

المديرية العامة للمؤسسات الصحية الخاصة

Directorate General of Private Health Establishment

وزارة الصحة

Ministry of Health



Licensing Requirement for Radiology Imaging Services

1st Edition

October 2025



Document Title	Licensing Requirement for Radiology Imaging Services
Document Type	Guideline
Directorate/Institution	Directorate of Private Health Establishment
Targeted Group	Radiology Departments in PHE
Document Author	Medical Imaging taskforce in DGPHE, next page
Designation	Medical Imaging taskforce in DGPHE, next page
Document Reviewer	• Munira Rashid Suliman Al Kalbani • Nadia Mohammed Ali Al Essai • Talal Mohammed Al-Sabahi • Huda Rashid Al-Harhi
Designation	• Medical physicist • Medical physicist • Sr Radiographer • Sr. Staff Nurse , Document control
Release Date	August /2025
Review Frequency	3 years

Validated by		Approved by	
Name	Dr. Said Mohammed Al Mughairi	Name	Dr. Muhanna Nasser Al Muslahi
Designation	Director of Quality Control & Patient Safety	Designation	Director General of Directorate General of Private Health Establishments
Signature		Signature	
Date	October 2025	Date	October 2025

Acknowledgements

The Directorate General of Private Health Establishments would like to appreciate and acknowledge the following members for the efforts dedicated in developing this guideline . The team are :

- Dr. Khamis Salim Al Muzahmi. Senior Consultant Radiologis
- Raaid. Ahmed Khamis Al Shamakhi , Medical imaging specialist
- Dr. Jokhah Mubarak Al Kalbani, Senior Consultant Radiologist
- Dr. Hamood Hamed Al Dhuhli, Senior Consultant
- Dr. Yahya Hamed Al Brashdi. Senior Consultant
- Dr. Ahmed Suod Al Dhuhli, Consultant Radiologist
- Dr. Khalsa Zahran Al Nabhani, Senior Consultant Nuclear medicine
- Mr. Sultan Rashid Al Sulti, Specialist medical imaging
- Mr. Ahmed Nasser Al Rashdi. Specialist medical imaging
- Mr. Hood Ibrahim Al Balushi. Specialist medical imaging

The Directorate General of Private Health Establishments extends its sincere acknowledgement and appreciation to all reviewers of this document, including the esteemed members of the Committee for Regulating Policies, Guidelines, Forms, and Circulars at the Directorate General of Private Health Establishments, as well as to the Diagnostic and Interventional Imaging Services at the Directorate General of Health Services and Program, for their valuable contributions and efforts in the validation of this document.

Contents Table:

Acknowledgements.....	3
Contents Table:	4
Acronyms	7
Definitions.....	7
Chapter 1.....	8
1. Introduction	8
2. Scope	8
3. Purpose	8
Chapter 2.....	9
4. Structure	9
4.1. DESIGN AND CONSTRUCTION STANDARDS	9
4.2. X-RAY ROOM	9
4.2.1. X-Ray Room Layout Specifications	9
4.2.2. The Control Room	10
4.2.3. X-Ray Equipment Specifications.....	11
4.2.4. Ancillary & Accessory	12
4.2.5. PACS/ Film Storage.....	13
4.3. COMPUTED TOMOGRAPHY (CT) SCANNING.....	15
4.3.1. CT Scan Room Layout Specifications	15
4.3.2. CT Scan Equipment Specifications.....	16
4.3.3. Accessory Equipment And PPE:.....	17
4.4. ORTHOPANTOMOGRAPHY (OPG)/ CONE BEAM CT (CBCT)	19
4.4.1. OPG/CBCT Room Layout Specifications	19
4.5. MAMMOGRAPHY	21
4.5.1. Mammography Room Specifications.....	21
4.5.2. Equipment Specifications:	22
4.5.3. Documentation:.....	22
4.5.4. Accessory Equipment and PPE	23
4.5.5. Staffing.....	23
4.6. BONE MINERAL DENSITY (BMD)	25
4.6.1. BMD Room Specifications	25
4.7. FLUOROSCOPY IMAGING FACILITIES.....	27

4.7.1.	Fluoroscopy Room Specifications	27
4.8.	Interventional Radiology/ Cath Lab Room Plan Specifications.....	28
	Summary	28
4.8.1.	Room Overview & Primary Components	28
4.8.2.	Key Room Components:	28
4.8.3.	Dimensional & Spatial Requirements.....	29
4.8.4.	Shielding & Radiation Protection	29
4.8.5.	Structural & Flooring Requirements.....	30
4.8.6.	Electrical & Power Requirements.....	30
4.8.7.	HVAC & Environmental Control	31
4.8.8.	Medical Gases & Piped Services	31
4.8.9.	Lighting.....	31
4.8.10.	Adjacencies & Workflow.....	32
4.8.11.	IT & Communications	32
4.9.	ULTRASOUND.....	33
4.9.1.	Ultrasound Room And Layout Specifications	33
4.9.2.	Ultrasound Scans: General Sonographers vs Subspecialist Radiologists	33
4.10.	MAGNETIC RESONANCE IMAGING (MRI).....	36
4.10.1.	Room Layout and Specifications	36
4.10.2.	Equipment Specifications	37
4.10.3.	Warning Signs.....	38
4.11.	NUCLEAR MEDICINE (NM).....	40
4.11.1.	NM Room Layout & Specifications	40
4.11.2.	Equipment And Ancillaries Specifications	41
4.11.3.	Control Room:	42
4.11.4.	Hot Lab:	42
4.11.5.	Cardiac Stress Room:.....	43
4.11.6.	Injection Room:.....	43
4.11.7.	Reporting Room:.....	44
4.11.8.	Radioiodine 131 therapy isolation Room:.....	44
4.11.9.	Radioactive waste Storage Room outside:	44
4.11.10.	Special Procedure Room:	44
4.11.11.	Physicist Quality Control Room:	45

4.11.12.	Physicist Quality Control Room:	45
4.11.13.	Documentation	46
4.11.14.	Ancillary And Accessory	46
	Appendix 8: Typical Room for NUCLEAR MEDICINE (NM).....	47
4.12.	CYCLOTRON.....	50
4.12.1.	Room Layout and Specifications	50
4.12.2.	Loose Equipment Needed	51
4.12.3.	Radiation Protection.....	55
4.12.4.	Documentation	56
4.12.5.	Ancillary And Accessory	56
4.13.	CONTRAST MEDIA	59
4.14.	PERSONNEL RADIATION MONITORING	59
4.15.	RENOVATION, ADDITIONS AND RELOCATIONS TO FACILITY BUILDING	60
4.16.	QUALIFICATION & EXPERIENCE STANDARDS.....	60
4.16.1.	General Radiographer	60
4.16.2.	CT Technologist.....	60
4.16.3.	MRI Technologist	61
4.16.4.	Sonographer (Ultrasound Technologist).....	61
4.16.5.	Cardiac Technology / Interventional Radiology	61
4.16.6.	Mammography Technologist.	62
4.16.7.	Staffing Standards by Modality / Room.....	62
	Chapter 3.....	64
	Responsibilities	64
	Chapter 4.....	65
	Document history and version control table	65
	References and Further Reading	65

Acronyms

MOH	Ministry of Health
DGPHE	Directorate General of Private Health Establishments
GUD	Guideline
VERS	version
PACS	Picture Archiving and Communications System
CBCT	Cone Beam Computed Tomography
OPG	Orthopantomography
HVAC	Heating, Ventilation and Air Conditioning
KHU	Kilo Heat Unit
BMD	Bone Mineral Density
NCRP	National Council on Radiation Protection and Measurements
TLD	Thermoluminescent Dosimeter
OSL	Optically Stimulated Luminescence
MHU	Mega Heat Unit
CBCT	Cone Beam Computed Tomography

Definitions

Licensing: is the official authorization granted by the Ministry of Health to a healthcare facility to establish and operate radiology services in compliance with required standards and regulations.

Teleradiology: The practice of transmitting radiological images electronically for reporting and consultation by radiologists at remote locations.

Chapter 1

1. Introduction

This guideline has been developed by the Directorate General of Private Health Establishments (DGPHE) to establish clear requirements for the licensing and operation of radiology and medical imaging services in private healthcare facilities across the Sultanate of Oman. It provides standardized specifications for design, construction, equipment, staffing, safety, and quality assurance in order to ensure safe, effective, and patient-centered radiology services.

2. Scope

This policy applies to all healthcare institutions, radiology departments, healthcare professionals, and other stakeholders involved in diagnostic imaging services within the MOH.

3. Purpose

The purpose of this guideline is to:

- Support healthcare institutions in delivering high-quality diagnostic imaging services
- Standardize licensing requirements for radiology services across private healthcare facilities.
- Protect patients, staff, and the public from radiation hazards.
- Facilitate proper planning, design, and monitoring of imaging departments.

Chapter 2

4. Structure

4.1. **DESIGN AND CONSTRUCTION STANDARDS**

Special attention is to be given to the following when designing a medical imaging room:

- 4.1.1. Structural support for equipment including equipment mounted to ceilings.
- 4.1.2. Level floor for equipment positioning and safe patient movement.
- 4.1.3. The impact on room space of large diameter electrical cable support tray in floor.
- 4.1.4. Provision for cable trays, ducts or conduits should be made in floors, walls, and ceilings as required.
- 4.1.5. Ceiling heights shall suit the equipment, but shall not be less than 3 meters for ceiling tube mount installations.
- 4.1.6. Special consideration should also be given to the width and height of door ways to ensure delivery and removal of equipment is not impeded or prevented, and that patient trolley and bed movement is not hampered.

4.2. **X-RAY ROOM**

4.2.1. X-Ray Room Layout Specifications

- X-Ray examination room: recommended area a total of **24 m²** (size: 6 meters x 4 meters).
- Console/Control room: recommended size is 2 meters x 3 meters.
- Lead window size 100 cm x 100 cm
- Wall thickness:
 - Brick wall of 9" with lead lining of 2mm till height of minimum 2.5 m.
- Lead lined doors with lead thickness 2 mm.
- The distance between the patient table (or X-ray source) and the control console room should be a minimum of 2 meters.

- Changing room should be 1.5X1.5m include hangers, cupboard for gowns, mirror, and hamper for used gowns.
- Waste bins should be foot-operated, with yellow bins designated for medical waste and black bins for general waste.
- Typical x-ray room layout is available in the DGPHE/MOH portal.

❖ Notes:

- The DGPHE, Oman, must be consulted for any clarifications regarding the shielding specifications of walls, doors, and control console panels.
- The X-ray room layout must be approved by the DGPHE before commencing any construction work.

4.2.2. The Control Room

- The protective control room shall contain 2 mm lead equivalence to the wall lead and a leaded window (100 cmX100 cm) with a clear view to the room so that the radiographer can observe the patient during and x-ray exposure.
- The control panel of diagnostic X-ray equipment operating above 125 kVp shall be installed in a separate room located outside but contiguous to the X-ray room, and provided with appropriate shielding, direct viewing and oral communication facilities between the operator and the patient.
- The control panel of X-ray equipment operating up to 125 kVp, can be located in the X-ray room.
- The distance between the control panel and X-ray unit/chest stand shall be not less than 3 m for general purpose fixed X-ray equipment.
- If the control panel is within the X-ray room, the protective shield shall be positioned to ensure that neither scattered radiation nor direct radiation can pass round the edge of the protective shield from any part of the room where X-ray procedures are carried out.

4.2.3. X-Ray Equipment Specifications

- X-Ray system must be either fully digital with digital detectors or analog system with computed radiography system.
- The X-ray generator should be a high-frequency converter type with microprocessor control.
- Tube power rating at least 40 kW.
- kV range at least 40 to 150 kVp.
- mAs range at least 0.5 to 500 mAs.
- Rotating Anode with dual focus spot.
- Anode heat storage capacity at least 300 KHU.
- Tube Housing Cooling Rate not less than 14 KHU/min.
- Total Filtration at least of 2.5 mm Aluminium equivalent.
- Cable length more than 2 m to enable operation from a minimum distance of 2 meters from the x-ray tube.
- System should have DICOM facility for image transfer and storage.
- Provision of SID (Source-to-Image receptor Distance) measurement feature.
- Also required to be provided:
 - Full technical specifications, including the power rating of the unit.
 - Supplier name, type of identification, and serial number or other unique identifier.
 - Supplier contact person and telephone number, as appropriate.
 - Date of receipt and date of commissioning (putting into service).
 - Supplier instructions, if available, or a reference to where they are retained.
 - Maintenance contract should be done for all equipment this to ensure that maintenance policy is followed
 - Complete maintenance records for all equipment.

