Australasian Health Facility Guidelines

Part B - Health Facility Briefing and Planning

0500 - Nuclear Medicine Unit

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Australasian Health Facility Guidelines

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01 INTRODUCTION

01.01 Preamble

PURPOSE OF GUIDELINE

This Health Planning Unit (HPU) has been developed for use by project staff - architects, planners, engineers, project managers and other consultants, and for end users to facilitate the process of planning and designing a unit that will be fit for purpose in line with local service plans.

It should be read in conjunction with the Australasian Health Facility Guideline (AusHFG) generic requirements and Standard Components described in:

- Part A: Introduction and Instructions for Use
- Part B: Section 80 - General Requirements
- Part C: Design for Access, Mobility, OHS and Security
- Part D: Infection Prevention and Control
- Part E: Building Services and Environmental Design.

It is strongly recommended that this HPU is read in conjunction with HPU 480 - Positron Emission Tomography (PET).

01.02 Introduction

DESCRIPTION OF NUCLEAR MEDICINE

Nuclear Medicine (including PET) is the specialty of medicine which employs unsealed sources of radioactive isotopes (radiopharmaceuticals or tracers) for diagnosis (85%) and therapy (15%). It has an impact on most areas of modern clinical medicine.

Nuclear medicine differs from most other imaging modalities in that:

- it has distinctive clinical and technical staffing, training and accreditation requirements; and
- the tests primarily show the physiological function of the system or organ being investigated as opposed to the anatomy as is the case with radiology.

However, nuclear medicine images can be superimposed on appropriately registered images from modalities such as computed tomography (CT) or magnetic resonance imaging (MRI) - image fusion - to further highlight in which part of the body the radiopharmaceutical is concentrated.

Nuclear medicine imaging works by administration of a radioactive substance or tracer to the patient that gives off energy as gamma rays or beta particles. In a normal organ, the radiopharmaceutical will have characteristic uptake, clearance or distribution. Organs not functioning normally will have variations on these characteristics and therefore indicate potential disease. The gamma camera detects the rays and with computer processing, images and measurements of organs and tissues are produced.

The tracer is usually administered intravenously but may be taken orally, inhaled or by other means such as eye drops.

The radiopharmaceutical used is determined by the part of the body under study, since some compounds collect in specific organs better than others.

DIAGNOSTIC PROCEDURES

Nuclear medicine scanning techniques may be used for, but are not limited to:

- analysis of kidney function;

- imaging of blood flow and cardiac function;
- scans of lungs for respiratory and blood-flow problems;
- examination of brain function to determine signs of dementia, epilepsy and tumour;
- staging of tumours at diagnosis and assessment of response to therapy and tumour viability;
- early detection of metastatic disease;
- measurement of thyroid function to detect an overactive or underactive thyroid; and
- evaluation of bones for fracture, infection, arthritis or tumour.

THERAPEUTIC PROCEDURES

Therapeutic procedures include, but are not limited to:

- treatment for an overactive thyroid (hyperthyroidism) or thyroid tumours using radioactive Iodine-131 - also called Radioiodine-131;
- palliative pain relief and palliation of metastatic bone pain using Strontium- 89; and
- palliation and treatment of other tumours including liver and adrenal malignancies.

In therapeutic nuclear medicine, the radionuclides used often differ from those in diagnostic nuclear medicine in that they are usually beta emitters with longer physical and biological half-lives. Therapy radionuclides may require different facilities to radionuclides used for diagnostic procedures to ensure the safe preparation and administration of the radiopharmaceutical.

RADIOPHARMACY

Radiopharmacy deals largely with the preparation, compounding, quality control and dispensing of radiopharmaceuticals for human use - in vivo studies. Radioactive isotopes are attached to a pharmaceutical substance and used as radiopharmaceuticals in the diagnosis and treatment of many diseases.

Radiopharmaceuticals are prepared in a Radiopharmacy Laboratory. Only designated units will have an in-house laboratory where cold kits are prepared for in-house use and for supply to smaller Nuclear Medicine Units. Smaller units will be supplied with sterile pharmaceuticals to Therapeutic Goods Administration (TGA) standard as cold kits stored and dispensed in a laboratory specifically designed for the storage and supply of radiopharmaceuticals. This is called the Hot Laboratory.

The work is performed by radiochemists or nuclear medicine technologists and/or dedicated medical laboratory scientists. Many nuclear medicine units e.g. private practices may receive a daily delivery of the radiopharmaceutical already prepared and dispensed as individual patient doses. Other isotopes / radionuclides e.g. gallium, thallium are delivered weekly or monthly as required and come prepared for dispensing into individual doses.

TECHNETIUM

Technetium is a short-lived solution used for a wide range of organ scanning. It is the work horse of isotope production and is eluted from a technetium generator.

A range of cold kits is reconstituted with aliquots of the eluted 99mTc solution to form 99mTc-radiopharmaceuticals. Following quality control tests, the products are released for use as bone, renal, brain, myocardial, liver, spleen, blood flow and infection imaging agents.

It is common to have two generators at any one time as the expiry date for each is two weeks. The generators are placed in customised lead caves on a reinforced bench. Generators may be returned to the supplier on expiry, or may be stored on site for longer periods.

A weekly delivery will usually provide adequate technetium supply for most units.

SOURCE OF ISOTOPES & RADIOPHARMACEUTICALS

All users obtain isotopes from a range of external sources both within Australia and overseas. Some units with a Radiopharmacy Laboratory prepare their own radiopharmaceuticals for administration.

HALF LIFE

Half-life is the time required for the radioactivity of the isotope to diminish by 50% of its original activity due to radioactive decay. This is different to biological half-life which is the time required to eliminate 50% of the original activity of the radiopharmaceutical from the target organ.

This is important with regard to timing of scans once the radioisotope has been administered to the patient and also for frequency of delivery of isotopes from external suppliers and in-house manufacturing.

The most commonly used isotope, Technetium-99m (99mTc), is delivered from a 99Mo/99mTc generator and eluted as required to create the appropriate radiopharmaceutical with a half-life of 6 hours.

01.03 Policy Framework

RADIATION PROTECTION

All issues relating to radiation protection and safety are subject to each jurisdiction's legislation with regard to Radiation Safety Acts and Regulations.

Codes of practice and guidelines relating to radiation and protection are available from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA).

In particular, project staff should familiarise themselves with RPS 14.2 Safety Guide for Radiation Protection in Nuclear Medicine (ARPANSA 2008b).

This safety guide is one of three guides that support the application of the Code of Practice for Radiation Protection in the Medical Application of Ionizing Radiation.

IONISING RADIATION SAFETY IN LABORATORIES

For safety requirements for laboratories and precautions needed to prevent the exposure of workers and members of the public to excessive levels of radiation where sources of ionising radiation are used, refer to AS 2243 (Stds Aust 1998a).

