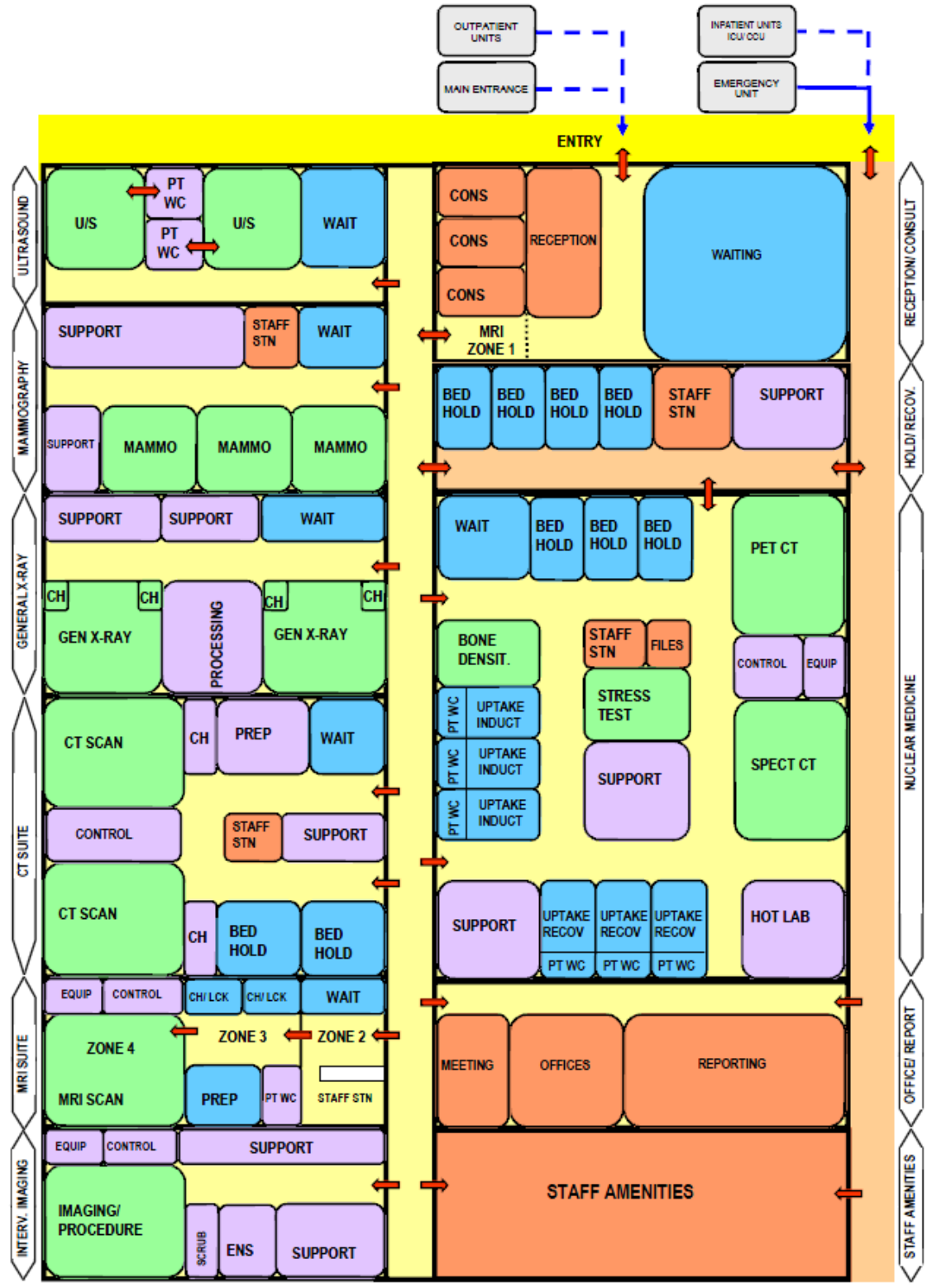
4.3.1 Medical Imaging Unit - General



LEGEND

- Patient Areas
- Procedural Areas
- Support Areas
- Public Corridor
- Circulation
- Staff Areas
- Direct Relationship
- Indirect Relationship
- Staff/ Service Corridor
- Path of travel
- Controlled access

4.3.2 Medical Imaging Unit – General, Modular option (with Nuclear Medicine)



LEGEND

- Patient Areas
- Procedural Areas
- Support Areas
- Public Corridor
- Circulation
- Staff Areas
- Direct Relationship
- Indirect Relationship
- Staff/ Service Corridor
- Path of travel
- Controlled access

5 Design Considerations

5.1 Construction Standards

Special attention is to be given to the following in the design of a Medical Imaging Unit:

- Structural support for equipment including equipment mounted to ceilings. Particular consideration must be taken for MRI, typically KN/M^2.
- Level floor for equipment positioning and safe patient movement
- Provision for cable support trays, ducts or conduits may be made in floors, walls, and ceilings and the impact on room space of large diameter electrical cable trays (to floors or surface mounted on walls)
- Ceilings are recommended at 3000mm, but a minimum of 2800mm is required
- Equipment ventilation
- Procedure timing (clocks)
- Task lighting/dimming and room blackout, as required
- A tiled ceiling may be considered for ease of installation, service, and remodelling
- Provision for shielding

5.2 Environmental Considerations

5.2.1 Acoustics

The Medical Imaging Unit should be designed to minimise the ambient noise level within the unit and transmission of sound between patient areas, staff areas and public areas.

Acoustic privacy should be provided to:

- All imaging rooms
- Interview and Meeting rooms

- Offices and Reporting areas.
- Additional acoustic privacy considerations include:
- Waiting areas should not be located close to Offices, Meeting and Interview Room/s
- Staff Room/s should not be located close to public and waiting areas

5.2.2 Natural Light/ Lighting

The use of natural light in the Unit should be maxinised throughout the unit. Windows are an important aspect of sensory orientation and psychological well-being of staff and patients.

Variable lighting levels should be provided in Control/ Reporting rooms, X-ray and Imaging rooms, Angiography rooms, Ultrasound and reporting rooms, where screen visibility is required.

5.2.3 Privacy

Visual patient privacy is an important consideration to be addressed in the design of imaging rooms and waiting spaces. Doors to imaging and screening rooms should be located to avoid patient exposure to circulation areas. Change rooms should be located adjacent to imaging rooms so that a patient is not required to cross corridors to access them. Privacy screening is required to all Patient Bed Bays.

5.3 Space Standards and Components

5.3.1 Imaging rooms

The size of imaging rooms will be influenced by the following:

- Ease of movement in and around the room for patients, staff, equipment, bed and trolley access
- The number of staff required in and around the room to operate the equipment and support the patient

- The equipment to be installed; design will need to consider the manufacturer's recommended room sizes, equipment placement and services requirements
- Potential future upgrading of equipment.

Scanning rooms should be sized to allow a clear dimension of 920mm around three sides of the imaging table for patient access and transfers

Ceiling heights shall suit the equipment to be installed but shall not be less than 3000mm for ceiling tube mount installations; ceilings may be higher if required.

5.4 Accessibility

Wheelchair access is required in all patient areas including Waiting, Consult and Imaging rooms. Waiting areas should also include space and power outlets for charging electric mobility equipment along with suitable seating for patients with disabilities or mobility aids and bariatric patients.

5.5 Doors

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. A minimum of 1400mm clear opening is recommended for doors requiring bed/trolley access.

5.6 Size of the Unit

The size of the Medical Imaging Unit is dependent on the level of service and determined by the facility's Service Plan and Operational Policies. Schedules of Accommodation have been provided for typical Medical Imaging Units in a hospital at role delineation Levels 2 (less complex services) to 6 (teaching/ research facilities).

5.7 Safety and Security

Design should consider the following issues:

- Access control to the unit which may be provided at Reception
- Zones within the unit should be organised to allow patients to access the intended area only and prevent patients and visitors entering unrelated areas
- Doors to the perimeter of the Unit and all offices should be lockable
- Rooms used for storing equipment and files and records should be lockable
- Meetings and functions scheduled after-hours requiring access by staff and visitors may involve special access arrangements

5.8 Finishes

The Medical Imaging Unit finishes including fabrics, floor wall and ceilings should provide a calm and inviting impression. Finishes should be selected with consideration of the following:

- Infection control and cleaning
- Acoustic properties of the materials
- Durability, replacement of materials
- Fire safety of the materials
- Movement of equipment

In Nuclear Medcicine and Interventional Units, all impervious flooring is mandatory. For other madalities, impervious flooring is optional (anti-static flooring is not required).

Wall protection should be provided where bed or equipment movement occurs including corridors, bed bays and imaging rooms.

Refer also to **Part C - Access Mobility, OH&S** in these Guidelines for further information on floors and ceilings.

5.9 Curtains/ Blinds

Window treatments should be durable and easy to clean. Consideration may be given to use double glazing with integral blinds, tinted glass, reflective glass, exterior overhangs or louvers to control the level of lighting.

Privacy bed screens must be washable, fireproof and cleanly maintained at all times. Disposable bed screens may also be considered.

5.10 Fixtures, Fittings and Equipment

Imaging equipment and the necessary services will require installation to the manufacturer's recommendations and specifications.