❖ **Notes:**

- The X-ray unit must be new (unused) or manufacturer-refurbished, with a maximum age of five (5) years from the date of manufacture.
- If the unit is transferred from another clinic, it should not exceed five (5) years from the date of manufacture, ensuring compliance with the latest safety and performance standards by performing QC Test.
- The mobile x-ray unit can NOT be used inside x-ray rooms, it is only for inpatients in the wards and operation theatre.
- The acceptance testing for all radiographic units (including mobile radiographic unit) must be evaluated and approved by certified medical physicist.
- All x-ray units must not be installed or relocated without prior approval from DGPHE.

4.2.4. Ancillary & Accessory

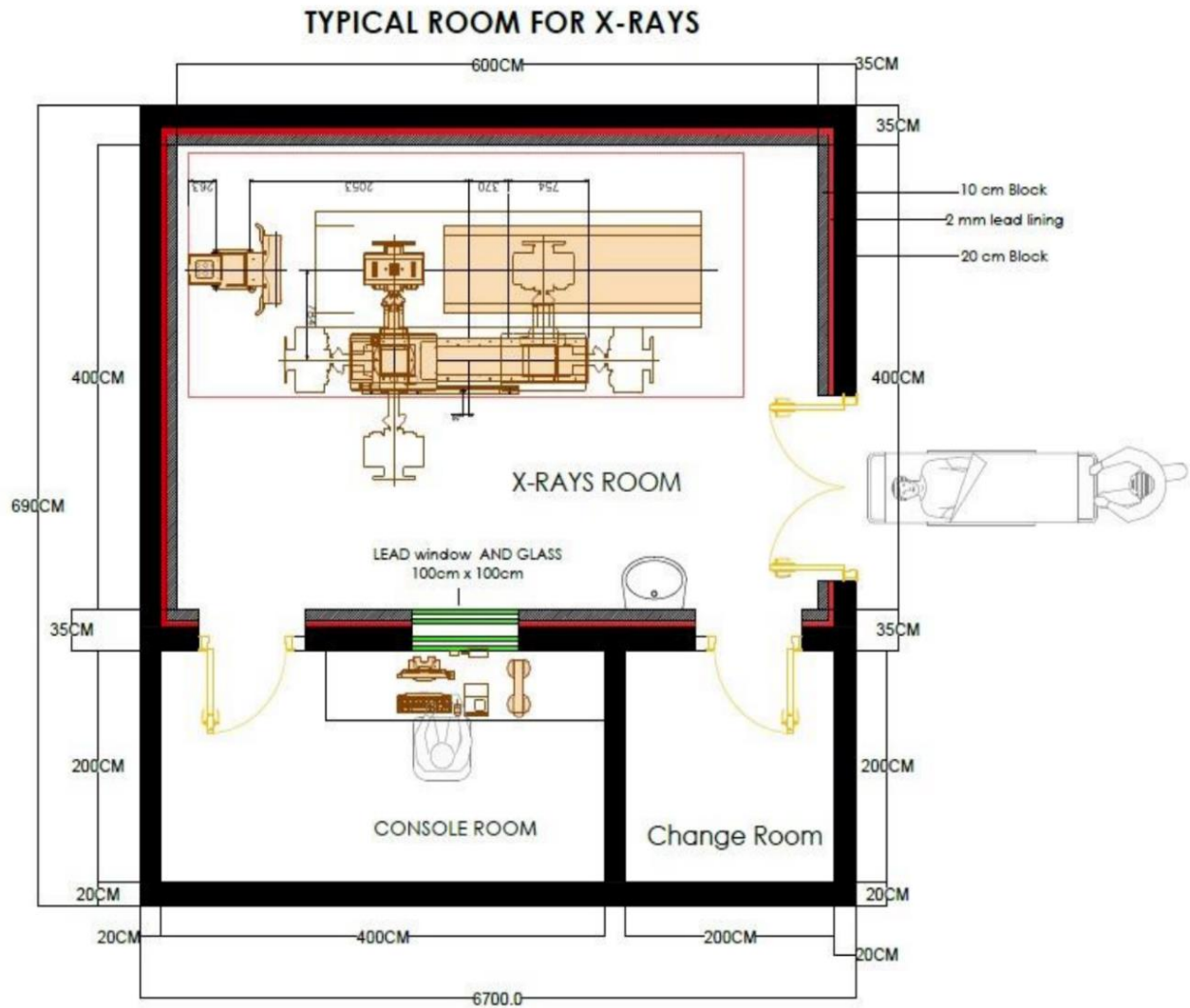
- X-ray machine with X- Ray table, and chest wall bucky unit.
- Lead aprons: Minimum 2 Nos., with at least 0.25 mm Pb equivalence.
- Gonad shields: A set of small, medium & large with at least 0.5 mm Pb equivalence.
- Thyroid shields: Minimum 2 Nos., with at least 0.5 mm Pb equivalence
- Half Shields A set of small, medium & large with at least 0.5 mm Pb equivalence.
- Immobilizer devices.
- Personal Radiation Monitoring device for each radiation worker (TLD or OSL badge)
- PPE (Personal Protective Equipment).
- Detector: digital detectors or Cassette and CR Reader.
- Grid
- Racks for cassette.
- Working table with bench.
- Footstep to help Patients to step in to X-ray table.
- Lead apron hanger.
- Computer workstation.

- Radiation warning light indicating when the X-ray beam is OFF/ON.
- X-ray caution sign on the tube housing.
- Radiation warning and No Entry signs as per MOH standard on all entrance doors (English and Arabic).
- Special accessory for pediatric support (cassette holder/chair).

4.2.5. PACS/ Film Storage

- Digital imaging applications need to be an area for the Picture Archiving and Communications System (PACS).
- Cabinets or shelves to file hard copies of patient film shall be provided, located close to the reception/ administration area.
- Archived film may be stored outside the Imaging Unit but must be properly secured to protect films against loss or damage.

Appendix 1: Typical Room for X-rays



4.3. COMPUTED TOMOGRAPHY (CT) SCANNING

4.3.1. CT Scan Room Layout Specifications

- Room: Typical Recommended Area 49m². Typical size 7 meters x 7 meters (for examination room only).
- Console Room: 2 meters x 4 meters
- Lead window of minimum 1W-meter x 2 meters
- Wall thickness:
 - Brick wall of 9" with Lead lining of 2mm till height of minimum 3.2 m or
 - Brick wall of 9" with Lead lining of 2mm till false ceiling.
 - The density of concrete or solid bricks should be such that it should offer sufficient protection for the radiation employed in the CT facility.
- Lead lined doors with lead thickness on 2 mm with overlapping of lead at joints.
- Not more than one unit of any type shall be installed in the same room.
- The room shall be sized to allow a minimum clear dimension of (2meters) on three sides of the table for access to the patient and to facilitate transfer.
- The door swing shall not encroach on the equipment, patient circulation, or transfer space.
- Patient gowning area 2 meters x 2 meters with safe storage for valuables and clothing, mirror, and hamper for use gowns.
- A view window shall be provided to permit full view of the patient.
- The angle between the control and equipment shall permit the control operator to see the patient's head.
- A patient toilet shall be provided. It shall be close to the procedure room (directly accessible to the scan room is recommended, and direct exit, so a patient can leave the toilet without having to re-enter the scan room).
- Emergency Power Off pushbutton station shall be provided. – Accessible to staff in control room, and scanning room.
- Magnetic door interlock with CT controller to prevent interruption of scanning procedure
- There shall be warning light with wording "CT IN USE, DO NOT ENTER". Provide interface with CT controller via interface relay.

- CT warning light interface relay shall be provided with low voltage power supply to match CT equipment requirements
- Radiation warning signs should be posted on the entrance door of CT scanner room (English and Arabic). Warning signs for X-Rays and alerts for pregnant patients.
- CT Scanning Rooms and Interventional Radiology rooms require radiation shielding, engineered by an appropriately certified medical physicist. Construction documents will require written certification by a registered health physicist. (MOH or environment control legal authority)

❖ **Notes:**

- The DGPHE, Oman must be consulted for any clarifications regarding the shielding specifications of walls, doors and control console panels.
- The CT room layout must be approved by the DGPHE before commencing the construction work.
- Typical CT room layout is available in the DGPHE/MOH portal.

4.3.2. CT Scan Equipment Specifications

- CT Scanner must be at least 16 Slice, state of art with simultaneous acquisition capability & superior image quality, for better visualization of anatomical structures in finer detail at reduced dose radiation to the patient
- The generator power should be minimum 80 KW and anode heat capacity should be minimum 4 MHU with high anode speed rate to ensure high quality at low x ray dose to patient.
- The CT imaging software must have separate optimized adult and pediatric protocols.
- Patient table should be designed to take patient load of minimum 200 Kgs.
- System should have DICOM facility for image transfer and storage.
- System should have laser printer facility.
- Provide radiation inspection report.
- System should be FDA or CE approved.
- The acceptance testing for CT units must be evaluated and approved by certified Medical physicist

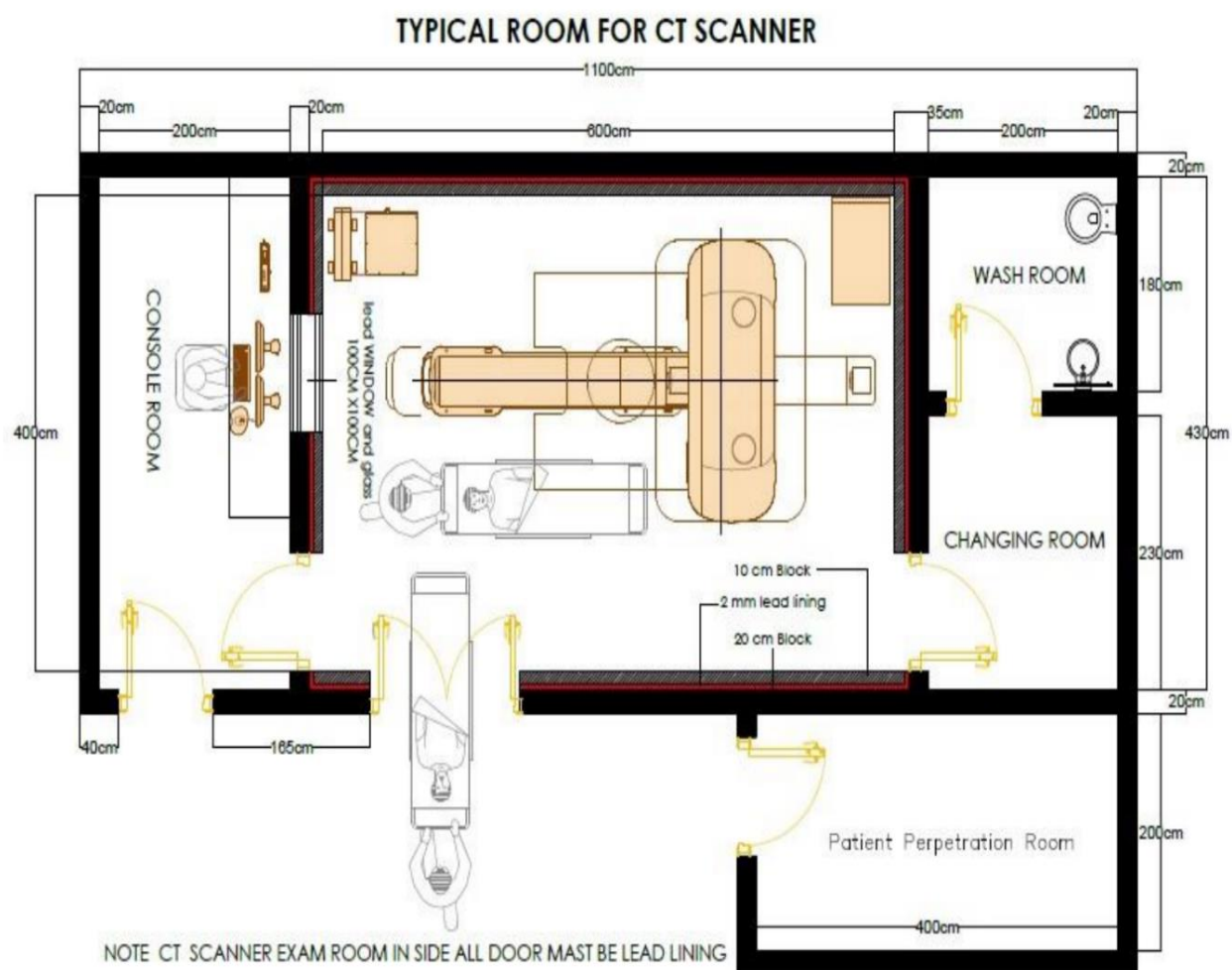
❖ **Notes:**

- Condition when received must be new or refurbished by manufacture and should not be more than 7 years.