01.04 Description

DESCRIPTION OF NUCLEAR MEDICINE HEALTH PLANNING UNIT (HPU)

Nuclear medicine services are usually provided in a dedicated unit or suite of rooms within a healthcare facility that may or may not include a Radiopharmacy Laboratory and may incorporate a PET/CT suite. The size of a unit in terms of numbers and type of cameras will be determined by the service plan and clinical needs.

Scanning equipment may comprise:

- single photon emission computed tomography (SPECT);
- dual head gamma cameras capable of SPECT;
- hybrid SPECT/CT cameras;
- PET/CT if an integrated unit; and
- bone densitometry may be incorporated in some units and is therefore addressed in this HPU.

SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHY (SPECT)

SPECT is a nuclear medicine tomographic imaging technique using gamma rays. It is very similar to conventional nuclear medicine planar imaging using a gamma camera. However, it is able to provide true 3D information. This information is typically presented as cross-sectional slices through the patient, but can be freely reformatted or manipulated as required.

To acquire SPECT images, the gamma camera is rotated around the patient. Projections are acquired at defined points during the rotation, typically every 3-6 degrees. In most cases, a full 360 degree rotation is

used to obtain an optimal reconstruction. The time taken to obtain each projection is also variable, but 15-20 seconds is typical. This gives a total scan time of 15-20 minutes.

A SPECT camera may be combined with a computerised tomography (CT) unit to form a hybrid system and fusion imaging of the physiology and anatomy of the area/s being scanned. SPECT/CT requires a separate control room and radiation screening in accordance with CT requirements.

SCANNING PROCESS

Injections (doses / tracers) may be administered by injection, orally or by inhalation e.g.Technegas. Patients may be scanned during, immediately after, a few hours later, or even several days after administration of the tracer depending on the organs to be studied and the time required for full uptake.

Scanning times vary and may range from as little as 10 minutes for oesophageal transit studies to two hours for whole body scan studies. The general range is 20 to 45 minutes.

Patients may be scanned on the gamma camera table or on their own bed although the latter is rarely possible with SPECT and SPECT/CT cameras so scanning rooms should be able to accommodate transfer of patient from bed to table and space to park the bed.

Once the scan is complete, patients remain in the waiting room until the scans have been reviewed by medical staff to avoid unnecessary return for rescan.

Patients should not be discharged if it seems likely that:

- a sealed source of radiation is lost;
- a spread of contamination may occur as a result of the excretion of an unsealed source; and
- the patient may vomit shortly after the oral administration of an unsealed source.

Refer to Radiation Protection Series 4 (ARPANSA 2002).

PATIENT CHARACTERISTICS

The Nuclear Medicine Unit requires facilities to accommodate a wide range of patients who may be:

- all ages, levels of acuity and frailty. For paediatric studies refer to Operational Policies - Paediatric Studies;
- ambulant and wheelchair-dependent outpatients - the predominant patient group;
- inpatients including ventilated intensive care patients; and
- breathless or exercise intolerant patients.

02 PLANNING

02.01 Operational Models

HOURS OF OPERATION

The Nuclear Medicine Unit will usually operate during business hours with a possible requirement for emergency access afterhours, particularly in tertiary centres.

MODEL OF CARE

The model of care will depend on level of services provided as defined in the service plan and the presence or otherwise of PET as a sub-component of the Nuclear Medicine Unit.

In large centres, it will be a discrete unit. If there are only one or two gamma cameras, it may be a discrete sub-unit of Medical Imaging. All units will have a Hot Laboratory - Hot Lab. Large centres may or may not have a Radiopharmacy Laboratory that will prepare its own radiopharmaceuticals for general use and may service other Nuclear Medicine Units in the area.

Bone densitometry may or may not be included and is described in this HPU.

FUTURE GROWTH

Service planning relies on population projections and advances in technology. In cases where it is expected that population growth will require enhanced service capacity within a five year period, the following issues need to be addressed with regard to future expansion of the Unit:

- expansion of the scanning rooms to allow for upgrades to the equipment which will require additional shielding, increased load bearing capabilities and services requirements;
- access for supply and installation of new equipment;
- increased numbers of bariatric patients; and
- identification of expansion zones for increased staffing requirements to meet service demand and technological changes.

02.02 Operational Policies

GENERAL

Operational policies have a major impact on the design and the capital and recurrent costs of health facilities. Policies will vary from unit to unit depending on a wide range of factors but the cost implications of proposed policies should be fully evaluated to ensure the most cost-effective and efficient design solutions are developed.

The development of operational policies is crucial to defining how the unit will operate within the healthcare facility, the health service and adjoining health services from where patients may be referred. Users should define their own policies - refer to Part B Section 80 for further information. The following are policies specific to this HPU.

ANAESTHESIA

General anaesthesia (GA) or deep sedation is rarely needed except in units with a large paediatric component. However, at least one scanning room should be GA capable with direct access into the scanning room. Refer to the section on Paediatric Studies below. Sedated/anaesthetised/unstable patients may proceed to a general recovery area after the examination is completed or may recover in the Unit.

BOOKINGS

Appointments are made in the Unit via a central booking system in order to coordinate supply of radiation substances. Due to the nature of some of the advice and instructions given to patients when booking the

scanning procedure, access to an interview room or privacy booth will be required at reception for this purpose.

FILM / RECORDS STORAGE

Picture Archiving and Communication Systems (PACS) is assumed. Therefore a dark room is not necessary, but a server and print room will be required if the PACS system is hosted by Nuclear Medicine. A print room is required and should be large enough to include a CD robot, a multi-format printer and consumable media for these devices.

In the absence of a comprehensive electronic patient record system, storage space for paper copies of patient scan reports / consent forms and referral documentation will be required. All patient records, including paediatric records, should be maintained and retained according to relevant jurisdiction policies and procedures. For adults this may range from seven to 15 years, and 21 years for children.

Consideration should be given to electronic records in the future including electronic ordering of scanning procedures.

MANAGEMENT OF MEDICAL EMERGENCIES

Management of medical emergencies will be in accordance with hospital policy. A resuscitation trolley should be located in or very near the Stress Testing Room as this is the most likely place for cardiac arrest. In a very large unit, a second trolley may be required in or near the Patient Holding Area.

MANAGEMENT OF RADIOACTIVE SUBSTANCES SPILLS

All surfaces including floors, bench tops, walls and junctions should be impermeable and easy to clean. An emergency shower and eye wash in the Radiopharmacy Laboratory and a separate shower for patients and staff will be required - located in close proximity to all areas of potential exposure. A decontamination kit should be stored in the Hot Lab or Radiopharmacy for quick access to contain and clean up radioactive spills.

PAEDIATRIC STUDIES

Carefully consider the needs of children treated in Units. Sedation may be needed in children younger than four years of age for specific studies that take 30 to 45 minutes to complete or for which body motion may severely degrade the images. The sedation is usually oral, however may be intravenous, depending on the child's weight. Unless the child has been sedated, daily activities can be resumed after the nuclear medicine examination. Unless pregnant, a parent may stay with the child during the procedure. Refer to the radiology information resource for patients website www.radiologyinfo.org

Specific issues relating to children and adolescents may include:

- presence of parent / carer / nurse;
- patient preparation including caloric intake and warming; and
- immobilization or when to use sedation or general anaesthesia.