Refer to **Part C - Access Mobility, OH&S** of these Guidelines, the Room Layout Sheets (RLS) and Room Data Sheets (RDS) for more information

5.11 Radiation Signage

All rooms that are used for undertaking imaging procedures require radiation shielding. A certified physicist or qualified expert needs to assess the plans and specifications for radiation protection as required by FANR (Federal Authority for Nuclear Regulation) Laws and Regulations. A radiation protection assessment will specify the type, location and amount of radiation protection required for an area according to the final equipment selections, the layout of the space and the relationship between the space and other occupied areas.

The radiation protection requirements are to be incorporated into the final specifications and building plans. Radiation requirements should be re-assessed if the intended use of a room changes during the planning stages, equipment is upgraded or surrounding room occupancy is altered. Consideration should be given to the provision of floor and ceiling shielding when rooms immediately above and below are occupied.

5.12 Building Service Requirements

This section identifies unit specific services briefing requirements only and must be read in conjunction with **Part E - Engineering Services** for the detailed parameters and standards applicable.

5.12.1 Information and Communication Technology

The Medical Imaging Unit requires reliable and effective IT / Communications service for efficient operation of the service. The IT design should address:

- Booking, appointment and queuing systems
- Patient/ clinical information systems and electronic records
- Picture Archiving Communications Systems (PACS) and storage for digital archives
- Voice/ data cabling and outlets for phones, fax and computers
- Network data requirements and wireless network requirements to support remote reporting
- Video and teleconferencing capability, including connection to imaging rooms for educational purposes
- CCTV surveillance if indicated
- Patient, staff, emergency call, duress alarms and paging systems
- Communications rooms and server rooms
- Reporting and recording systems that may include dictation or voice recognition and include printing of reports

5.12.2 Staff Call

Patient, staff assist and emergency call facilities shall be provided in all patient areas (e.g. Holding bays, Recovery bays, Preparation rooms, Change Rooms, Toilets and Imaging rooms) in order for patients and staff to request for urgent assistance.

The individual call buttons shall alert to an annunciator system. Annunciator panels should be located in strategic points visible from Staff Stations and audible in Staff Rooms and Meeting Rooms.

5.12.3 Heating, Ventilation and Air conditioning (HVAC)

The Medical Imaging Unit should be air-conditioned to provide a comfortable working environment for staff and visitors. Interventional Imaging rooms may require air-conditioning equivalent to operating room conditions, i.e. filtered and positive pressured. Rooms with heat generating equipment may require special air-conditioning. Refer to **Part E - Engineering Services** in these guidelines and to the Standard Components, RDS and RLS for further information.

5.12.4 Medical Gases

Medical gas is that which is intended for administration to a patient in anaesthesia, therapy, or diagnosis.

The Unit requires oxygen and suction in all patient investigation rooms, treatment rooms and procedure rooms and patient bays. The Provision of medical air to patient recovery bays and interventional rooms is optional.

Full anaesthetic capability is required within interventional diagnostic rooms, including systems for the delivery of nitrous oxide and the 'scavenging' of gases that have been exhaled by the patient that should not be breathed in by any medical personnel.

Refer to **Part E - Engineering Services** in these guidelines and to the Standard Components, RDS and RLS for further information.

5.12.5 Radiation Shielding

All rooms that are used for undertaking imaging procedures require radiation shielding. A certified physicist or qualified expert needs to assess the plans and specifications for radiation protection as

required by FANR. An approval from FANR should be sought in addition to the requirements of these Guidelines. Information from FANR can be found at https://www.fanr.gov.ae/en. A radiation protection assessment will specify the type, location and amount of radiation protection required for an area according to the final equipment selections, the layout of the space and the relationship between the space and other occupied areas.

The radiation protection requirements are to be incorporated into the final specifications and building plans. Radiation requirements should be re-assessed if the intended use of a room changes during the planning stages, equipment is upgraded, or surrounding room occupancy is altered. Consideration should be given to the provision of floor and ceiling shielding when rooms immediately above and below are occupied.

5.13 Infection Control

Standard precautions apply to the Medical Imaging Unit to prevent cross infection between patients, staff and visitors. Paths of travel for inpatients should be separated from outpatients as far as possible. Hand hygiene is important, and it is recommended that in addition to hand basins, medicated hand gel dispensers be located strategically in staff areas and circulation corridors. Consideration should be given to separate clean and dirty workflows in all imaging/ procedure, preparation and clean-up rooms.

5.13.1 Hand Basins

Hand basins will be located in each imaging/ procedure room except MRI zone 4, patient holding, recovery areas as well as clinical support rooms including clean and dirty utilities. In holding and recovery areas the minimum provision is one hand basin per 4 bed or chair bays. Hand basin for MRI shall be included within zone 3.

Interventional imaging rooms such as Angiography may have an adjoining scrub facility.

Hand basins should comply with **Standard Components for Bay - Handwashing**. Refer to the **Standard Components, RDS and RLS** of these guidelines for additional information.