4.3.3. Accessory Equipment And PPE:

- Lead aprons: Minimum: 3 Nos., with at least 0.35 mm Pb equivalence.
- Gonad shields: A set of small, medium & large with at least 0.5 mm Pb equivalence.
- Thyroid shields: Minimum 2 Nos., with at least 0.5 mm Pb equivalence
- Half shields: A set of small, medium & large with at least 0.5 mm Pb equivalence.
- Lead apron hanger.
- Personal Radiation Monitoring device (TLD, OSLD badge or equivalent etc.) for each radiation worker
- Red warning light sign indicating when the CT beam is OFF/ON.
- X-ray caution sign on the tube housing.
- Radiation warning and No Entry signs on all entrance doors (English and Arabic).
- Computer work station.
- Foot step to help patients to step in to X-ray table.
- Immobilizer devices.
- Special accessory for pediatric support etc.

Appendix 2: Typical Room for CT Scanner



4.4. **ORTHOPANTOMOGRAPHY (OPG)/ CONE BEAM CT (CBCT)**

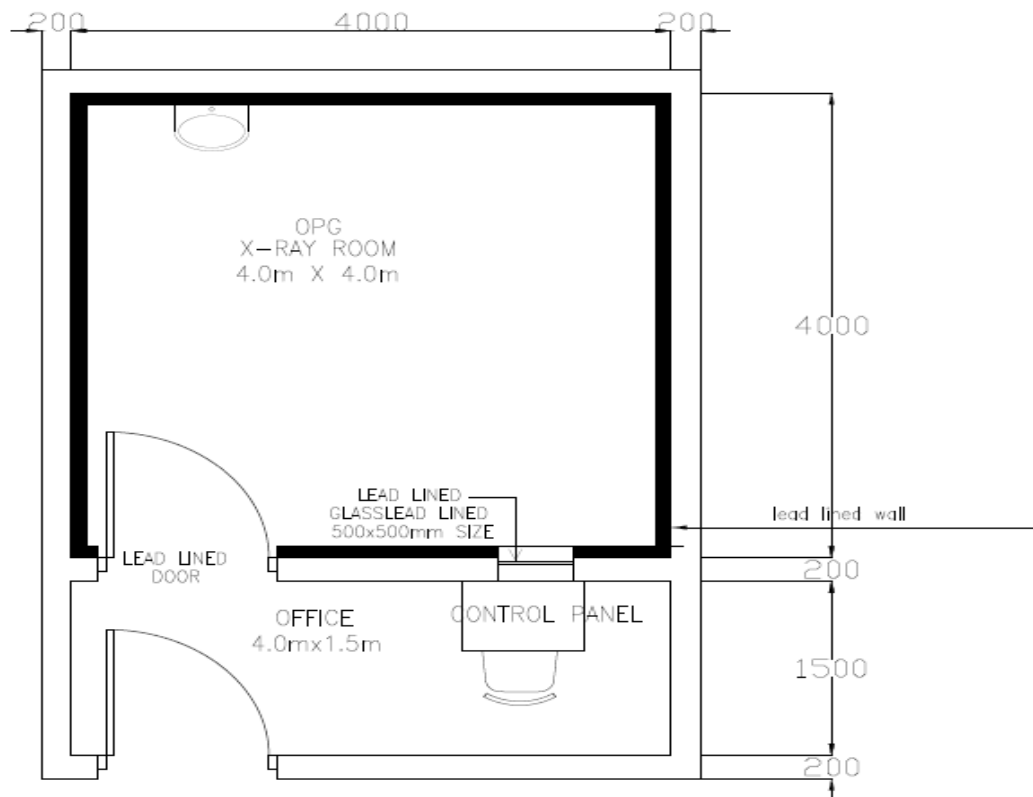
4.4.1. OPG/CBCT Room Layout Specifications

- OPG Room: Typical Recommended area 16 m². Typical size - 4 meters X 4 meters
- This equipment may be incorporated into a general x-ray room, with size 6x7m.
- OPG room minimum size 3x3 meters.
- Control room 2x2 meters (refer to the control room specification).
- Lead window of minimum 60cm x 60 cm
- Walls at primary x-ray beam shall not be less than 25cm brick thickness or if the walls are with hollow bricks, 1mm lead lining to be added.
- Walls at scattered X-ray shall not be less than 23 cm brick thickness.
- Doors shall be 1.5mm lead thicknesses.
- Protective barriers shall be 1.5mm lead thickness.
- Lead shields should be not less than 2.5-meter height and above the x-ray tube.
- Provide radiation inspection report.
- Waste bins Foot operated / yellow for clinical waste/black for general waste.
- Red warning light sign indicating when the X-ray beam is OFF/ON.
- X-ray caution sign on the tube housing.
- Radiation warning signs on doors (English and Arabic).
- The OPG/CBCT unit must be evaluated and approved by certified Medical physicist for rendering the dental radiology services and radiation protection aspects of the OPG unit.

❖ Notes:

- Typical OPG/CBCT room layout is available in the DGPHE/MOH portal.
- The OPG/CBCT room layout must be approved by the DGPHE before commencing the construction work.

Appendix 3: Typical OPG room Layout



TYPICAL OPG ROOM LAYOUT

4.5. **MAMMOGRAPHY**

4.5.1. Mammography Room Specifications

- Mammography room space requirement is at least 16 square meters preferably with 4 x 4 meters area with patient gowning area with safe storage for valuables and clothing, which shall be immediately accessible to the room.
- Radiation Protection 9” thick brick wall or with 100 mm hollow concrete bricks plus 1 mm lead lining
- Single leaf door lined with 1.0 mm lead
- Control unit with protective barrier of 1.5mm lead equivalence
- Warning light with wording “X-RAY IN USE, DO NOT ENTER”.
- Red warning light sign indicating when the X-ray beam is OFF/ON.
- X-ray caution sign on the tube housing.
- Radiation warning signs on doors (English and Arabic).
- Warning signs for X-Rays and alerts for pregnant patients.
- Each X-ray room shall include a shielded control cubicle. Mammography machines with built-in shielding for the operator, shall be permitted, but must be approved specifically by ministry of health and verified for radiation protection safety.
- Quality Control:
- Mammography imaging may be included for diagnostic purposes. It should be sized to allow prone positioning for some interventional biopsy procedures (only if plan for interventional).
- Mammography should be located adjacent to an ultrasound room.

❖ **Notes:**

- The DGPHE, Oman must be consulted for any clarifications regarding the shielding specifications of walls, doors and control console panels etc.

4.5.2. Equipment Specifications:

- All Mammography units MUST be digitized (Either full field digital mammography or conventional analogue mammography unit with Mammo CR reader).
- The machine MUST be regularly maintained as follows: -
- Regular preventive maintenance by the vender minimum twice per year
- Quality assurance test and radiation inspection report) by QC trained personal and reported to the radiology department at DGHPE.

4.5.3. Documentation:

- CR Reader & Laser Printer must be mammography Compatible
- Certificate of calibration
- Regular Preventive maintenance
- PACS\Workstation:
- High resolution monitor (8 MP) or higher
- Good backup solution e.g. external drive or recording media
- Printer should be cleared for mammography applications (printer pixel pitch shall not exceed the detector element).
- Typical mammography room layout is available in the DGPHE/MOH portal.
- The mammography room layout must be approved by the DGPHE before commencing the construction work.
- The mammography facility must be evaluated and approved by certified Medical physicist for rendering the clinical mammographic patient care services in the mammo suite and radiation protection aspects of the mammography unit.
- Also, any mobile mammography facility/unit in any medical center/ polyclinic / hospital must be evaluated and approved by certified Medical physicist for rendering the mammographic services and radiation protection aspects of the mobile mammography facility.

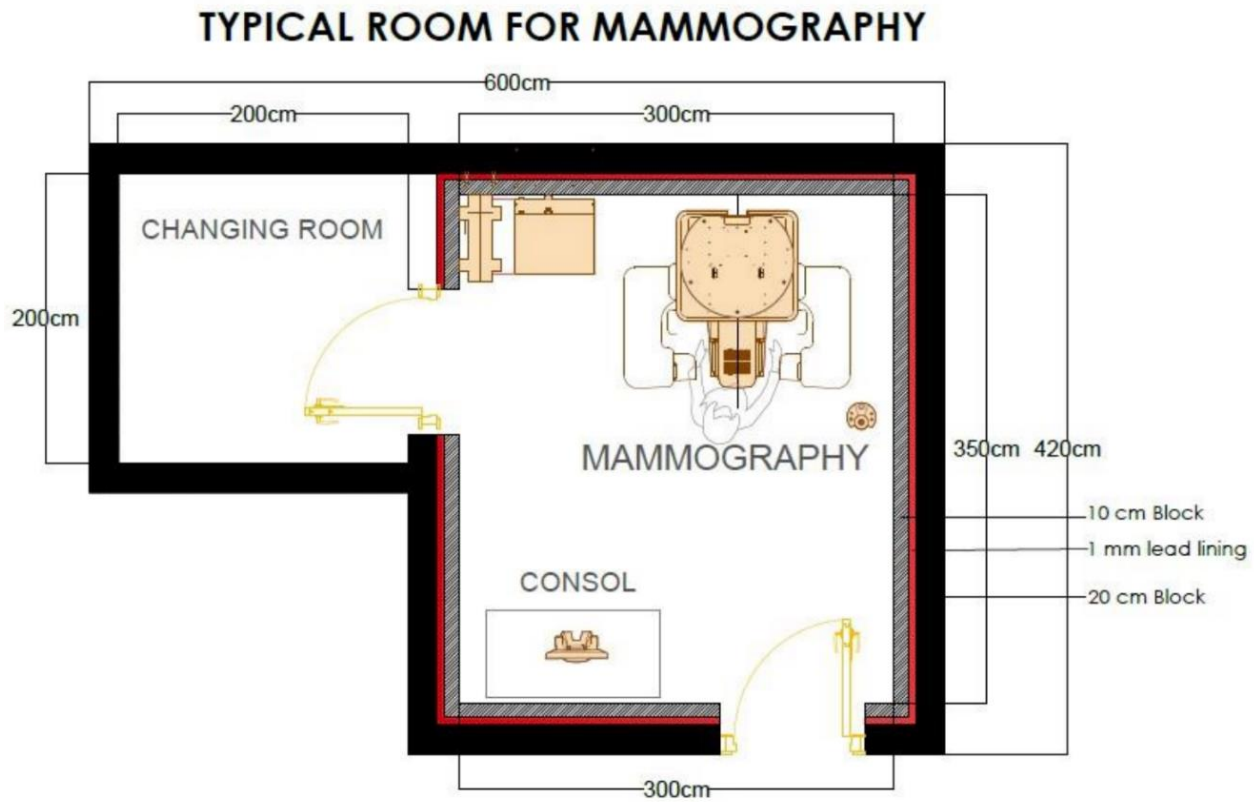
4.5.4. Accessory Equipment and PPE

- Lead apron(s): Minimum: 1 Nos. with at least 0.25 mm Pb equivalence.
- Personal Radiation Monitoring device for each radiation worker (TLD, OSLD badge or equivalent etc.)
- Lead apron hanger.
- Computer work station.
- Red warning light sign indicating when the Mammo beam is OFF/ON.
- X-ray caution sign on the tube housing.
- Radiation warning and No Entry signs on all entrance doors (English and Arabic).
- Change rooms should be dedicated and access to an interview room will be required.
- Hand wash with elbow operate or automated sensor.
- Wall mounted antimicrobial liquid soap dispenser e.g. chlorhexidine gluconate (Hydrex4%) next to the sink
- Wall mounted paper towel next to the sink
- Staff education on hand washing technique/ Hand rub poster available.
- Alcohol based hand rub on entrance and exit of the room.
- Disinfected wipes and all equipment are clean and free from dust, spills etc,

4.5.5. Staffing

- One Mammo-grapher or mammographic technician.
- One Sr. Specialist or consultant radiologist with experience in women imaging.