PATIENT AMENITIES

The following patient amenities should be available and, where possible, should be positioned so that dosed patients do not have to cross undosed waiting areas or public corridors to access these areas:

- toilets including access toilet; and
- change cubicle/s and shower - for emergencies and post-stress testing hygiene.

PATIENT REFRESHMENTS

A beverage bay or drinking fountains should be provided for patient refreshments. Many patients undergoing scanning procedures may be fasting pre-scan, may require a cup of coffee or tea to relieve headaches and nausea, or need to be provided with a fatty meal to precipitate gall bladder contraction. Provision of refreshments should be supervised by staff.

PATIENT WAITING

Ideally, waiting areas should allow separation of dosed and undosed patients, particularly for patients undergoing cardiac scans who may wait for 45 minutes for uptake.

It is preferable to separate dosed patients from people who accompanied them to the Unit which may include young adults, pregnant women and children. Patients having a post-therapy I-131 scan should preferably be separated from patients having diagnostic scans.

Dosed patients should have access to drinking water and toilet facilities without having to go through general waiting areas. It is preferable to separate outpatients from inpatients as the latter need more privacy e.g. for bedpans, nursing care etc. Provide separate entrances.

Outpatients and their relatives need to be provided with explicit advice about the radiation safety requirements for themselves and others if they are required to wait several hours for uptake pre-scan. These patients should be encouraged to stay within the dosed patient waiting area, but if allowed to leave should be discouraged from spending any appreciable amount of time in enclosed public areas such as cafeterias. Inpatients may return to their respective wards.

Care should be taken if patients have to go to other areas for further tests.

PATIENT TRANSPORT

The model of care / service plan for the unit should define whether the Unit will have its own porter staff possibly shared with an adjoining unit or use a central transport department.

The decision may depend on the number of inpatient studies to be undertaken. If required, facilities should comprise a small porter's base with handbasin, linen storage, portable oxygen cylinders and parking areas for trolleys and wheelchairs.

PROTECTIVE APPAREL

Depending on unit policies, staff may need to wear a protective lead apron. Refer to RPS 14.2 (ARPANSA 2008b). Equipment bays holding the appropriate personnel protective apparel should be provided in close proximity to the scanning areas or located within the scanning rooms for ease of access and use.

RADIOACTIVE ISOTOPES - DELIVERY

Nuclear Medicine Units will receive sealed radioactive isotopes (delivered to a licensed person) and will be required to handle and store these as described within RPS 14.2, Section 10.4 on the Storage and Safe Handling of Sealed Radiation Sources (ARPANSA 2008b).

Technetium generators may only need to be delivered weekly, depending on requirements. There may be no guarantee delivery will occur during

business hours so arrangements will have to be made for couriers to have access to a secure area in the Nuclear Medicine Unit. This can be directly into a small storage area opening off the main corridor or via the Unit into a nominated area such as the Hot Lab.

WASTE MANAGEMENT - GENERAL

There are several categories of waste but within the context of this HPU, and excluding radioactive waste covered separately below, waste will consist of:

- clinical waste - excluding sharps used for injection of radiopharmaceuticals;
- recyclable waste - usually paper and bottles / cans; and
- general waste - any waste not included above and which is not capable of being recycled, reprocessed or re-used.

Refer to individual health jurisdiction waste management policies.

RADIOACTIVE WASTE MANAGEMENT

Radioactive waste is material contaminated with radioactive substances and may be solid, liquid or gaseous. An emergency shower and eye wash in the Radiopharmacy Laboratory and a separate shower for patients and staff will be required. A decontamination kit should be stored in the Hot Lab or Radiopharmacy for quick access to contain and clean up radioactive spills.

RADIOACTIVE WASTE DISPOSAL - LIQUID

A delay holding tank within the Unit for effluent from patient toilets, pan sanitisers and laboratory sinks is not required. For further information regarding toilets associated with treatment of inpatients with radioactive iodine, refer to section below.

RADIOACTIVE WASTE DISPOSAL - SOLID

Solid radioactive waste includes all items / materials used in treatment and manufacture e.g. laboratory glassware, pipette tips, plastic vials and trays, paper tissues, used syringes, tools, etc. Such items are to be suitably bagged, labelled and segregated, and retained in a dedicated waste holding area until designated safe for routine disposal.

It is essential that items contaminated with iodine are stored in a shielded area for three months to allow for full decay and may then be disposed of in the usual manner e.g linen, sharps, and clinical waste.

The Radioactive Waste Store may be in the Nuclear Medicine Unit or elsewhere on the campus and should be appropriately sited and shielded. It is preferable that the waste store is in the Nuclear Medicine Unit, so consider a room at the perimeter with dual and carefully controlled access. However,

if not in the Unit itself, access should not compromise radiation safety principles e.g. appropriate shielding (ARPANSA 2008c).

RADIOACTIVE WASTE DISPOSAL - SHARPS

To reduce the risk of needle stick injury and radiation exposure of staff, needles, cannulae etc used for dispensing and dose administration should be disposed of into shielded sharps containers at the point of use. When the containers are full they should be held in the radiation waste storage area for disposal.

STORAGE

Provide different storage areas to cater for clinical and non-clinical supplies and equipment. These include:

- storage in the scanning rooms to reduce manual handling issues associated with movement of heavy or bulky articles such as collimators and scanning phantoms;
- equipment bays for mobile items such as portable TVs, wheelchairs, trolleys, lifters and ultrasound scanners;
- equipment bay for Technegas unit and argon cylinder/s. The Technegas unit is bulky and sits on a trolley about 600x800mm which can be wheeled to bedside or camera for patient to inhale Tc99m. When not in use, it needs parking space alongside a large cylinder of argon gas;
- general storage for smaller equipment items;
- storage for office supplies;
- storage for sterile stock and medical consumables; and
- storage for cleaning supplies.

STAFFING

A staff establishment should be developed early in the planning process in order to assess the offices, workstations and amenities that will be required. This HPU does not offer advice on staffing levels. However a Unit should be large enough to ensure that the safety, security and emergency responses

of staff on duty are accommodated. Sizing of the Unit on this basis provides for improved operational cost effectiveness as well as compliance with security and OHS requirements.

The staff establishment may include:

- Medical Specialists qualified in Nuclear Medicine including radiologists, endocrinologists, cardiologists and paediatricians;
- Nuclear Medicine registrars / residents supported by cleaners, orderlies;
- Nuclear Medicine physicists;
- Nuclear Medicine technologists / scientists;

- Radiopharmacist/s;
- Nursing staff; and
- Administration staff.

A Radiation Safety Officer should be appointed who may or may not be a Nuclear Medicine staff member.