5.13.2 Antiseptic Hand Rubs

Antiseptic hand rubs should be located so they are readily available for use at points of care, at the end of patient beds and in high traffic areas.

The placement of antiseptic hand rubs should be consistent and reliable throughout facilities.

Antiseptic hand rubs are to comply with **Part D - Infection Control**, in these guidelines.

Antiseptic Hand Rubs, although very useful and welcome, cannot fully replace Hand Wash Bays, both are required.

For further information related to Infection Control refer to **Part D – Infection Control** in these Guidelines.

6 Standard Components of the Unit

Standard Components are typical rooms within a health facility, each represented by a Room Data Sheet (RDS) and a Room Layout Sheet (RLS).

The Room Data Sheets are written descriptions representing the minimum briefing requirements of each room type, described under various categories:

- Room Primary Information; includes Briefed Area, Occupancy, Room Description and relationships, and special room requirements)
- Building Fabric and Finishes; identifies the fabric and finish required for the room ceiling, floor, walls, doors, and glazing requirements

- Furniture and Fittings; lists all the fittings and furniture typically located in the room; Furniture and Fittings are identified with a group number indicating who is responsible for providing the item according to a widely accepted description as follows:

Group	Description
1	Provided and installed by the builder
2	Provided by the Client and installed by the builder
3	Provided and installed by the Client

- Fixtures and Equipment; includes all the serviced equipment typically located in the room along with the services required such as power, data and hydraulics; Fixtures and Equipment are also identified with a group number as above indicating who is responsible for provision
- Building Services; indicates the requirement for communications, power, Heating, Ventilation and Air conditioning (HVAC), medical gases, nurse/ emergency call and lighting along with quantities and types where appropriate. Provision of all services items listed is mandatory

The Room Layout Sheets (RLS's) are indicative plan layouts and elevations illustrating an example of good design. The RLS indicated are deemed to satisfy these Guidelines. Alternative layouts and innovative planning shall be deemed to comply with these Guidelines provided that the following criteria are met:

- Compliance with the text of these Guidelines
- Minimum floor areas as shown in the schedule of accommodation

- Clearances and accessibility around various objects shown or implied
- Inclusion of all mandatory items identified in the RDS

The Medical Imaging Unit contains Standard Components to comply with details in the Standard Components described in these Guidelines. Refer to Standard Components Room Data Sheets and Room Layout Sheets.

6.1 Non-Standard Rooms

Non-standard rooms are rooms are those which have not yet been standardised within these guidelines. As such there are very few Non-standard rooms. These are identified in the Schedules of Accommodation as NS and are separately covered below.

6.1.1 Orthopantomography (OPG) Room

The OPG imaging unit may be located in a room or bay. The room size is dependent on the equipment to be installed; circulation space is required around the imaging unit. Access is required for patients in wheelchairs.

Room requirements include:

- Radiation shielding of the space with access to lead gowns for the patient and staff
- Radiation warning light
- Patient and emergency call system
- A handbasin in close proximity

7 Schedule of Accommodation

The Schedule of Accommodation (SOA) provided below represents generic requirements for this Unit. It identifies the rooms required along with the room quantities and the recommended room areas. The sum of theroom areas is shown as the Sub Total as the Net Area. The Total area is the Sub Total plus the circulation percentage. The circulation percentage represents the minimum recommended target area for corridors within the Unit in an efficient and appropriate design.

Within the SOA, room sizes are indicated for typical units and are organised into the functional zones. Not all rooms identified are mandatory therefore, optional rooms are indicated in the Remarks. These guidelines do not dictate the size of the facilities, therefore, the SOA provided represents a limited sample based on assumed unit sizes. The actual size of the facilities is determined by Service Planning or Feasibility Studies. Quantities of rooms need to be proportionally adjusted to suit the desired unit size and service needs.

The Schedule of Accommodation are developed for particular levels of services known as Role Delineation Level (RDL) and numbered from 1 to 6. Refer to the full **Role Delineation Framwork** (**Part A - Appendix 6**) in these gduielines for a full description of RDL's.

The table below shows five alternative SOA's for role delineations 2 to 6 including typical imaging specialties. The inclusion of imaging specialties in health facilities will be dependent on the service plan and operational policy of the facility.

Any proposed deviations from the mandatory requirements, justified by innovative and alternative operational models may be proposed and record in the **Non-Compliance Report** (refer to **Part A - Appendix 4**) with any departure from the Guidelines for consideration by the DHA for approval.