Appendix 4: Typical Room for Mammography



4.6. **BONE MINERAL DENSITY (BMD)**

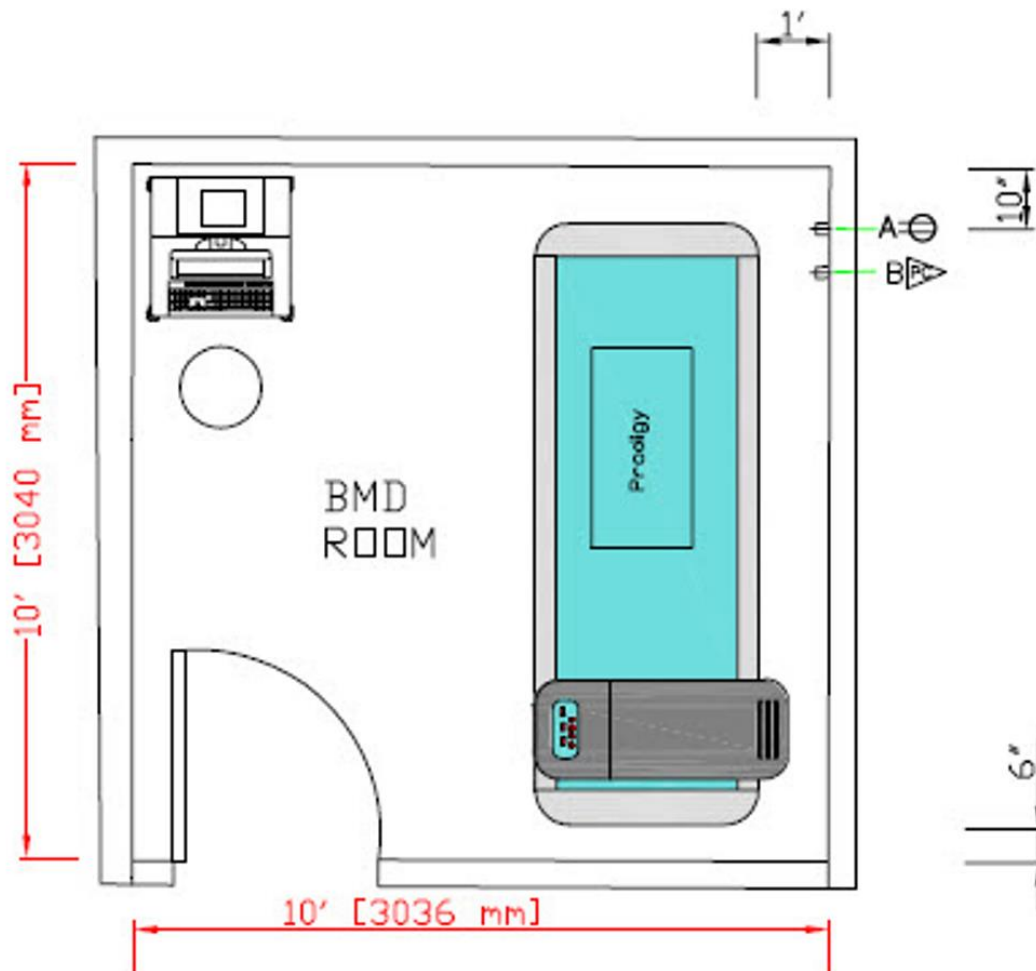
4.6.1. BMD Room Specifications

- BMD Room: Typical Recommended area 12 m². Typical size – 3.5 meters x 3.5 meters
- This equipment may be incorporated into a general x-ray room, with size 6 x7 meters.
- Control room 2 x1.5 meters.
- Lead window of minimum 60cm x 60 cm
- Walls at primary x-ray beam shall not be less than 25cm brick thickness or if the walls are with hollow bricks, 1mm lead lining to be added.
- Walls at scattered X-ray shall not be less than 23 cm brick thickness.
- Doors shall be 1.5mm lead thicknesses.
- Protective barriers shall be 1.5mm lead thickness.
- Lead shields should be not less than 2.5-meter height and above the x-ray tube.
- Provide radiation inspection report.
- Waste bins Foot operated / yellow for clinical waste/black for general waste.
- Red warning light sign indicating when the X-ray beam is OFF/ON.
- X-ray caution sign on the tube housing.
- Radiation warning signs on doors (English and Arabic).
- The BMD unit must be evaluated and approved by certified Medical physicist for rendering the dental radiology services and radiation protection aspects of the OPG unit.

❖ Notes:

- Typical BMD room layout is available in the DGPHE/MOH portal.
- The BMD room layout must be approved by the DGPHE before commencing the construction work.

Appendix 5: Typical Room for Bone Mineral Density



4.7. FLUOROSCOPY IMAGING FACILITIES

4.7.1. Fluoroscopy Room Specifications

- Fluoroscopy room: Typical Minimum Recommended area 36 m². Typical size - 6 meters x 6 meters
- Console Room: Typical size - 2 meters X 3 meters
- Lead window of minimum 200cm X 100cm
- Wall thickness: concrete wall of 9" thickness or brick wall of 9" with Lead lining of 2mm till height of minimum 3.2 m or till false ceiling.
- Lead lined doors with lead thickness on 2 mm
- Distance of minimum 2 meters to be maintained between operator and
- X- Ray source at all positions of the tube head.
- Typical fluoroscopy room layout is available in the DGPHE/MOH portal.
- Changing room should be 2X2m include hangers, cupboard for gowns, mirror, and hamper for used gowns
- Waste bins Foot operated / yellow for Medical waste/black for general waste.
- The fluoroscopy room layout must be approved by DGPHE before commencing the construction work.
- The other recommendations and guidelines mentioned for a radiographic/X-ray unit in sections 2.1 – 2.6 applies here as well.
- The fluoroscopic/ cardiac catheterization laboratory / angiographic facility must be evaluated and approved by certified Medical physicist for rendering the patient care services and radiation protection aspects of the fluoroscopic facility.
- Similarly, any mobile fluoroscopic unit in any medical center/ polyclinic / hospital must be evaluated and approved by certified Medical physicist for rendering the radiologic services and radiation protection aspects of the mobile x-ray facility.

❖ **Notes:**

- The DGPHE, Oman must be consulted for any clarifications regarding the shielding specifications of walls, doors and control console panels etc

4.8. Interventional Radiology/ Cath Lab Room Plan Specifications

Summary

This document outlines the minimum technical, spatial, and infrastructural requirements for the construction and installation of a state-of-the-art interventional radiology angiography/ Cath lab suite. The design prioritizes patient safety, clinical workflow efficiency, radiation protection, and integration of advanced imaging technology. Compliance with all applicable local and international building codes, electrical standards, and radiation safety regulations is mandatory.

4.8.1. Room Overview & Primary Components

- **Primary Function:** To perform minimally invasive image-guided procedures including, but not limited to: angiograms, embolizations, thrombolysis, stent placements, TIPS, chemoembolization (TACE), Y-90 radioembolization, biopsies, drain placements, and endovascular aneurysm repairs (EVAR).
- **Core System:** A ceiling-mounted/ floor mounted C-arm (Monoplane or Biplane) fluoroscopic angiography system with digital subtraction angiography (DSA) capabilities.

4.8.2. Key Room Components:

1. Angiography System (Equipment not included in construction budget)
2. Ceiling-mounted or boom-mounted equipment for anesthesia
3. Advanced hemodynamic and physiological patient monitoring system
4. Radiation protection systems (lead shielding, protective apparel)
5. Medical gas outlets
6. Integrated audiovisual and communication systems
7. Specialized lighting

4.8.3. Dimensional & Spatial Requirements

Parameter	Minimum Requirement	Recommended	Notes
Room Clear Floor Area	50 m ² (538 ft ²)	55-65 m ² (592-700 ft ²)	Must be clear of fixed obstructions for C-arm and table movement.
Room Width	6.0 m (19.8 ft)	6.5 m (21.3 ft)	Critical for lateral movement of the C-arm.
Room Length	8.0 m (26.2 ft)	9.0 m (29.5 ft)	Accommodates table travel, equipment racks, and staff zones.
Ceiling Height	2.7 m (8.9 ft)	3.0 - 3.2 m (10 - 10.5 ft)	Absolute critical dimension. Must accommodate the ceiling-mounted C-arm, its full range of motion, and ceiling-mounted booms. Must be confirmed with specific equipment vendor's plans.
Door Opening (Width)	1.6 m (63 in)	1.8 m (71 in)	To accommodate beds with wide side rails, ICU equipment, and bariatric patients.
Control Room Window	1.2 m x 0.9 m (4ft x 3ft)	1.8 m x 1.2 m (6ft x 4ft)	Must provide a clear, unobstructed view of the patient and all key equipment displays from the control console.

4.8.4. Shielding & Radiation Protection

- Shielding Design: Must be performed by a qualified medical physicist based on the specific equipment's workload, dose rates, and location of adjacent spaces (e.g., public corridors, offices) [1, 2].

- **Primary Barriers:** Walls, ceiling, and floor in the direct line of the X-ray beam must be shielded with lead or equivalent (e.g., barium plaster) to the thickness specified by the physicist [1, 2].
- **Secondary Barriers:** All other walls, the control room window (lead glass), and door(s) must be shielded.
- **Door:** Lead-lined, interlocked door. The X-ray system must automatically shut off if the door is opened during exposure.
- **Viewing Window:** Lead glass of specified lead equivalence (typically ≥ 2.0 mm Pb eq).
- **Penetrations:** All conduits, pipes, and cable pass-throughs in shielded walls must have "S" or "Z" patterns to prevent radiation leakage ("sky-shining") and be sealed after installation.

4.8.5. Structural & Flooring Requirements

- **Floor Loading:** Must support ≥ 680 kg/m² (140 lbs/ft²) to account for the weight of the angiography system, patient table, and multiple staff members.
- **Floor Flatness:** Critical for system stability and precision. Must be level to within ± 3 mm over 3 m ($\pm 1/8$ " over 10 ft). A monolithic, seamless, conductive epoxy resin flooring is strongly recommended.
- **Table Pedestal:** A reinforced concrete pedestal may be required by the equipment vendor. Exact location, size, and load-bearing specifications must be obtained from the vendor's installation manual.

4.8.6. Electrical & Power Requirements

- **Main Power:** Dedicated, isolated power branch from the main hospital distribution panel.
- **System Power:** A dedicated 3-phase, 480V/60A (or per vendor specs) outlet for the angiography system.
- **Receptacles:** Minimum of 16 duplex, 120V/20A hospital-grade isolated power outlets around the room perimeter, with at least 4 located in the ceiling for equipment booms.
- **Emergency Power:** All critical systems (angiography system, room lights, patient monitors, emergency outlets) must be connected to the essential or life safety branches of the emergency generator [3].

- Uninterruptible Power Supply (UPS): A central UPS is required to protect the angiography system and image storage servers from power sags and outages, preventing data loss and equipment damage.

4.8.7. HVAC & Environmental Control

- Temperature: 18° - 22° C (65° - 72° F). Strict control is required for sensitive electronic equipment.
- Humidity: 30% - 60% relative humidity, non-condensing.
- Air Changes: Minimum of 15 total air changes per hour, with a minimum of 3 outdoor air changes for infection control and odor removal [3, 4].
- Pressurization: The procedure room must be positively pressurized relative to corridors and adjacent non-clean spaces to prevent ingress of contaminants [4].
- Cooling Capacity: The HVAC system must be sized to handle a significant heat load from the angiography system, lights, and computers (≥ 5 -7 tons of cooling is typical).

4.8.8. Medical Gases & Piped Services

A minimum of two gas columns or ceiling booms should supply:

- Oxygen (O₂): Two outlets
- Vacuum (Vac): Two outlets
- Medical Air (MA): One outlet
- Nitrogen (N₂) or Compressed Air (CA): One outlet (required for powering certain angiographic injectors).
- Suction: One outlet
- Data Ports: Multiple Ethernet and RJ45 ports per column/boom.

4.8.9. Lighting

- General Examination: Dimmable, multi-level fluorescent or LED ceiling lights. Color rendering index (CRI) > 85 for accurate tissue assessment.
- Procedure/Surgical: A high-intensity, fully adjustable, ceiling-mounted surgical light with sterile handles. Must provide shadow-reduced illumination at the operative site.
- Viewing Boxes: Integrated DICOM-compliant viewing monitors have replaced traditional analog film boxes. Ensure power and data for large-screen diagnostic monitors.

4.8.10. Adjacencies & Workflow

- Control Room: Directly adjacent with a large, shielded viewing window. Houses the main system control console, hemodynamic monitor displays, and speech privacy.
- Equipment/Prep Room: Immediately outside the procedure room for storing catheters, wires, embolic agents, and other sterile supplies. Used for staging equipment and handwashing.
- Patient Holding Area: Nearby pre-procedure and recovery bays with monitoring capabilities.
- Staff Areas: Changing rooms, lead apparel storage, and a planning office should be in close proximity.

4.8.11. IT & Communications

- Network: Redundant CAT-6A or fiber optic connections to the room for PACS, HIS/RIS integration, and 3D image processing.
- Voice Communication is preferred: Hands-free intercom system between control room and procedure room. Telephone jack. (Optional).
- Audio: Integrated sound system for playing music in the procedure room (Optional).
- Video: Capability for recording and live-streaming procedures for teaching and telemedicine. (Optional).