TEACHING AND RESEARCH

The extent of teaching and research conducted in the Unit will need to be ascertained to ensure that necessary offices, laboratories, and staff and student amenities are provided.

All major teaching hospitals will undertake staff and student teaching, research and possibly prepare novel radiopharmaceuticals for clinical use. Units undertaking clinical trials will need to carefully assess needs in excess of routine requirements both in terms of treatment rooms and staff facilities.

Dedicated infusion rooms may be required for patients requiring extended periods of observation.

02.03 Planning Models

LOCATION

The Unit should not act as a thoroughfare to other units of the healthcare facility.

The floor loading weight of both equipment and shielding should be taken into consideration when locating the Unit. A ground floor site may be the most suitable location but if this cannot be achieved, consider units above, below and adjoining the proposed location with regard to radiation shielding requirements, the weight of equipment and associated shielding and access for equipment and radioactive isotopes.

Care should be taken to ensure that the location of the Unit minimises access by persons such as lost visitors, wandering patients from other units or those with criminal intent.

CONFIGURATION

Configuration of the Unit is critical with regard to patient and staff flows. This should ensure that patients, staff and visitors are not exposed to unacceptable levels of radiation as a consequence of poor layout resulting in unnecessary traffic movement in front of, through or adjacent to areas occupied by dosed patients and scanning rooms.

Effective layout can also reduce the need for costly radiation shielding. Separate patient and staff corridor systems for the privacy of inpatients, and provide separate entries for the general public / outpatients and for patients on beds / trolleys. All patient corridors should accommodate passing and turning of wheelchairs and beds.

If provided, the Bone Density Room should be located near the entry to the Nuclear Medicine Unit to ensure patients do not unnecessarily cross areas of radioactivity. Consider separating the room from dosed patients by distance or shielding to avoid interference from high ambient radiation levels.

02.04 Functional Areas

FUNCTIONAL ZONES

The following rooms / spaces form the main functional zones of the Unit:

- reception / administration;
- outpatient waiting;
- patient holding, observation and recovery area;
- treatment areas;
- clinical support areas;
- hot lab / radioactive waste store;

- staff offices and amenities; and
- teaching and research facilities in Tertiary Centres.

RECEPTION / ADMINISTRATION

Facilities will usually comprise:

- entry lobby and general public waiting;
- reception / enquiry desk;
- bookings office or alcove;
- administrative offices; and
- clerical work area for filing, photocopying, and report typing.

Public toilets should be readily available but need not be inside the Unit. If the Nuclear Medicine Unit is part of a Medical Imaging Unit, these facilities may be shared.

OUTPATIENT WAITING

The Outpatient Waiting Area usually comprises:

- separate areas for dosed and undosed patients who may be ambulant or in wheelchairs;
- access to toilets, shower and refreshments arranged so that dosed patients are not travelling across the undosed patient waiting area; and
- child play area, if required.

A separate small waiting area for patients having bone density studies may be appropriate / required or the general public waiting may be utilised.

PATIENT HOLDING, OBSERVATION AND RECOVERY AREA

An area will be required for holding of inpatients, and recovery and observation as necessary of both inpatients and outpatients. It usually comprises the following:

- dedicated inpatient entry - direct is desirable if this can be achieved;
- curtained bed / trolley bays for holding, observation and recovery. The size of each bay and configuration of the overall space should permit both dosed and undosed patients to be held safely;
- a small staff base with handbasin;
- ready access to Dirty Utility, Linen Trolley Bay, Sterile Stock Store; and
- resuscitation trolley - if only one, it is recommended it be parked in or near the Stress Testing Room.

TREATMENT AREAS

All the following rooms are accessed by patients and require radiation shielding as advised by consultants:

- sosing / consult exam rooms - ideally adjacent to the dispensing Hot Lab;
- cardiac stress testing room;
- scanning room/s; and
- bone density room if provided.

CLINICAL SUPPORT AREAS

Clinical support areas usually include the following areas. However, if collocated with a Medical Imaging Unit, some areas listed may be shared:

- viewing / reporting area;
- dirty utility room;
- disposal room;
- equipment bays;
- equipment and general stores;
- sterile stock store or clean utility room; and
- print / server room.

VIEWING AND REPORTING AREA

Provide a dedicated room for viewing and reporting on scans. In determining the size of this room, consider future trends in service delivery and the need to accommodate increasing levels of technology.

Each viewing workstation will require PACS capability, image display monitors, patient information access monitors and a PC at each workstation plus shelving for resource material.

The number of reporting stations will be dependent on service level, number of scanning rooms and the staff establishment. Dimmable lighting is required and either no windows or windows with blinds for light control.

HOT LAB / DISPENSARY AND RADIOACTIVE WASTE STORE

In the Hot Lab radioactive radiopharmaceuticals are stored, drawn up and prepared ready for administration to the patient. A lead screen will act as a barrier behind which dispensing occurs.

Radioactive waste holding may also be incorporated into or adjacent to this space. Refer to Non-Standard Components for details.

STAFF OFFICES AND AMENITIES

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

- staff room / beverage bay;
- meeting rooms and library;
- offices in accordance with staff establishment and teaching / research roles; and
- toilets, showers and lockers.

Refer to individual jurisdiction policies regarding office provision.

RADIOACTIVE IODINE SEALED BEDROOM

Some patients who receive radioactive I-131 treatment will require inpatient management within a specially shielded inpatient single bed room. The physical location of the bed/s will be dependent on the operational policy and service requirements for the facility. These rooms are usually associated with tertiary services, recognising the role delineation / service capability profile of the facility. Refer to the end of this HPU for specific requirements.

02.05 Functional Relationships

The source of most inpatients will be Cardiology and Oncology Wards and the Emergency Department but will depend on the clinical specialties of the individual healthcare facility.

Collocation with Medical Imaging has advantages and, if Nuclear Medicine is only a small unit, some facilities such as Reception and Staff Amenities may be shared. The Unit may be collocated with the PET Suite where provided.

03 DESIGN

03.01 Accessibility

EXTERNAL

Provide:

- easy, direct access for delivery of isotopes / cold kits both during and after business hours
- easy access to/from the inpatient units, outpatient units and staff facilities
- easy access for vehicles providing maintenance or delivery of large, heavy items.

INTERNAL

Patients should have ready access to water, refreshments, toilets and shower.

03.02 Parking

Patients and visitors will use the public parking facilities with access to drop- off areas and disabled parking. An identified parking area for vehicles delivering isotopes is required. This should be in close proximity to the Hot Lab. It is best to consider this issue during the schematic design phase of the project. For staff parking, refer to Part C Section 790 for further information.

03.03 Disaster Planning

Each unit will have operational plans and policies detailing the response to a range of emergency situations both internal and external. Consider the ability to effect complete lock-down and issues such as the placement of emergency alarms, the need for uninterrupted or emergency power supply (UPS) to essential clinical equipment such as scanners, electronic sensor taps and services such as emergency lighting, telephones, duress alarm systems, servers and computers.