7.1 Medical Imaging Unit - General

ROOM/ SPACE	Standard Component Room Codes	RDL 2 Qty x m²	RDL 3 Qty x m²	RDL 4 Qty x m²	RDL 5 Qty x m²	RDL 6 Qty x m²	Remarks
Entry / Reception							
Reception/ Clerical	recl-10-d similar recl-15-d			1 x 9	1 x 12	1 x 15	1, 2 & 3 staff
Waiting	wait-20-d similar			2 x 15	2 x 20	2 x 25	Gender segregated; 1.2 m^2 per seat, 1.5m^2 per wheelchair
Bay - Vending Machines	bvm-3-d				1 x 3	1 x 3	Optional
Bay - Wheelchair	bwc-d		1 x 4	1 x 4	2 x 4	2 x 4	
Consult/ Exam Room	cons-d		1 x 13	1 x 13	2 x 13	2 x 13	Number dependent on service plan
Office -Shared	off-2p-d off-3p-d off-4p-d		1 x 12	1 x 16	1 x 20	1 x 20	Clerical/ bookings; 2, 3 or 4 person shared office
Office - Workstation	off-ws-d			1 x 5.5	1 x 5.5	1 x 5.5	Transport Staff; locate adjacent to trolley parking
Play Area	plap-10-d			1 X 10	1 x 10	1 x 10	Adjacent to Family waiting 4-5 places for children
Toilet - Accessible	wcac-d			2 x 6	2 x 6	2 x 6	Divided into gender segregated areas
Toilet - Patient	wcpt-d			2 x 4	2 x 4	4 x 4	Divided into gender segregated areas
General X-ray & Fluoroscopy		**1 room**	**3 rooms**	**4 rooms**	**5 rooms**	**8 rooms**	
Waiting	wait-10-d similar	2 x 5*	2 x 5*	2 x 10	2 x 10	2 x 10	*Optional for level-2 & 3. Gender segregated areas
General X-Ray	genxr-d	1 x 30	2 x 30	2 x 30	3 x 30	4 x 30	
Screening Room (Fluoroscopy)	scrn-d		1 x 30	2 x 30	2 x 30	4 x 30	Includes control; qty of rooms to suit service plan
Toilet - Patient	wcpt-d		1 x 4	2 x 4	2 x 4	4 x 4	For Fluoroscopy
Change Cubicle - Accessible	chpt-d-d	1 x 4	3 x 4	4 x 4	5 x 4	8 x 4	For X-Ray and Fluoroscopy rooms, may include a locker .
Patient Bay - Holding	pbtr-h-10-d		2 x 10	4 x 10	4 x 10	4 x 10	Gender segregated, may be located in recovery area
Bay - Handwashing, Type B	bhws-b-d		1 x 1	1 x 1	1 x 1	2 x 1	For patient bed bay areas
Bay - PPE	bppe-d	1 x 1.5	1 x 1.5	1 x 1.5	1 x 1.5	2 x 1.5	For Lead Apron storage
Bay - Linen	blin-d		1 x 2	1 x 2	1 x 2	1 x 2	may be shared
Bay - Resuscitation Trolley	bres-d		1 x 1.5	1 x 1.5	1 x 1.5	1 x 1.5	may be shared
Dirty Utility	dtur-12-d similar		1 x 10	1 x 10	1 x 10	1 x 10	Disposal, clean-up, dirty linen storage; may be shared
Dental/Oral Radiology						**1 room**	
OPG Room	NS					1 x 7	Room area depends on equipment selected