4.9. **ULTRASOUND**

4.9.1. **Ultrasound Room And Layout Specifications**

- Ultrasound room shall be not less than 8 meters square space providing that at least one examining bed is available with hand wash facilities and with facilities/provision for patient dress change.
- Hand wash with elbow operate or automated
- Wall mounted antimicrobial liquid soap dispenser e.g. chlorhexidine gluconate (Hydrex4%) next to the sink
- Wall mounted paper towel next to the sink
- Staff education on hand washing technique/ Hand rub poster available.
- Alcohol based hand rub on entrance and exit of the room
- Disinfected wipes and all equipment are clean and free from dust, spills etc,
- Waste bins Foot operated / yellow for medical waste/black for general waste.
- A Patient toilet shall be accessible within the ultrasound room.

4.9.2. **Ultrasound Scans: General Sonographers vs Subspecialist Radiologists**

This document summarizes which ultrasound scans are usually performed by general sonographers and which are typically done by subspecialist radiologists or highly specialized sonographers. Local practice may vary depending on training, certification, and institutional protocols.

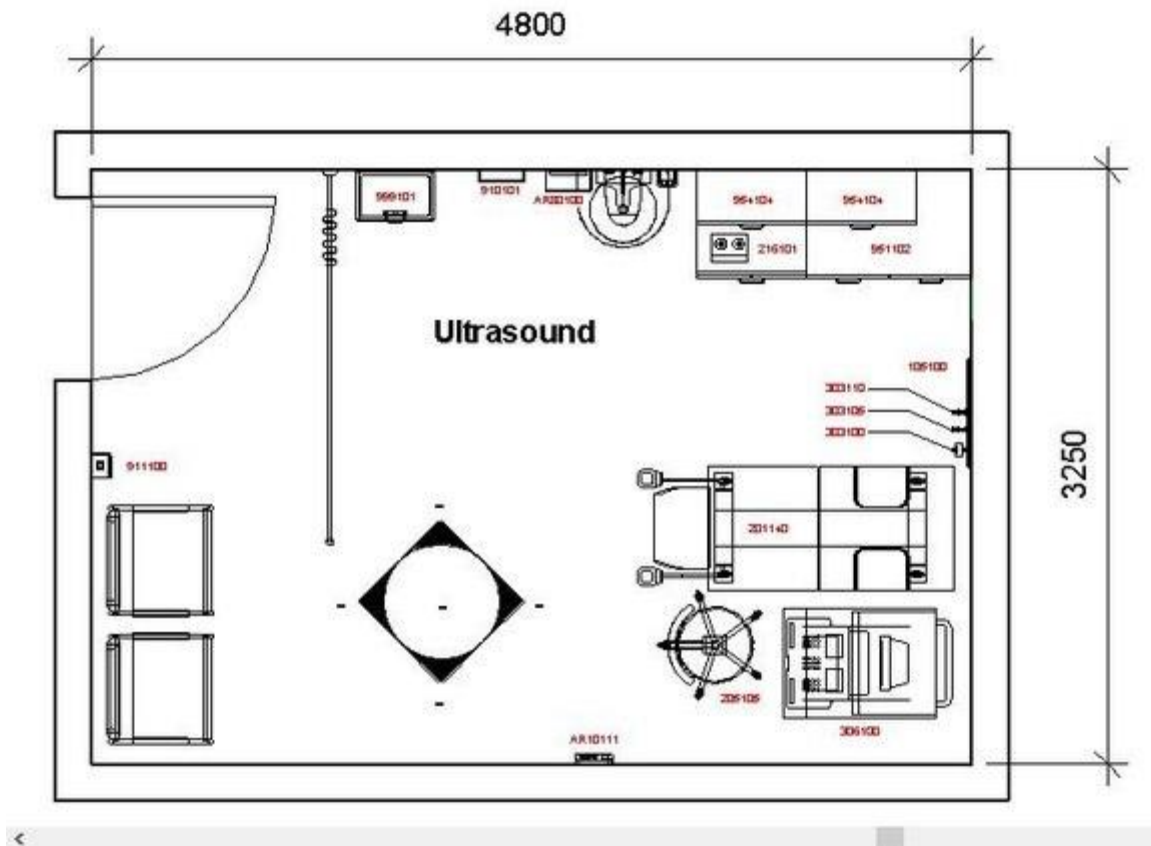
Usually performed by general sonographers	Usually performed by subspecialist radiologists / specialized sonographers
• Abdominal ultrasound (liver, gallbladder, pancreas, spleen, kidneys, aorta) • Pelvic ultrasound (uterus, ovaries,	• Detailed musculoskeletal (MSK) ultrasound (tendons, ligaments, nerves, dynamic assessment) • Contrast-enhanced ultrasound (CEUS)

Usually performed by general sonographers	Usually performed by subspecialist radiologists / specialized sonographers
bladder; transabdominal & transvaginal if trained) • Obstetric scans (dating, growth, anatomy – depends on training/regulations) • Small parts (thyroid, testes/scrotum, breast) • Vascular studies (e.g., lower limb venous Doppler, carotid Doppler) • Renal tract/bladder scans • Soft tissue lumps (assessing cystic vs solid)	• Interventional procedures (biopsies, aspirations, drainages, joint injections) • Advanced vascular studies (complex arterial mapping, dialysis fistula assessment) • Detailed fetal anomaly scans or fetal echocardiography • Pediatric ultrasound in complex cases (e.g., neonatal brain, hip dysplasia)

❖ **Note:**

- Sonographers typically acquire and document the images, and radiologists provide the final interpretation and report. In some healthcare systems, advanced sonographers may also issue formal reports under radiology department governance.
- One radiologist.
- One medical orderly
- If facility applied for sonographer only:
 - Radiologist should be available.
 - Contract with teleradiology service (teleradiology should have scanning guidelines).

Appendix 6: Typical Room for ultrasound



4.10. MAGNETIC RESONANCE IMAGING (MRI)

4.10.1. Room Layout and Specifications

- MRI Suite: Typical Recommended area 64 m². Typical size - 8 meters x 8 meters
- Examination Room: 7 meters x 7 meters
- Console Room: 2 meters x 4 meters
- MRI Window: Window of minimum 2 meters x 1 meter
- Technical Room: As per equipment requirements with proper air conditioning.
- Careful consideration must be given to the location of the MRI to minimize the provision and cost of shielding required including the following:
 - Floor / slab must be structurally capable of carrying the weight of the MRI.
 - Room size and shape must be able to contain the 5 Gauss (0.5mT) magnetic field with the room and consideration should be given to the needs for future 3T MRIs.
- Access control needs and computer equipment room security, must be included to ensure only authorized staff enter the MRI room
- The MRI room shall be located away from moving ferrous objects which can affect operation such as lifts, cars moving through car parks, construction sites.
- Ensure that emergency equipment such as fire extinguishers and medical gas bottles in the vicinity do not contain magnetic iron
- Patient gowning area outside the magnet room, with safe storage for valuables and clothing shall be provided. At least one space should be large enough for staff-assisted dressing.
- Hand-washing stations shall be provided convenient to the MRI room, but not be within the room.
- Magnetic door interlock
- MRI warning light and signs must be provided.
- No ferrous material is allowed in the construction of the room.
- There must be an emergency power supply - all power to MRI to pass through MRI isolation transformer

- Adequate space for coils storage based on these anatomic applications proposed.
- lighting is limited to nonmagnetic lighting
- Fixtures and fittings are to be non-magnetic
- Compatible MRI medical equipment including but not limited to sphygmomanometer, wheel chair and injector all should be tagged, and non-magnetic.
- Waste bins Foot operated / yellow for Medical waste/black for general waste.
- Typical MRI room layout is available in the DGPHE/MOH portal.
- The MRI room layout must be approved by DGPHE before commencing the construction work.

4.10.2. Equipment Specifications

- The MRI machine should be at least 1.5 Tesla active shielded superconducting, light weight.
- Magnet bore should be wide preferably 70 cms or at least 60 cms.
- Minimum 8/16 channel (higher channel are preferred).
- Gradient
- RF Amplifier maximum output power
- 10kw & above for body
- 2kw&above for head
- Patient table should withstand a patient load of 200 kg or more and should be height adjustable.
- System should be DICOM compatible for image transfer and storage.
- System should have printing facility.
- System should be FDA or CE approved

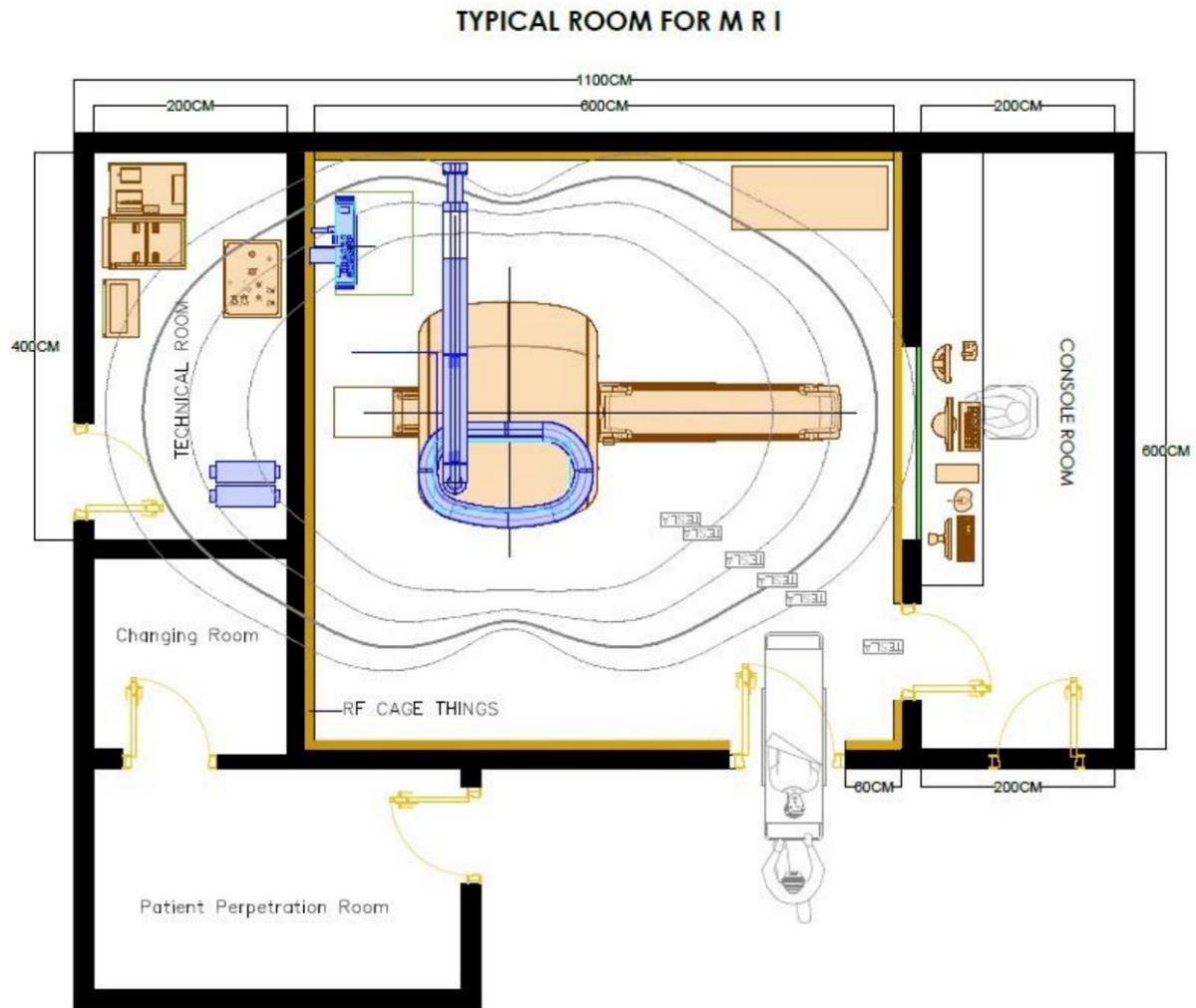
❖ Note:

- Condition when received must be new or refurbished by manufacture and should not be more than 7 years.

4.10.3. Warning Signs

- Significant warning signs must be put to highlight MRI hazards and alert people entering MRI room.
- Hand held or fixed metal detectors to be used regularly to avoid any accidents related to metal parts.
- The MRI unit must be evaluated and approved by certified Medical physicist for rendering the clinical patient care services and the MR suite must be accredited by ACR guidelines.
- Similarly, any mobile MRI unit must be evaluated and approved by certified Medical physicist for rendering the clinical patient care services and the MR suite must be accredited by ACR guidelines.