Arrangements for management of spills and radioactive exposure should be in place. An emergency shower with eyewash station should be readily accessible to staff, patients and the public in case of contamination. Refer to Part B Section 80 for general information regarding other disaster situations.

03.04 Infection Control

The infectious status of many patients admitted to the Unit may be unknown. All body fluids should be treated as potentially infectious and standard precautions should be taken in accordance with hospital policy.

Handbasins should be located in all clinical areas. Refer to Part D Infection Prevention and Control for further information and to individual jurisdiction policies and guidelines.

03.05 Environmental Considerations

ACOUSTICS

Sound attenuation should be provided, but not limited to, the following areas:

- SPECT/CT scanning rooms (hybrid units may be noisy);
- viewing / reporting room;

- consulting rooms; and
- toilets particularly if adjacent to offices.

For further information also refer to acoustic requirements noted on Room Data Sheets.

NATURAL LIGHT

Natural light is desirable in all patient areas, the staff room, and controllable in reporting rooms. External windows provided in scanning and uptake rooms should be assessed by a Radiation Consultant for shielding requirements. In practice, it may be difficult to shield windows equal to wall shielding levels.

PRIVACY

Visual and acoustic privacy is required in all consultation, examination rooms, and treatment spaces / scanning rooms. Patients on beds / trolleys should not have to pass through public circulation space in order to access treatment areas.

Patients will also require privacy to discuss billing and private health related concerns.

SIGNAGE

Visible warning signs are to be provided at every entry to a room where unsealed radioactive material is stored or used. Warning signs should comply with AS 1319 (Stds Aust 1994). Visible warning signs are also required to rooms with irradiating apparatus - bone densitometry and SPECT/CT systems.

INTERIOR DECOR

As far as possible without compromising clinical practice or safety, the environment should be calming, non-threatening and welcoming. Treatment areas should have soft colours, paintings, etc to counteract, as much as possible, the isolation during treatment. Consideration should be given to providing a decorative or interesting element to the ceiling for patient interest.

03.06 Space Standards and Components

HUMAN ENGINEERING

Human engineering covers those aspects of design that permit effective, appropriate, safe and dignified use by all people, including those with disabilities. Refer to Part C Section 730.

ERGONOMICS

Design the Unit so that patients, staff, visitors and maintenance personnel are not exposed to avoidable risks of injury and radiation exposure.

Badly designed recurring elements, such as height, depth and design of workstations and counters, shelving and the layout of critical rooms, have a great impact on the occupational health and safety of staff as well as the welfare of patients.

Consider work practices in relation to manual handling of equipment with significant weight. Manual handling requirements may be reduced by appropriate local storage. Refer to Part C Section 730 for further details.

ACCESS AND MOBILITY

Where applicable, comply with AS 1428 (Stds Aust 2010). Refer to Part C Section 730 for further details.

BUILDING ELEMENTS

Building elements include walls, floors, ceilings, doors, windows and corridors and are addressed in detail in Part C Section 710. Refer also to Room Data and Room Layout Sheets.

Doorways and turning circles should be sufficiently wide and high to permit the manoeuvring of wheelchairs, trolleys and equipment without risk of damage or manual handling risks, and to allow ingress / egress of equipment for installation or removal.

Ensure that floors are able to support the weight of equipment, and shielding, and that equipment is not located in vibration prone areas. Consider the need for shielding to floors or ceilings directly above, below or adjacent to the Unit.

Ensure that the allowances in some equipment specification manuals provide adequate space for complex transfers requirements such as patient from ICU bed to scanner. Refer to non standard components and the schedule of accommodation for guidance on appropriate room sizes for the scanning rooms.

DOORS AND DOORWAYS

Doorways should be sufficiently wide and high to permit movement of bariatric patients on large hospital beds, traction beds, wheelchairs, trolleys, equipment and accompanying staff escort without risk of damage or manual handling risks.

Sliding doors may be appropriate provided there is an area of wall of sufficient length. Provide the same level of shielding to vision panels in doors to treatment rooms and Hot Labs as to the adjoining walls.

Doorways to scanning rooms should be flush to the floor for ease of camera installation and movement of equipment such as collimator carts. For details refer to Part C Section 710.

RADIATION SHIELDING

Advice should be sought for each project from the Radiation Safety officer. Radiation shielding will be required to a number of areas within the Unit. These areas include but are not limited to the following:

- gamma camera rooms;
- SPECT scanning room;
- SPECT/CT scanning room;
- dosed patient waiting area; and
- reception and other rooms adjacent to dosed patient areas.

Consider the need for shielding to floors or ceilings directly above or below treatment rooms or hybrid SPECT/CT rooms.

03.07 Safety and Security

GENERAL

Safety and security involves people and policies as well as physical aspects but should be built in as part of overall design and not superimposed on a completed facility. A safety audit via a risk analysis of potential hazards should be undertaken during the design process. For details refer to Part C Section 790 and to Worksafe Victoria (2007).

OCCUPATIONAL HEALTH AND SAFETY

The handling of people and equipment is a significant issue in this Unit. As radiation exposure to staff can increase with time spent in close proximity to patients, it is important that the design facilitates efficient manual handling practices.

Consider work practices in relation to:

- manual handling of equipment for which significant weight is attached - bariatric patient beds etc;
- manual handling of patients e.g. transfers from trolleys and exact positioning for scanning in narrow or confined spaces; and
- repair and maintenance of scanning equipment.

Manual handling requirements may be reduced by appropriate local storage locations and provision of space around equipment to allow transfers and use of manual handling equipment. Refer to Part C Section 730 and to A Guide to Designing Workplaces for Safer Handling of People (Worksafe Victoria 2007).

SAFETY

Consider the impact of finishes, surfaces and fittings on safety. In particular, consider:

- slippery or wet floors;

- protrusions or sharp edges;
- stability and height of equipment or fittings;
- fittings which should be well above floor level and/or waterproof;
- adequate protection for workers against infection and any other hazards - particularly radiation exposure;
- manual handling of technetium generators. The generators weigh up 20 kg and a hoist may be required to transfer from transport package to bench top; and
- and vice versa. The hoist should be capable of slow, accurate manipulation to avoid damage to the Mo99 column within the generator shield.

Refer to individual jurisdiction policies and guidelines.

RADIATION SAFETY

Refer to RPS 14.2 (ARPANSA 2008b).

SECURITY

The security of radioisotopes and radioactive waste is of particular importance. Refer to RPS 14.2 Section 10 - (ARPANSA 2008b) and RPS11 - Security of Radioactive Sources, (ARPANSA 2007). For general security, refer to individual jurisdiction policies and guidelines.

03.08 Finishes

WALLS

Walls should washable and easily decontaminated in the event of a radioactive spill. Refer to Part C Section 710 for further information.

FLOOR FINISHES

Floor finishes and junctions should be impermeable and non-absorbent in case of radiation spills. Refer to Part C Section 710 and also to TS-7 (NSW Health & CHAA UNSW 2009).