ROOM/ SPACE	Standard Component Room Codes	RDL 2 Qty x m²	RDL 3 Qty x m²	RDL 4 Qty x m²	RDL 5 Qty x m²	RDL 6 Qty x m²	Remarks
Bay - PPE	bppe-d					1 x 1.5	Lead aprons, adjacent to imaging rooms
CT Scanning				1 room	2 rooms	2 rooms	
Waiting	wait-10-d			2 x 5	2 x 10	2 x 10	Divided into gender segregated areas
CT Scanning - Procedure Room	ctpr-d			1 x 45	2 x 45	2 x 45	Room size is dependent on equipment selected
Change Cubicle - Accessible	chpt-d-d			1 x 4	2 x 4	2 x 4	For CT Scanning, May Include a locker
CT Scanning - Control Room	ctcr-d similar			1 x 14	1 x 20	1 x 24	May be shared between 2
CT Computer Equipment Room	coeq-d			1 x 8	2 x 8	2 x 8	Room size dependant on equipment selected
CT Scanning - Reporting Room	xrrr-d similar			1 x 9	1 x 9	1 x 9	One workstation/2 scanning rooms
Patient Bay - Holding,	pbtr-h-10-d			2 x 10	2 x 10	2 x 10	1 for each scanning room. Gender segregated
Toilet –Patient	wcpt-d			2 x 4	2 x 4	2 x 4	Gender segregated; may share with adjacent areas
Bay - Handwashing, Type B	bhws-b-d			1 x 1	1 x 1	1 x 1	1 per 4 bed bays; Refer to Part D Infection Control
Bay - Linen	blin-d			1 x 2	1 x 2	1 x 2	May be shared
Bay - PPE	bppe-d			1 x 1.5	1 x 1.5	2 x 1.5	For Lead Apron storage
Office - Workstation	off-ws-d			1 x 5.5	1 x 5.5	1 x 5.5	Optional, staff base
Ultrasound & Mammography			1 room	4 rooms	6 rooms	8 rooms	
Waiting	wait-10-d similar		2 x 5	2 x 5	2 x 10	2 x 10	Divided into gender segregated areas
Ultrasound	ultr-d		1 x 14	2 x 14	3 x 14	4 x 14	
Toilet - Patient	wcpt-d			2 x 4	3 x 4	4 x 4	For Ultrasound. Within ultrasound room
Ultrasound - Interventional	proc-20-d similar				1 x 20	2 x 20	For Interventional ultrasonography procedures
Mammography	mammo-d			1 x 14	1 x 14	1 x 14	
Mammography - Interventional	mam-int-d			1 x 16	1 x 16	1 x 16	For symptomatic and needle biopsy procedures
Viewing and Reporting Room	xrrr-d similar		1 x 12	1 x 12	1 x 12	1 12	Adjust size to suit service plan
Patient Bay - Holding	pbtr-h-10-d						Refer to Holding/Recovery Areas for patient bays
Bay - Handwashing, Type B	bhws-b-d		1 x 1	1 x 1	1 x 1	1 x 1	1 per 4 bed bays; Refer to Part D Infection Control
Bay - Linen	blin-d		1 x 2	1 x 2	1 x 2	1 x 2	May be shared with adjacent area
Dirty Utility	dtur-s-d			1 x 8	1 x 8	1 x 8	Optional
Office - Workstation	off-ws-d		1 x 5.5	1 x 5.5	1 x 5.5	1 x 5.5	For Sonographers
Angiography/ Digital Subtraction Angiography				1 room	2 rooms	3 rooms	
Waiting	wait-10-d			2 x 5	2 x 10	2 x 10	Divided into gender segregated areas

ROOM/ SPACE	Standard Component Room Codes	RDL 2 Qty x m²	RDL 3 Qty x m²	RDL 4 Qty x m²	RDL 5 Qty x m²	RDL 6 Qty x m²	Remarks
Angiography Procedure Room	anpr-d			1 x 42	2 x 42	3 x 42	Number of rooms to suit service plan
Scrub-Up/ Gowning	scrb-6-d			1 x 6	2 x 6	3 x 6	May be shared
Angiography Control/ Reporting	ancrt-d			1 x 14	2 x 14	3 x 14	May be shared between rooms
X-Ray Viewing and Reporting	xrrr-d			1 x 12	1 x 12	1 x 12	May be combined with Control room
Computer Equipment Room	coeq-d			1 x 8	2 x 8	3 x 8	1 per Angiography room
Anaesthetic Induction Room	anin-d			1 x 15	1 x 15	1 x 15	Optional
Patient Bay - Holding	pbtr-h-10-d			2 x 10	4 x 10	6 x 10	Refer to Holding/Recovery Areas for patient bays
Property Bay	prop-3-d similar			2 x 1	2 x 1	2 x 2	For patients; Second bay optional if gender segregation is required.
Toilet - Patient	wcpt-d			2 x 4	2 x 4	2 x 4	Within Angiography Suite, close to Patient Bay-Holding
Bay - Linen	blin-d			1 x 2	1 x 2	1 x 2	May be shared
Bay - PPE	bppe-d			1 x 1.5	1 x 1.5	1 x 1.5	For Lead Aprons
Bay - Resuscitation Trolley	bres-d			1 x 1.5	1 x 1.5	1 x 1.5	May be shared if located close to another trolley
Dirty Utility	dtur-s-d dtur-12-d			1 x 8	1 x 12	1 x 12	May be shared
Angiography Sterile Store/ Set-up	anss-d similar			1 x 10	1 x 15	1 x 20	
MRI				**1 room**	**2 rooms**	**2 rooms**	
Waiting - Sub	wait-sub-d			2 x 5	2 x 5	2 x 5	Divided into gender segregated areas
MRI Scanning Room	mri-42-d			1 x 42	2 x 42	2 x 42	Room size dependant on equipment selected
Change Cubicle - Accessible	chpt-d-d			1 x 4	2 x 4	2 x 4	May include a Locker
MRI Computer Equipment Room,	coeq-8-d			1 x 8	2 x 8	2 x 8	MRI. requirements as per manufacturers specs
MRI Control/ Reporting Room	ancrt-d			1 x 14	2 x 14	2 x 14	Shared between 2 MRI rooms
Viewing and Reporting Room	xrrr-d			1 x 12	1 x 12	1 x 12	May be combined with Control Room
Anaesthetic Induction Room	anin-d			1 x 15	1 x 15	1 x 15	Optional
Patient Bay - Holding,	pbtr-h-10-d			2 x 10	4 x 10	4 x 10	Divided into gender segregated areas.
Bay - Handwashing, Type B	bhws-b-d			1 x 1	1 x 1	1 x 1	1 per 4 bed bays; Refer to Part D Infection Control
Toilet - Patient	wcpt-d			2 x 4	2 x 4	2 x 4	Divided into gender segregated areas
Bay - Handwashing, Type A	bhws-a-d			1 x 1	2 x 1	2 x 1	1 per MRI room, in close proximity to MRI rooms
Bay - Linen	blin-d			1 x 2	1 x 2	1 x 2	May be shared