Appendix 7: Typical Room for MRI



4.11. NUCLEAR MEDICINE (NM)

4.11.1. NM Room Layout & Specifications

- The Nuclear Medicine room and doors are big enough to accommodate patients' wheelchairs/beds/trolleys and other accessories (e.g., pressure injector, monitors etc.) all the scanning rooms and Hot lab injection Room including the doors should be lead-lined
- Clear dimensions on three sides of the table to access the patient and facilitate the transfer.
- Spacious control room to accommodate all monitors and other accessories.
- Recovery/ Preparation room must be available/ If Myocardial Scintigraphy, this area shall include provision of sink, emergency crash cart that complies with MOH policy, reliable Oxygen source with backup tank/ suction apparatus etc.
- A lead lined patient toilet provided, close to the scan/ recovery room.
- Two separate waiting area cold and Hot - Male/ Female.
- The door swing does not interfere with the equipment, patient circulation, or transfer space.
- Air conditioning /lightening/ventilation are well maintained
- Hand wash with elbow operate or automated mixer and its accessories to be available in the scan & preparation room.
- Radioactive materials holding tank is a must outside the building.
- outside radioactive waste materials store
- List of utilized Rooms for patients in the Nuclear Medicine
 - ❖ Scanning Room
 - ❖ Control Room
 - ❖ Reception
 - ❖ Hot lab
 - ❖ Cardiac Stress Room
 - ❖ Injection Room
 - ❖ Reporting Room

- ❖ Radioactive waste Storage
- ❖ Two Radioiodine 131 therapy isolation Room
- ❖ Special Procedure Room
- ❖ Physicist Quality Control room

4.11.2. Equipment And Ancillaries Specifications

- Equipment availability SPECT/CT Gamma camera/or only SPECT. The Gamma camera should come with four types of Collimators, **if needed**
 - ❖ High Energy Collimator
 - ❖ Medium Energy Collimator (ME)
 - ❖ Low Energy High Resolution (LEHR)
 - ❖ Low Energy all-purpose (LEAP)
- The Gamma camera should come with all QC equipment such as QC phantoms for the daily and monthly QC.
- Loose Equipment needed for the Gamma Camera Scanning Room:
 - ❖ Free Slide Rolling pad (Transglade) (1).
 - ❖ Pressure injector (single/ dual head).
 - ❖ Lead lined Bins (1)
 - ❖ Portable suction machine (1)
 - ❖ Stainless steel dressing trolley 24 x 18 (1)
- Wall unit consists of Oxygen unit, suction machine
 - ❖ Vital Signs Machine (1)
 - ❖ BP apparatus (1)
 - ❖ Emergency Power-Off push button.
- IV stand
- Footsteps (1)

- Lead lined transportation trolley (1)
- Area monitoring for each isolation room and all radiation area

4.11.3. Control Room:

- Gamma camera workstation + processing stations + image viewer and ALshifa station
- Laser printer/ CD burner
- Stand-alone PC for reading outside CD connected to the internet and printer (1)
- Control room shielded with glass leaded with a clear view to the patient.

4.11.4. Hot Lab:

- Safety cabinet laminar flow should be lead lined for preparing radiopharmaceuticals.
- Dose Calibrator with accessories, linear moly assay shield, syringe and moly assay shield vial
- Transporting lead syringe box (3)
- Radioactive color-coded lead vials (10)
- Stainless steel top work bench
- L-Bench with leaded glass
- Radioactive waste lead-steel containers (3)
- Lead bricks (interlocking lead bricks (2 inch lead) for 3 walled enclosure 20 inch wide x 12 inch height x 20 inch deep, total weight 475 lbs
- Portable GM survey meter (latest model)
- Medical refrigerator
- Hot lab emergency eyewash near the sink/ or emergency shower.
- Dose rate monitor with alarm (2)
- Electronic personal dosimeter (to the number of technologists working in the department)
- Decontamination Kit
- Long leg stool (1)
- Good ventilation
- Control access door

- Specific cleaning materials

4.11.5. Cardiac Stress Room:

- Bed with railing (1)
- Stainless steel dressing trolley 24 x 18 (2)
- Portable suction machine (1)
- Sitting weighing scale (1)
- Infusion pump (1)
- crash trolley with defibrillator (1)
- Free Slide Rolling pad (1)
- Portable Oxygen cylinder with flow meter (1)
- Vital Signs Machine with cardiac monitor (1)
- Wall unit consist of Oxygen unit, suction machine
- Reflow machine
- Twin flow meter
- O2 connector
- O2 Cylinder
- IV stand (1)
- Stool (2)
- Lead lined Bins (1)
- Stethoscope (1)
- Wall mounted BP apparatus or portable BP apparatus (1)
- Humidifier (1)
- Blood Glucose meter (1)
- Hamper (1)
- Medicine trolley

4.11.6. Injection Room:

- Special injection (reclining chair)
- Emergency eyewash near the sink

- Stainless steel dressing trolley 24 x 18 (1)

4.11.7. Reporting Room:

- Stand PC for reading outside CD connected to the internet and printer (1).
- PACS/ Mini-PACS/ Viewing Box
- Availability of a dedicated reporting workstation and storage devices (storage devices as per MOH)

4.11.8. Radioiodine 131 therapy isolation Room:

- Small coffee table
- TV
- Refrigerator
- Lead screen barrier
- Lead-lined cupboard to keep the Iodine 131 capsule
- Bed with railing (1)
- Wall unit consists of Oxygen unit, suction machine and BP apparatus
- CCTV
- Storage room

4.11.9. Radioactive waste Storage Room outside:

- Should have heavy metal shelves
- Lead-lined walls
- Good ventilation

4.11.10. Special Procedure Room:

- Bed with railing (1)
- Stainless steel dressing trolley 24 x 18 (2)
- Portable suction machine (1)
- Free Slide Rolling pad (1)

- Portable Oxygen cylinder with flow meter (1)
- Vital Signs Machine with cardiac monitor (1)
- Wall unit consists of Oxygen unit, suction machine
- Twin flow meter
- O2 connector
- IV stand (1)
- Stool (2)
- Lead lined Bins (1)
- Stethoscope (1)
- Wall mounted BP apparatus or portable BP apparatus (1)
- Humidifier (1)
- Blood Glucose meter (1)
- Hamper (1)

4.11.11. Physicist Quality Control Room:

- Dose Calibrator with accessories, linear moly assay shield, syringe and moly assay shield vial and well counter
- Radiation Area monitor
- Electronic personal dosimeter: to the number of technologists working in the department
- TLC thin layer chromatography reader with all strips and chemicals are needed for QC

4.11.12. Physicist Quality Control Room:

- Door and wall are lead shielded as per MOH specifications.
- Door with- red warning light sign indications (SPECT/CT X-ray in use DO NO ENTER).
- Availability of lead protection devices and placed on a hanger.
- The control room shielded with glass leaded with clear view to the patient head.
- The availability of iterative reconstruction (IR) is strongly recommended.
- The availability of iterative reconstruction (IR) is strongly recommended.

- Patients' radiation dose is documented & maintained
- Availability of TLD and monthly dose report for workers.

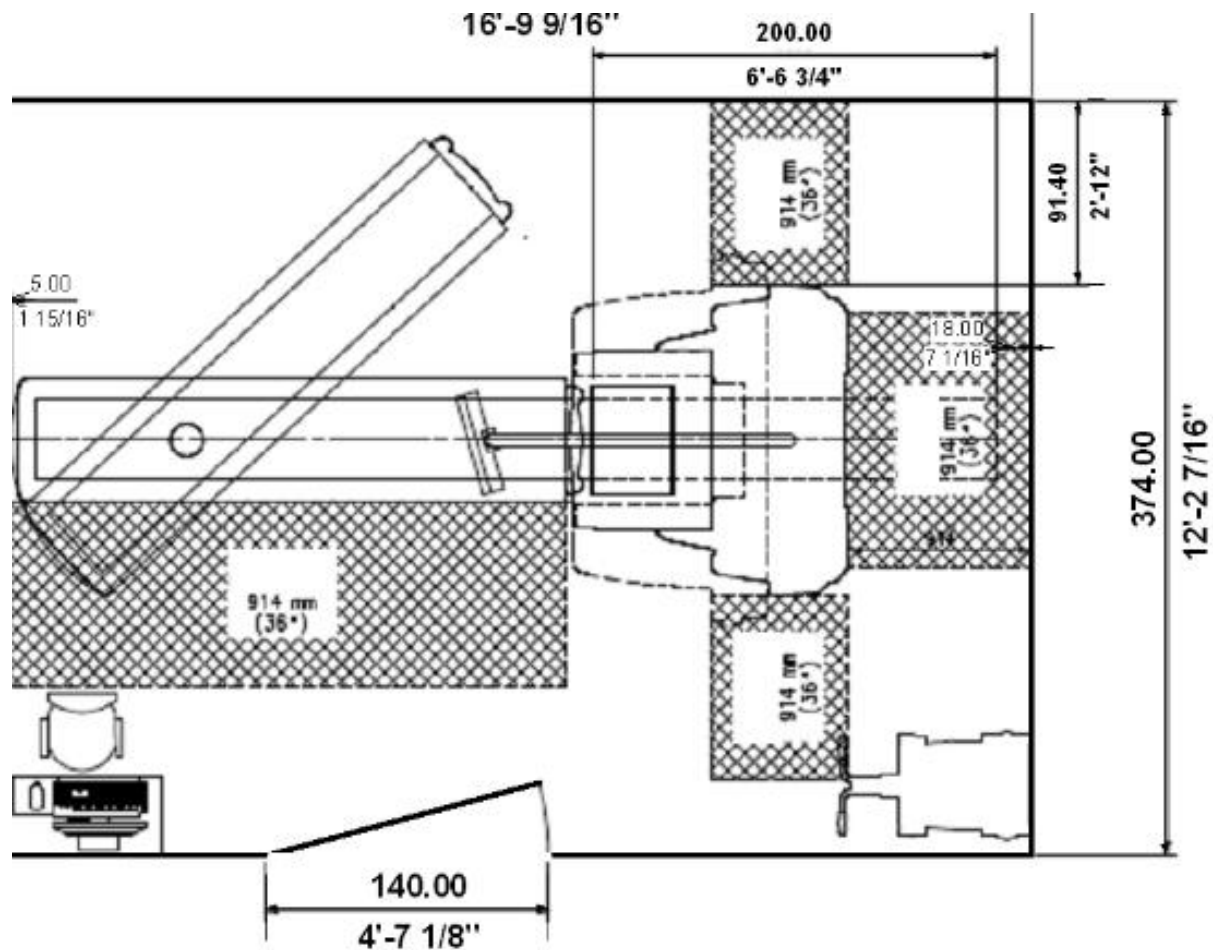
4.11.13. Documentation

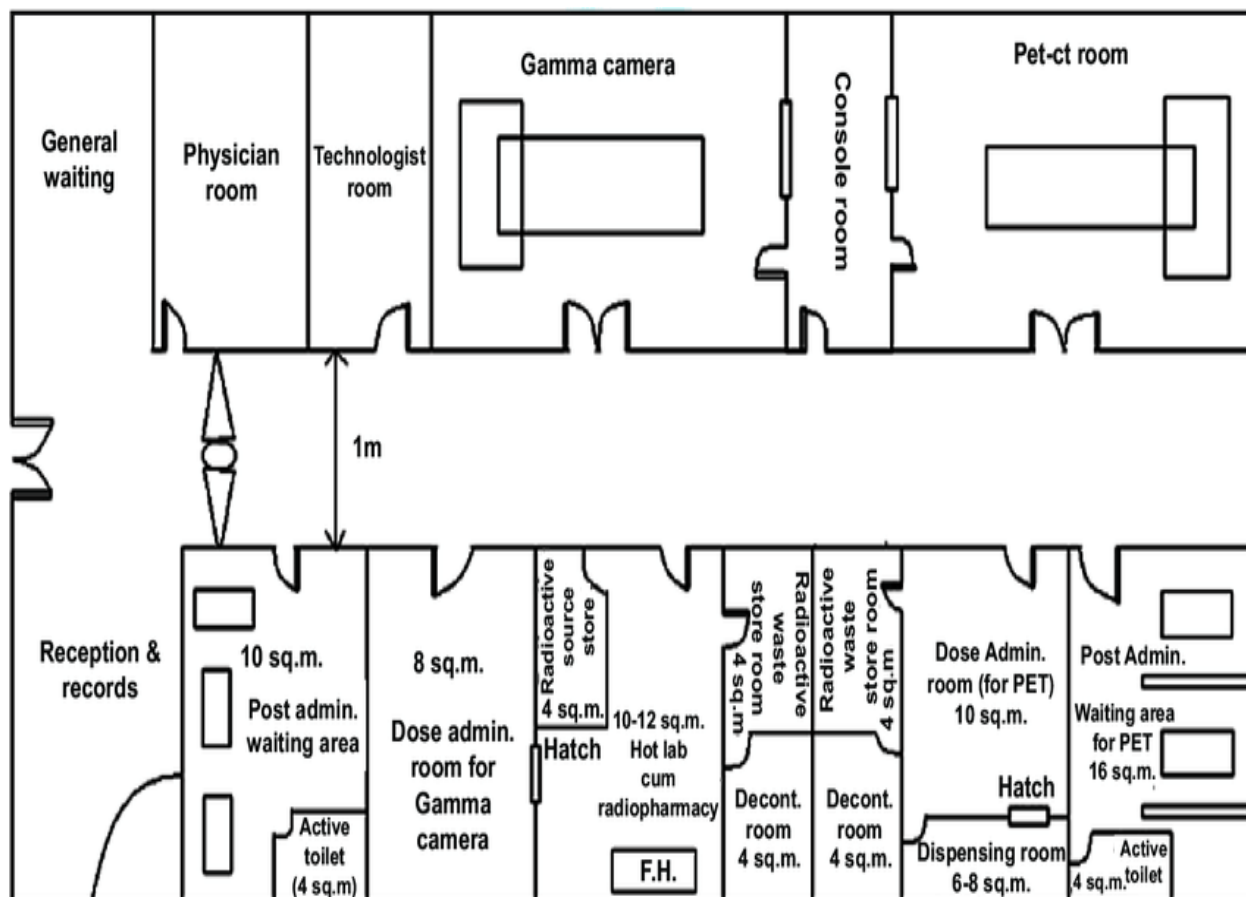
- The SPECT/CT Gamma camera/or only SPECT. should be licensed by a recognized professional body by MOH/ environment authority and fulfilling their regulations.
- Certificate of acceptance test performed by a recognized professional party.
- Preventative maintenance of equipment as per manufacturer's instructions/documented/ signed by the supervisor.
- Any breakdown is recorded and documented in the logbook.