CEILING FINISHES

Refer to Part C Section 710 for further information.

03.09 Fixtures, Fittings & Equipment

DEFINITIONS - FIXTURES AND FITTINGS

Fixtures and Fittings are defined as follows:

- **Fixtures:** Items that require service connection to walls, floor or ceilings (electrical, hydraulic, and mechanical) and include, but are not limited to, basins, light fittings, medical service panels.
- **Fittings:** Items attached to walls, floors or ceilings that do not require service connections such as curtain and IV tracks, hooks, mirrors, blinds, joinery, pin boards etc.

For additional detailed information refer to Part C Section 710, Part F Project Implementation Section 680, and to the Room Data Sheets (RDS) and Room Layout Sheets (RLS).

03.10 Building Service Requirements

GENERAL

High cost engineering areas which should receive careful consideration by design teams include:

- lighting and the impact of deep planning on lighting requirements;
- the number of sanitary fittings and the potential for reducing these by strategic location;
- extent of the required emergency and uninterrupted power supply;
- extent of provision of emergency doors;
- the need for and the cost benefit / implications of a pneumatic transport system; and
- extent of provision of essential back-up systems (e.g. dual generators, chillers, boilers and dual electrical circuits).

Refer to Part E Building Services and Environmental Design, TS-11 Engineering Services and Sustainable Development Guidelines (NSW Health 2007) and Health Facility Guidelines for Engineering Services 2006 (WA Health 2006).

CONSTRUCTION

In constructing the Unit address the following issues:

- ensure that new and existing floor structure and finishes are adequate to meet load requirements for equipment, shielding, patients, and personnel;
- ensure that walls contain the necessary support systems for medical service panels;
- provision should be made for cable trays, ducts or conduits in floors, walls, and ceilings as required for specialised equipment;
- the integrity of the shielding should not be compromised by ducts and penetrations;
- ceiling height in the scanning rooms should be a minimum of 3 metres;
- ceiling mounted equipment should have properly designed rigid support structures located above the finished ceiling; and
- a tiled ceiling should be considered for ease of installation, service and remodelling.

ELECTRICAL SERVICES

A sufficient number of power outlets, both general and essential supply, including three phase outlets, are required for current and anticipated future needs. Refer to TS-11 Section 3 (NSW Health 2007), relevant Australian Standards and to jurisdiction specific engineering services guidelines.

An emergency back-up system for the power supply should be available for high priority equipment and illumination. Provide uninterrupted power supply (UPS) to cameras, acquisition workstations and servers to prevent data loss and/or damage during power surges or brown outs.

All treatment rooms are to be body protected electrical areas. All scanning rooms require dimmable down lighting with lighting not located directly above scanning beds.

HYDRAULIC SERVICES

When routing hydraulic services and air conditioning ducts in ceiling spaces, avoid the space above gamma cameras as water leaks can cause significant damage.

The need for delayed holding tanks to patient toilets in the Unit will be dependent on the local water authority requirements and advice from the Radiation Safety Officer.

INFORMATION TECHNOLOGY AND COMMUNICATION SYSTEMS

The infrastructure for the following should be considered for the present and possible future expansion:

- wireless technology;
- voice / data systems;
- video conferencing capacity;
- duress call - fixed and personal (optional);

- CCTV monitoring systems of entry points, if considered necessary and in the scanning and uptake rooms;
- infrastructure for PACS, electronic records and imaging information management system;
- server room; and
- patient / nurse and emergency call systems compatible with existing hospital systems.

Refer also to Part E Section 2 for additional information.

MECHANICAL SERVICES

For general requirements refer to TS-11 (NSW Health 2007) and the Western Australia Health Facility Guidelines for Engineering Services (WA Health 2006).

Refer to specific Special Requirements identified in the Standard and Non Standard Components and to those listed below. Additional cooling and ventilation will be required to Scanning Rooms and associated computer equipment rooms as the equipment is sensitive to excessive ambient heat. Additional cooling capacity should be built in to allow for future growth and technological development of scanners. Some scanners may require chilled water for cooling.

Avoid large temperature changes in scanning rooms (>4˚C/hour) because of the possibility of crystal fracture in gamma cameras. General airconditioning needs to cool equipment but not blow over partially undressed patients.

To maintain a high level of staff concentration and to minimise the possibility of accidents, the temperature of the Unit should be maintained within a comfortable range not exceeding 25˚C. Smoke detectors in treatment rooms should be sensitive to radiation i.e. Photoelectric. Carefully consider the location of these. Additional air extraction may be required in the Camera Room/s where ventilation agents such as Technegas are administered in accordance with state regulatory requirements.

Hot lab and Technegas room air should not be recirculated but exhausted. Both rooms should be at a negative pressure to the rest of the Unit. The Hot Lab may require a fume cabinet with ducting to a stack. A pneumatic tube system should be provided and linked to Pathology, inpatient units and other departments as required.

MEDICAL GASES

Oxygen, suction and medical air will be required in all scanning rooms, stress testing rooms and to patient bed bays. Nitrous oxide and scavenging will be required in rooms where general anaesthesia may be administered, particularly in units where children are treated. Medical gases installation and testing in accordance with AS2896 (Stds Aust 1998b).

RADIATION SHIELDING

The principles of radiation safety and protection should be developed and integrated into the design and documentation of the Unit from the earliest stages and it is important the design team is comprehensively briefed. A qualified radiation expert should be involved in the design.

Advice from the Radiation Safety Officer should be sought for each project. Radiation shielding will be required to a number of areas within the Unit. These areas include but are not limited to the following:

- pre scan uptake rooms and patient amenities;
- SPECT/CT scanning rooms;
- post-scan waiting areas; and
- Hot Lab / radiopharmacy lab.

Refer to RPS 14.2, Section 10.2 (ARPANSA 2008b). Also refer to applicable State legislation, regulations and guidelines. In NSW, refer to the Draft Radiation Guidelines (NSW Department of Environment and Climate Change 2008).

04 COMPONENTS OF THE UNIT

04.01 Standard Components

Rooms / spaces are defined as:

- *standard components* (SC) which refer to rooms / spaces for which room data sheets, room layout sheets (drawings) and textual description have been developed;
- *standard components – derived rooms* are rooms, based on a SC but they vary in size. In these instances, the standard component will form the broad room 'brief' and room size and contents will be scaled to meet the service requirement;
- *non-standard components* which are unique rooms that are usually service-specific and not common.

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

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

04.02 Non-Standard Components

The following Non-Standard Components are unit-specific:

- Scanning Rooms SPECT and SPECT/CT;
- Dosing / Consult / Exam Room;
- Hot Laboratory;
- Radioactive Waste Holding; and
- Bone Densitometry Room.

SCANNING ROOM - SPECT AND SPECT/CT

Description and Function

A scanning room is used for obtaining nuclear medicine images. The room for SPECT/CT should be larger. Equipment may be SPECT camera or combined SPECT/CT hybrid system.