ROOM/ SPACE	Standard Component Room Codes	RDL 2 Qty x m²	RDL 3 Qty x m²	RDL 4 Qty x m²	RDL 5 Qty x m²	RDL 6 Qty x m²	Remarks
Bay - Resuscitation Trolley	bres-d			1 x 1.5	1 x 1.5	1 x 1.5	Non-ferrous
Store - Dewar Tank	NS			1 x 6	1 x 6	1 x 6	Optional, for top-up using tanks, accessible to MRI rooms
Store- Helium	NS			1 x 6	1 x 6	1 x 6	Optional. It can be integrated
Store - Files	stfs-10-d similar			1 x 8	1 x 8	1 x 8	Optional
Patient Holding/ Recovery Areas				**4 bays**	**8 bays**	**12 bays**	**Optional if centralised Holding/Recovery Area**
Patient Bay - Holding,	pbtr-h-10-d			4 x 10	8 x 10	12 x 10	Holding/ recovery. 2 Bays per interventional imaging room, Divided into gender segregated areas
Staff Station	sstn-14-d similar			1 x 10	1 x 10	1 x 14	
Bay - Beverage	bbev-op-d			1 x 5	1 x 5	1 x 5	Optional
Bay - Handwashing, Type B	bhws-b-d			1 x 1	2 x 1	2 x 1	
Bay - Linen	blin-d			1 x 2	1 x 2	2 x 2	
Bay - Resuscitation Trolley	bres-d			1 x 1.5	1 x 1.5	1 x 1.5	May be shared with imaging areas if close
Consult Room	cons-d				1 x 13	2 x 13	Optional
Clean Utility	clur-8-d similar clur-12-d			1 x 8	1 x 10	1 x 12	
Dirty Utility	dtur-s-d dtur-12-d			1 x 8	1 x 10	1 x 12	
Disposal Room	disp-8-d similar			1 x 8	1 x 8	1 x 10	
Store - Equipment	steq-10-d			1 x 10	1 x 10	2 x 10	
Toilet - Patient	wcpt-d			2 x 4	2 x 4	2 x 4	Divided into gender segregated areas
Support Areas - Shared							
Bay - Mobile Equipment	bmeq-4-d similar		1 x 4	1 x 6	2 x 6	2 x 6	Depends on facility requirement
Bay - Resuscitation Trolley	bres-d			1 x 1.5	1 x 1.5	1 x 1.5	May be shared between imaging areas
Cleaner's Room	clrm-6-d			1 x 6	1 x 6	2 x 6	
Clean Utility	clur-12-d similar			1 x 8	1 x 10	1 x 12	
PACS Storage and Viewing	pacs-d similar	1 x 8	1 x 12	1 x 16	1 x 20	1 x 30	Size and number of PACS Server and Viewing Statiofn to be determined by Operational Policy
Dirty Utility	dtur-s-d similar dtur-12-d			1 x 8	1 x 10	1 x 12	Optional, Shared between imaging and patient areas
Disposal Room	disp-8-d	shared	1 x 8	1 x 8	1 x 8	1 x 8	
Laser Imager	lasi-d	1 x 2	1 x 2	1 x 2	1 x 2	1 x 2	Optional, alternatively can be provided in Viewing and Reporting Room