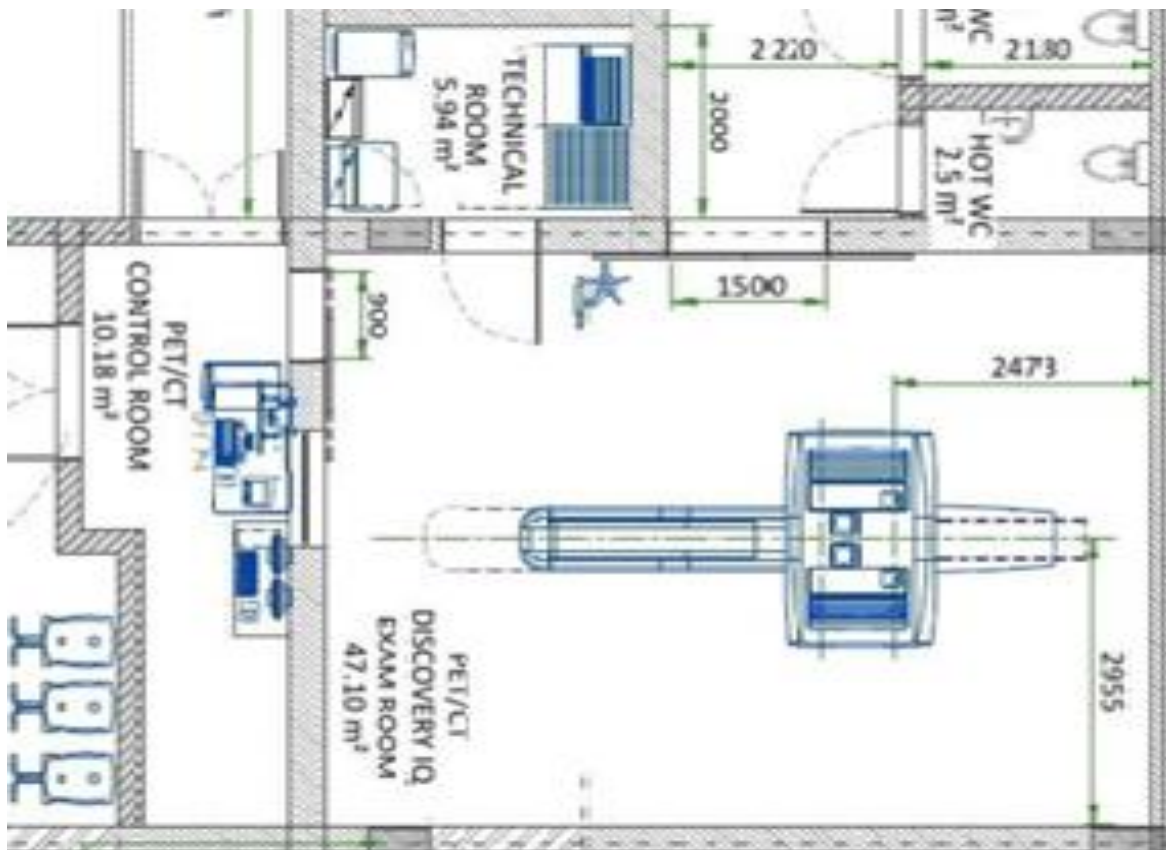
4.11.14. Ancillary And Accessory

- SPECT/CT Gamma camera/or only SPECT tabletop with mattress and disposable tissue roll.
- Medical pillow/pillow cover/sheets and blankets available and clean.
- Patient register /RNI report is available and documented.
- Electronic or paper Nuclear medicine request form (including patient name/ gender/ age/MRN/justification for the X-ray/LMP if applicable/parts to be examined and signature of the requesting doctor).
- Availability of protective equipment (gloves, gowns, face mask).
- Immobilization devices on racks or cupboards.
- Availability of foot operator dust/ waste pin.
- Fire exits marked/ lighted and unobstructed.
- Working table bench/chair.
- Lifting & transferring accessories (sliding board).

Appendix 8: Typical Room for NUCLEAR MEDICINE (NM)







4.12. CYCLOTRON

4.12.1. Room Layout and Specifications

- Availability of facility location map, design and layout including shielding thickness as well as the operational arrangements and workflow.
- Adequate space for the cyclotron and the associated infrastructure should be considered.
- The planners should follow GMP-compliant for radiopharmaceutical manufacturing incorporating a pharmaceutical quality clean room environment for control of air quality.
- High efficiency particulate air (HEPA) filters are used to filter out dust particles and other contaminants from the air coming into the building space.
- The air flow should always be designed so that the cyclotron vault is at the lowest pressure in the building, and the hot laboratories are at slightly higher pressure and the surrounding public areas are at the highest pressure.
- The area where vials are prepared, and the product is dispensed is typically a clean room with specified air particle quality that needs to be at higher pressure than its surroundings.
- Visual pressure differential monitoring devices at doorway to room.
- Flow of materials and personnel in the facility should be properly designed.
- The facility shall be secured at all times against unauthorized entrance.
- Static pressures must be maintained so that the cyclotron vault is negative to all surrounding areas, and laboratory areas are negative to office areas.
- Safety interlock doors for cyclotron room and hot lab.
- Fire extinguishers should be of the type which will not cause excessive damage to the electronic circuits.
- Availability of gas leak detector.
- Multiple emergencies exits.

- The walls should be covered with a seamless material or painted with a smooth surface paint.
- The floors should be covered with seamless vinyl or other material.
- Air conditioning /lightening/ventilation are well maintained.
- The decommissioning plan should be prepared.
- List of utilized Rooms for preparing radiopharmaceuticals:
 - ❖ Cyclotron Room
 - ❖ Cyclotron Control Room
 - ❖ Engineering Room
 - ❖ Gases Room
 - ❖ Radioactive Waste Store
 - ❖ Raw Materials Store
 - ❖ Ante Room
 - ❖ Hot Lab
 - ❖ Gowning Room
 - ❖ Laminar Flow Room
 - ❖ Production Room
 - ❖ Shipping Room
 - ❖ Transportation Room
 - ❖ Power Supply Room

4.12.2. Loose Equipment Needed

■Cyclotron Room.

- ❖ Cyclotron connected with UPS system
- ❖ Supplies of electricity, water and air for routine operation
- ❖ Radioactive waste storage area
- ❖ Lead-lined Bin
- ❖ Stainless steel trolley

- ❖ Emergency Power-Off push button
 - ❖ Footstep
 - ❖ Stair
 - ❖ Radiation area monitoring device with alarm
 - ❖ Temperature/Humidity Monitor
- **Cyclotron Control Room:**
 - ❖ Radiation level control system
 - ❖ Standalone PC for reading outside CD connected to the internet and printer
 - ❖ Radiation area monitoring device with alarm
 - ❖ Temperature/Humidity Monitor
- **Engineering Room:**
 - ❖ Spare parts
 - ❖ L-Bench with leaded glass
 - ❖ The work surfaces should be resistant to chemicals and solvents, smooth, and easy to clean. They should not generate dust.
- **Gases Room:**
 - ❖ Nitrogen gas grade 5.5
 - ❖ Argon Gas grade 5.5
 - ❖ Hydrogen gas grade 6.0
 - ❖ Zero air gas grade 5.5
 - ❖ Helium gas grade 5.5
 - ❖ Compressor air unit
- **Radioactive Waste Store:**
 - ❖ Space should be allocated with specific cabinets or bins for proper storage of radioactive materials.

■ **Raw Materials Store:**

- ❖ Space should be allocated with shelves for proper storage of raw materials.
- ❖ The label affixed on the raw material container should include such information as lot number, receipt and expiration dates.
- ❖ Inventory system.

■ **Hot lab:**

- ❖ The QC laboratory should be supplied with proper equipment to carry out the necessary tests according to international guidelines with special systems and printers.
- ❖ The computer systems and the software running the automated equipment require control and safeguarding, ensuring that no inadvertent or even deliberate changes have occurred.
- ❖ The work surfaces should be finished in hard, impervious, heat resistant, stain resistant, chemically resistant and easily cleaned material.
- ❖ Safety cabinet laminar flow should be lead lined for testing radiopharmaceuticals.
- ❖ Dose calibrator and well counter with accessories, syringe and vial shielded holder.
- ❖ Transporting lead syringe box
- ❖ Top work bench
- ❖ L-Bench with leaded glass
- ❖ Radioactive waste lead-steel containers
- ❖ Lead bricks
- ❖ Portable GM survey meter (latest model)
- ❖ Hot lab emergency eyewash near the sink/ or emergency shower.
- ❖ Hand wash with elbow operate or automated mixer and its accessories to be available in the laboratory.
- ❖ Radiation area monitoring device with alarm

- ❖ Electronic personal dosimeter (to the number of staff working
- ❖ Decontamination Kit
- ❖ Forceps
- ❖ Good ventilation
- ❖ Control access door
- ❖ Medical refrigerator
- ❖ Standalone PC for reading outside CD connected to the internet and printer
- ❖ Oven
- ❖ Incubators required for microbial monitoring for sterility and aseptic processing
- ❖ Water Deionizer machine
- ❖ Glassware
- ❖ Lead-lined Bins
- ❖ Temperature/Humidity Monitor
- ❖ Footstep
- ❖ Lab chairs

■ **Laminar Flow Room:**

- ❖ Stainless steel trolley
- ❖ Lab chairs
- ❖ Temperature/Humidity Monitor
- ❖ Biosafety Cabinet Class A

■ **Production Room:**

- ❖ Stand PC for monitoring cyclotron operation condition
- ❖ Hot Cells class B
- ❖ Automated dispensing hot cell class A
- ❖ Dose calibrator and well counter with accessories
- ❖ Synthesizers and stand PC with the system connected to the internet and printer.
- ❖ Stainless steel trolley

- ❖ Pass boxes to laminar flow room, to hot lab and to the shipping room
- ❖ Footstep
- ❖ Lab chairs
- ❖ Lead lined storage cabinet
- ❖ Temperature/Humidity Monitor
- ❖ Radiation area monitoring device with alarm.

■ **Shipping Room:**

- ❖ Heavy-duty stainless steel trolley.
- ❖ Radiation area monitoring device with alarm.
- ❖ Pass box to transportation room.

■ **Transportation Room:**

- ❖ Heavy-duty stainless steel trolley.
- ❖ Lead shielded vial/syringe containers.
- ❖ Lead shielded transportation box.
- ❖ Proper and licensed vehicle.

4.12.3. Radiation Protection

- Doors and walls are lead shielded as per MOH and IAEA specifications.
- Door with- red warning light sign indications (radiation use DO NO ENTER).
- Availability of lead protection devices.
- Hand foot radiation monitor.
- Availability of TLD and monthly dose report for workers.
- Staff' radiation dose is documented & maintained.
- Waste contaminated with radioactive material should be stored and handled in a way that is in compliance with all appropriate regulations.
- Availability of written plans for workers and public protection.