Radiation shielding is required for SPECT/CT. Bed / trolley access is required plus space to park bed or trolley. Installation of equipment should be in accordance with manufacturer's recommendations.

Location and Relationships

Rooms are ideally provided in pairs with direct access between rooms so one Nuclear Medicine technologist can monitor two patients if necessary.

Ready access is required from dosing rooms and dosed patient waiting areas.

Considerations

- floor structure should support the equipment weight;
- UPS power is required to the cameras and associated acquisition / processing workstation/s to prevent data loss and/or damage during power surges or brown outs;
- individual room temperature and humidity control is required;
- dimmable down lighting should be placed so that lights do not shine directly into the patient's eyes;

- bed / trolley access is required plus space to park a bed or trolley; and
- should be a body protected electrical area.

In addition to the camera / CT, fixtures, fittings and equipment will include:

- collimator rack/s - the collimator is a directional guide. The size and length of the collimator holes determine which gamma rays reach the detector in the camera. A range of collimators will be required. Collimator racks vary according to the model / level of Gamma Camera;
- ECG trigger and monitor for cardiac scans;
- CCTV camera (optional in SPECT/CT room);
- protective lead clothing;
- medical gases - oxygen, suction, medical air on service panel;
- nurse and emergency call system;
- power outlets on the medical services panel;
- handbasin - Type B;
- PAT slide wall-mounted;
- storage / prep bench and shelving;
- TV - fixed or portable (optional);
- overhead power to avoid floor leads; and
- computer data points near gamma camera unit as well as processing workstations.

Scanning rooms also need to consider the space requirements for servicing equipment and machines which is frequently done in situ given the size of these machines. Machines may be pulled apart to provide access to internal workings thus occupying a larger space than when operational.

CONTROL BAY

The Control Bay may be integral to the SPECT scanning room but should be separate area for SPECT/CT (as per CT imaging requirements). It requires:

- a lead observation screen for the ordinary camera to shoulder height and for SPECT to full height;
- a work bench;
- chair/s;
- viewing monitors;
- bookshelves; and
- CCTV monitor if CCTV camera installed in SPECT/CT room.

DOSING / CONSULT / EXAM ROOM

Description and Function

This room is for patient consulting, examination and administration of isotopes. In most respects, this room is similar to the Standard Component - Consult Room except that radiation screening will be required.

Location and Relationships

Ready access to scanning rooms and undosed patient waiting is required. Ideally, it should be located adjacent to the Hot / Dispensing Lab .

Considerations

Provide for inclusion of:

- examination couch;

- desk;
- chairs;
- handbasin; and
- PC / data / phone.

HOT LABORATORY

Description and Function

Note: This is not a Radiopharmaceutical Laboratory. This is a room for storage and dispensing of radiopharmaceuticals. Space is required for dose calibration, record keeping and quality control activities.

Location and Relationships

Ensure the room is readily accessible to/from dosing rooms and scanning rooms.

Considerations

- radiation shielding as advised by Consultants;
- appropriate radioactive signage on access doors;
- computerised dispensing system;
- sharps bins and a bin for general radioactive waste which may be located under a bench in lead-shielded cupboards;
- design of a preparation bench incorporating a stainless steel sink and a lead shielded cover behind which actual preparation occurs. The cover may be fixed or hinged;
- sinks and basins with handsfree taps for handwash and decontamination;
- fridges, freezers and storage cupboards for cold kits;
- computer and label printer; and
- dose calibrator.

RADIOACTIVE WASTE HOLDING

Description and Function

A room for the temporary storage of radioactive material until it is fully decayed when it can be disposed of as per normal waste.

Location and Relationships

Dual access to/from the Unit is desirable but with external access, well controlled.

Considerations

- radiation shielding to be provided in accordance with advice from the Radiation Consultants; and
- bench for sharps bins.

BONE DENSITOMETRY ROOM

Description and Function

A room for bone densitometry imaging studies primarily for osteoporosis assessment and management. Tests usually take 20 minutes. Patients are not usually required to change unless clothing has metal fasteners - zips, etc. If necessary they may change within the room itself unless throughput can be improved by providing separate change rooms.

The room should allow the operator to maintain a safe distance from the active equipment and to be able to see the patient during the scan and not positioned with back to the patient. The Radiation Consultant should be involved in the design of the room and the shielding to ensure the dose from scanner to operator is minimised. In facilities with spinal cord injury units or where the unit may be expected to see a larger number of highly dependent patients, the room should be sufficiently sized to allow safe transfer from a trolley.

Location and Relationships

The room should be located at or near the Unit entry to prevent patients coming into contact with dosed patients waiting scanning or having to pass in front of the scanning rooms. The scanner should be separated by distance or shielding from adjoining areas used by dosed patients. Check whether high radiation levels from nearby patients e.g. I -131 or PET could interfere with data/image quality of BMD scans.

Provide ready access to undosed patient waiting areas or alternatively these patients may use the general public waiting area.

Considerations

- bone densitometer machine - dual-energy x-ray absorptiometry - DXA or DEXA;
- computer workstation;
- office chair;
- visitor chair;
- shelving for gowns, positioning pillows, braces etc;
- handbasin; and
- shielding as necessary. NB: modern machines have a very low radiation dose for the scans.

AX APPENDICES

AX.01 Schedule of Accommodation

A Schedule of Accommodation follows.

The 'Room/ Space' column describes each room or space within the Unit. Some rooms are identified as 'Standard Components' (SC) or as having a corresponding room which can be derived from a SC. These rooms are described as 'Standard Components –Derived' (SC-D). The 'SD/SD-C' column identifies these rooms and relevant room codes and names are provided.

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

In some cases, Room/ Spaces are described as 'Optional' or 'o'. Inclusion of this Room/ Space will be dependent on a range of factors such as operational policies or clinical services planning.

ENTRY / RECEPTION

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 2 Cameras	Qty x m2 6 Cameras	Remarks
	Entry Lobby		1 x 6	1 x 6	
WAIT-10	Waiting	Yes	1 x 10	1 x 15	
RECL-10	Reception / Clerical	Yes	1 x 10	1 x 15	1 and 2 staff
MEET-9	Meeting Room, 9m2	Yes	1 x 9	1 x 9	Private consultations, bookings etc
OFF-2P	Office - 2 Person, Shared, 12m2	Yes	1 x 12	1 x 15	2 & 3 staff
STPS-8	Store - Photocopy / Stationery, 8m2	Yes	1 x 8	1 x 8	
STFS-10	Store - Files	Yes	1 x 8	1 x 8	