ROOM/ SPACE	Standard Component Room Codes	RDL 2 Qty x m²	RDL 3 Qty x m²	RDL 4 Qty x m²	RDL 5 Qty x m²	RDL 6 Qty x m²	Remarks
Preparation/ Set-up Room	prep-s-d		1 x 9	1 x 9	1 x 9	1 x 9	For contrast media storage and preparation
Store - Files	stfs-10-d similar	1 x 8	1 x 8	1 x 12	1 x 16	1 x 20	Films/media. Size determined by Operational Policy
Store - General	stgn-8-d stgn-14-d similar stgn-20-d similar	1 x 8	1 x 8	1 x 12	1 x 12	1 x 16	
Store - Photocopy/ Stationery	stps-8-d			1 x 8	1 x 8	1 x 8	Printing/ Digitiser; may locate in work space
Staff Offices & Reporting Areas							
Office - Single Person	off-s12-d			1 x 12	1 x 12	1 x 12	Director
Office - Single Person	off-s9-d			2 x 9	2 x 9	3 x 9	Radiologists, Radiographers
Office - Single Person	off-s9-d			1 x 9	1 x 9	2 x 9	Nurse Manager/ Supervisor
Office - Shared	off-2p-d off-3p-d			1 x 12	1 x 16	1 x 16	PACS Operation/ Management. 2-3 person
Office - Shared	off-2p-d off-3p-d similar off-4p-d			1 x 12	1 x 16	1 x 20	2, 3 & 4 person shared areas
Office - Workstation	off-ws-d			2 x 5.5	4 x 5.5	6 x 5.5	General imaging staff, PACs reporting, as required
Meeting Room - Small	meet-9-d similar			1 x 9	1 x 9	1 x 12	Optional
Meeting Room - Medium/ Large	meet-l-15-d similar			1 x 15	1 x 15	2 x 20	Optional
Store - Photocopy/ Stationary	stps-8-d similar			1 x 8	1 x 8	1 x 10	Optional
Staff Room	srm-15-d similar			1 x 15	1 x 20	1 x 20	May be divided into gender segregated areas
Change - Staff (Male/ Female),	chst-12-d similar			2 x 14	2 x 14	2 x 14	Gender segregated; Includes shower/ toilets/ lockers
Sub Total		**71.5**	**276.5**	**1225.5**	**1715.5**	**2164**	
Circulation %		**35**	**35**	**35**	**40**	**40**	
Area Total		**96.5**	**373.2**	**1654.4**	**2401.7**	**3029.6**	**Including the centralised Holding/Recovery Area**

Please note the following:

- Areas noted in Schedules of Accommodation take precedence over all other areas noted in the Standard Components
- Rooms indicated in the schedule reflect the typical arrangement according to the sample Key Planning Units
- All the areas shown in the SOA follow the No-Gap system described elsewhere in these Guidelines
- Exact requirements for room quantities and sizes shall reflect Key Planning Units (KPU) identified in the Clinical Service Plan and the Operational Policies of the Unit
- Room sizes indicated should be viewed as a minimum requirement; variations are acceptable to reflect the needs of individual Unit
- Offices are to be provided according to the number of approved full-time positions within the Unit

8 Further Reading

In addition to Sections referenced in this FPU, i.e. **Part C- Access, Mobility, OH&S** and **Part D - Infection Control** and **Part E - Engineering Services**, readers may find the following helpful:

- Agency for Science, Technology and Research, Clinical Imaging Research Centre, Singapore, Professor David W. Townsend, PhD, FRCR (Hon) Director, lecture: Future Trends in Medical Imaging refer to website: http://infieri-etwork.eu/sites/default/files/users/user270/DT_INFIERI_Lecture_Final.pdf
- American College of Radiology (ACR) Medical Imaging: 'Is the Growth Boom Over' Neiman Report Oct 2012 http://www.acr.org/Research/Health-Policy-Dnstitute/Neiman-Report-Dndex/Brief-01-Ds-the-Medical-Dmaging-Growth-Boom-Over
- Department of Veterans Affairs (US) Office of Facilities Management, VA Design Guide Magnetic Resonance Imaging, 2008, refer to website: http://www.cfm.va.gov/til/dGuide/dgmri02.pdf
- Dubai Health Authority, Health Regulation Sector, "Diagnostic Imaging Services Regulation" 2012 https://www.dha.gov.ae/Documents/Regulations/Diagnostic%20Imaging%20Services%20Regulation.pdf
- FANR Regulations and Guides https://fanr.gov.ae/en/rules-regulations/regulations-guides
- International Health Facility Guideline (iHFG) www.healthdesign.com.au/ihfg
- Ministry of Health UAE, Unified Healthcare Professional Qualification Requirements, 2017, refer to website: https://www.haad.ae/haad/tabid/927/Default.aspx
- NHS Estates, Department of Health Estates and Facilities Division, HBN 6 Facilities for diagnostic imaging and interventional radiology, HMSO, London, 2001

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- The Facility Guidelines Institute (US), Guidelines for Design and Construction of Hospitals, 2018. Refer to website: www.fgiguidelines.org
- The Facility Guidelines Institute (US), Guidelines for Design and Construction of Outpatient Facilities, 2018. Refer to website: www.fgiguidelines.org
- University of Oxford, Department of Physics, Future Trends in Medical Imaging 2016; refer to website: https://www2.physics.ox.ac.uk/events/2013/07/10/future-trends-in-medical-Imaging