- The facility should be equipped with a radiation alarm system.
- Shielding is required around all areas where radioactive material is being stored, processed, or used in synthesis.
- All radiation workers shall be appropriately trained in radiation safety.

4.12.4. Documentation

- Cyclotron should be licensed by the Environment Authority and fulfilling their regulations. Certificate of acceptance test performed by a recognized professional party.
- Written procedures for equipment validations, revalidations, calibrations and preventative maintenance of equipment as per manufacturer's instructions.
- Any equipment breakdown is recorded and documented in the logbook.
- All batch production and QC and transportation should be recorded and signed.
- Radioactive sources certificate and leak test records.
- All SOPs, forms, and quality documents required for cyclotron facility should be available and up to date.
- Written quality assurance program/quality management system including radiation safety manual.
- Written non-radioactive and radioactive waste management documents.
- Raw material specifications.
- Staff responsibilities and authorizations. Staff training records.
- Quality audit records.
- Clean room air monitoring records.
- A written emergency plan.

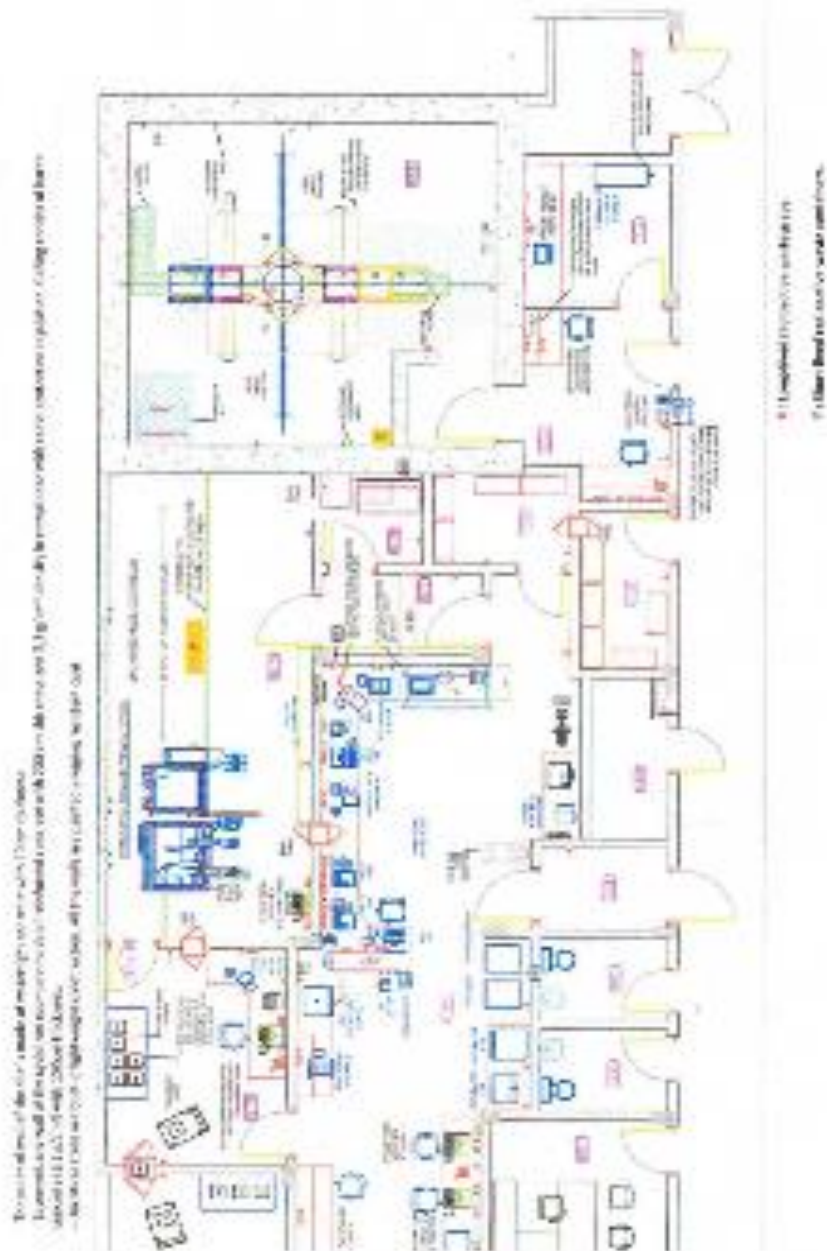
4.12.5. Ancillary And Accessory

- Staff offices with washroom.
- Staff room.
- Special shoes for staff to be worn inside the production room and in the hot lab.

- Special cleaning tools.
- Availability of protective equipment (gloves, gowns, face mask).
- Shelves and cupboards.
- Availability of foot operator dust/ waste pin.
- Fire exits marked/ lighted and unobstructed.
- Working table bench/chair.
- Board.
- Lifting & transferring accessories.
- The operation of a cyclotron facility requires a continuous supply of various raw materials and spare parts.

Appendix 11: Typical Room for Cyclotron

CYCLOTRON FACILITY LAYOUT



4.13. CONTRAST MEDIA

If contrast media are used (CT, MRI) this area should be 3x3 m and shall include:

- Provision of sink, counter, and storage area for medication.
- Hand wash with elbow operated or automated sensor.
- Wall mounted antimicrobial liquid soap dispenser e.g. chlorhexidine gluconate (Hydrex4%) next to the sink
- Wall mounted paper towel next to the sink
- Staff education on hand washing technique/ Hand rub poster available.
- Alcohol based hand rub on entrance and exit of the room
- A Crash trolley/crash cart is mandatory where contrast or invasive procedures are carried out, and shall comply with the Ministry of Health standard.
- Provision for central oxygen or oxygen cylinder.
- Appropriate emergency equipment and medications must be immediately available to treat adverse reactions associated with administered medication.
- Defibrillators, electrocardiography must be available.
- Waste bins Foot operated / yellow for Medical waste/black for general waste.
- One preparation room, if conveniently located, shall be permitted to serve any number of rooms.

4.14. PERSONNEL RADIATION MONITORING

- It must be provided by or under the supervision of a Medical Physicist.
- Using a calibrated and appropriate dosimeter, from an approved accredited dosimetry service either nationally or internationally which will accurately evaluate Medical Exposures.
- Dosimetry service must have:
 1. Monthly or bimonthly occupational dose records;
 2. Worker Annual Doses;
 3. Monthly dose monitoring for Pregnant Staff;
- 4. Overexposure and unexplained doses investigation

4.15. RENOVATION, ADDITIONS AND RELOCATIONS TO FACILITY BUILDING

In case of renovation or addition or re-location to the existing diagnostic imaging facility building, the management must apply for the same with the preliminary and final architectural plans with specifications showing the proposed renovation or addition or re-location to the existing facility.

Changing and upgrading or replacing of the x-ray tube /machine, radiation inspection to be done as in the case of a new installation and report to DGPHE. The DGPHE procedures for a new radiological facility must be followed in this case too.

4.16. QUALIFICATION & EXPERIENCE STANDARDS

4.16.1. General Radiographer

A. Minimum Qualification:

- Diploma (3 years) or Bachelor's Degree (4 years) in Radiography / Medical Imaging.

B. Experience Requirement:

- **Diploma holder:** Minimum 3 years supervised clinical experience before independent practice.
- **Bachelor holder:** 2 year of experience.

4.16.2. CT Technologist

A. Minimum Qualification:

- Bachelor's in Radiography/Medical Imaging, OR Diploma (3years).

B. Experience Requirement:

- **General radiography experience:** Minimum 2 years before starting CT specialization.
- **CT training:** At least 6–12 months structured training in CT.
- **Independent practice:** Usually after 3 years total experience.

4.16.3. MRI Technologist

A. Minimum Qualification:

- Bachelor's in Radiography/Medical Imaging (4years), OR Diploma (3years) + Postgraduate Certificate/Diploma in MRI.

B. Experience Requirement:

- **General radiography experience:** Minimum **2 years** before entering MRI.
- **MRI specialization training:** At least **6-12 structured training**
- **Independent practice:** **3 years total experience.**

4.16.4. Sonographer (Ultrasound Technologist)

A. Minimum Qualification:

- Bachelor's in Radiography/Medical Imaging (4years) + Postgraduate Certificate/Diploma in Ultrasound (1year), OR Direct BSc in Ultrasound (4 years).

B. Experience Requirement:

- **General radiography experience:** Minimum **2 years** before starting sonography training (if from Radiography background).
- **Specialized ultrasound training:** **1-year minimum.**
- **If BSc in Sonography:** **3 years' total experience.**

4.16.5. Cardiac Technology / Interventional Radiology

A. Minimum Qualification:

Diploma (3 years) in diagnostic radiography.

or Bachelor's Degree (4 years) in:

- Radiography / Medical Imaging, OR
- Cardiac Technology / Cardiovascular Technology
- International radiography.

4.16.6. Mammography Technologist.

A. Qualification:

- BSc Radiography OR Diploma in Radiography.
- Additional **certification/training in Mammography** (mandatory, especially for breast positioning, compression, and QC).

B. Experience:

- 2 yrs general radiography before starting mammography.
- 6–12 months structured mammography training.
- **Independent practice in Mammography:** 3 years total.

❖ Note:

For all specialties all candidates should pass a written exam and the interview.

4.16.7. Staffing Standards by Modality / Room

A. X-ray Room (Conventional Radiography)

- 1 General Radiographer per X-ray room per shift
- 1 Radiology Nurse (optional, only if contrast or interventional fluoroscopy is performed)

B. CT Scan Room

- **1 CT Technologist per CT scanner per shift**
- **1 Radiology Nurse (mandatory if contrast exams are performed)**

If **high-volume CT** (>30 patients/day), add **1 extra technologist** to cover patient prep and reporting workflow.

C. MRI Scan Room

- **1 MRI Technologist per MRI scanner per shift**
- **1 Radiology Nurse (mandatory if IV contrast is used or sedation cases are performed)**

For **high-volume centers** (>20 scans/day) or **sedation/anaesthesia cases**, add **1 extra technologist or nurse**.

D. Ultrasound Room

- **1 Sonographer per ultrasound room**

If the room handles **both OPD + inpatients**, consider **2 sonographers** (or 1 sonographer + 1 radiographer trained).

E. Cath Lab / Interventional Radiology Room

- **2 Cath Lab Technologists per room** (one operating the fluoroscopy system, one assisting scrub side).
- **1 Radiology Nurse (mandatory)**

F. Mammography Room (if available)

- **1 Female Mammography Technologist per room**
- **1 Female nurse in case of any contrast and biopsy procedure.**

** If MRI/ CT scan in diagnostic center or separate radiology it will require the following:

- Two receptionists.
- One radiologist
- One radiographer per machine.
- One radiology staff nurse.

Minimum Staffing for a Private Hospital with 1 X-ray, 1 CT, 1 MRI, 2 Ultrasound Rooms

Room/Modality	Minimum Staff per Shift
X-ray Room	1 Radiographer + (shared assistant)
CT Room	1 CT Technologist + 1 Nurse + (shared assistant)
MRI Room	1 MRI Technologist + 1 Nurse + 1 Assistant
Ultrasound Room (x2)	1 Sonographer each (total 2) + (shared assistant)
Cath Lab (if present)	2 Technologists + 1 Nurse + 1 Assistant + Cardiologist
Mammography Room	1 Technologist + 1 Assistant

Chapter 3

Responsibilities

Directorate General of Private Health Establishments shall

- Approve facility designs, issue licenses, monitor compliance, and conduct inspections.

Licensed Healthcare Professional shall

- Ensure adherence with the contents of this guideline.

Reporting Radiologists shall

- Ensure adherence with the contents of this guideline

Chapter 4

Document history and version control table

Version	Description	Author	Review date
1	Initial Release	Medical imaging taskforce in DGPHE	October 2028

References and Further Reading

1. National Council on Radiation Protection and Measurements (NCRP). (2005). NCRP Report No. 147: Structural Shielding Design for Medical X-Ray Imaging Facilities. Bethesda, MD: NCRP.
2. American Association of Physicists in Medicine (AAPM). (2021). AAPM Report No. 395: The Design and Planning of Interventional Radiology (IR) and Cardiovascular Interventional (CVI) Suites. Alexandria, VA: AAPM.
3. Facility Guidelines Institute (FGI). (2022). Guidelines for Design and Construction of Hospitals. Dallas, TX: FGI.
4. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). (2019). ASHRAE Handbook - HVAC Applications, Chapter 9: Health Care Facilities. Atlanta, GA: ASHRAE.
5. Equipment Vendor Site Planning Guides: (e.g., Siemens Healthineers, Philips, GE HealthCare, Canon Medical).