PATIENT CARE AREA

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 2 Cameras	Qty x m2 6 Cameras	Remarks
	Waiting - Dosed	Yes	1 x 12	1 x 20	Outpatients
WAIT-10	Waiting - Undosed	Yes	1 x 6	1 x 9	
PLAP-10	Play Area - Paediatric, 10m2	Yes	1 x 10 (o)	1 x 10 (o)	
WCPT	Toilet - Patient, 4m2	Yes	2 x 4	2 x 4	1 male, 1 female
WCAC	Toilet - Accessible, 6m2	Yes	1 x 5	1 x 5	
SHPT	Shower - Patient, 4m2	Yes	1 x 4	1 x 4	For post-stress testing patient hygiene and incontinent patients
BBEV-OP	Bay - Beverage, Open Plan, 4m2	Yes	1 x 4	1 x 4	
BWC	Bay - Wheelchair Park	Yes	1 x 4	1 x 4	May also include a patient trolley
	Entry Lobby - Inpatient		1 x 6(o)	1 x 6	
PBTR-H-9	Patient Bay - Holding, 9m2	Yes	3 x 9	8 x 9	Curtained bays
BHWS-B	Bay - Handwashing, Type B	Yes	1 x 1	2 x 1	Part of Inpatient Holding Area
	Staff Station / Clean Utility		1 x 8	1 x 10	Part of Inpatient Holding Area
BLIN	Bay - Linen	Yes	1 x 2	1 x 2	Part of Inpatient Holding Area
STSS-12	Store - Sterile Stock	Yes *	1 x 10	1 x 12	
DTUR-S	Dirty Utility - Sub, 8m2	Yes	1 x 8	1 x 8	
DISP-8	Disposal Room, 8m2	Yes	1 x 8	1 x 8	
	Discounted Circulation %		32	35	

TREATMENT AREAS

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 2 Cameras	Qty x m2 6 Cameras	Remarks
	SPECT Scanning Room (Inlcudes Control Bay)		42	42	Rooms should be rectangular (e.g. 6x7m)
	SPECT / CT Scanning Room		48	48	Rooms should be rectangular (e.g. 6x8m)
	SPECT Control Room		10	10	
BMEQ-4	Bay - Mobile Equipment, 4m2	Yes	1 x 4	2 x 4	
BMEQ-4	Bay - Mobile Equipment, 4m2	Yes	1 x 2	1 x 2	Technegas machine & argon cylinder
STRT	Stress Test Room	Yes	1 x 16	1 x 16	Add 2m2 if includes resuscitation trolley
BRES	Bay - Resuscitation	Yes	1 x 1.5	1 x 1.5	Unless located in Stress Testing Room
CONS	Consult Room	Yes	2 x 12	4 x 12	For dose administration and examination. Radiation safety advice may be required.
TRMT	Treatment Room	Yes		1 x 14 (o)	Ideally adjacent to the Hot / Dispensing Lab
	Bone Density Measurement Room	Yes	1 x 12 (o)	1 x 12 (o)	Increase to 16m2 if trolley / bed access required
STGN-9	Store - Equipment	Yes	1 x 9	1 x 12	
	Computer Room		1 x 8	1 x 8	Computers, printer
XRRR	X-Ray Viewing & Reporting Room	Yes	1 x 10	1 x 25	2 & 5 workstations near scanning rooms
	Discounted Circulation %		35	35	

HOT LABORATORY

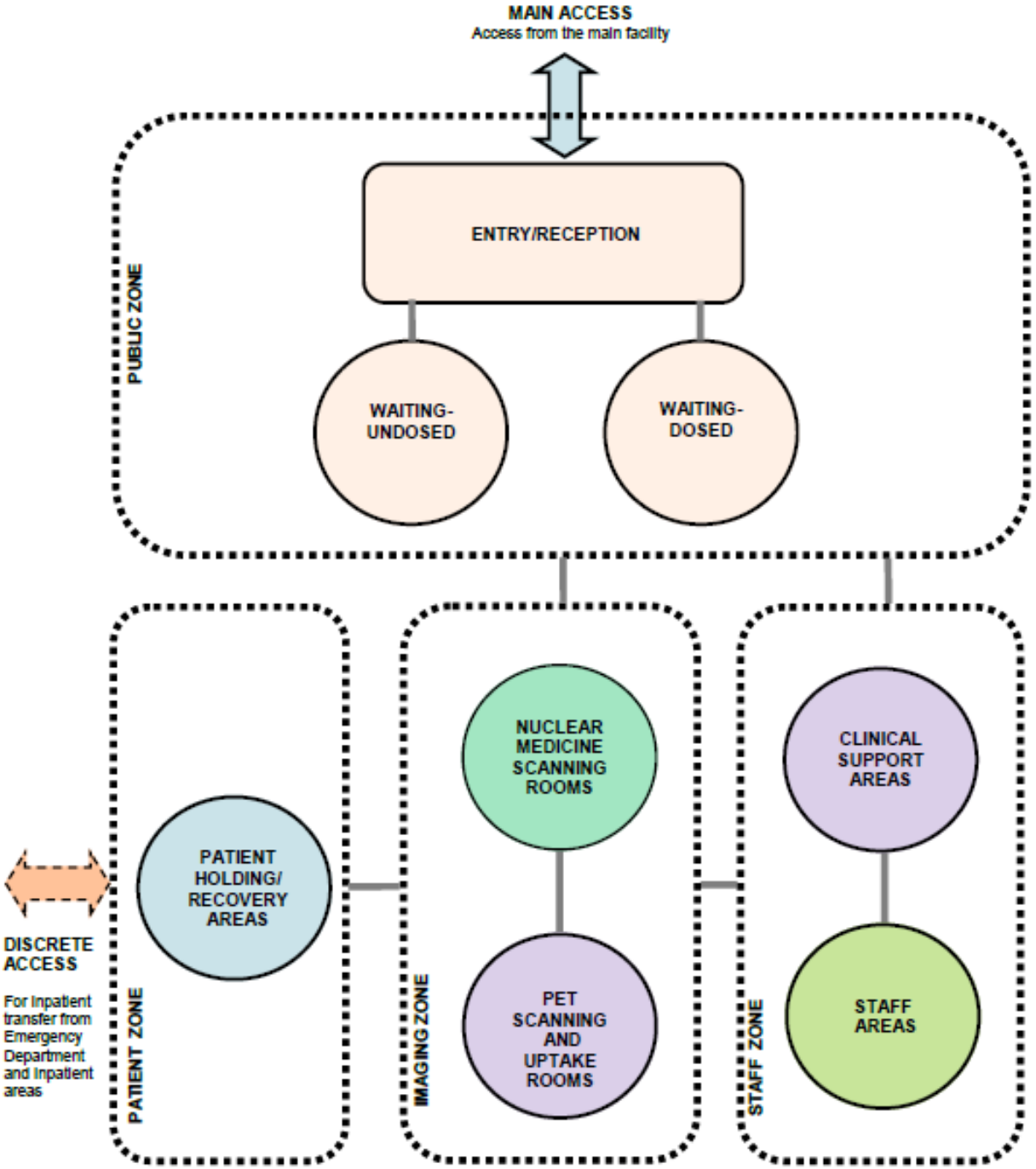
AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 2 Cameras	Qty x m2 6 Cameras	Remarks
	Entry Lobby - Isotope Delivery		1 x 4 (o)	1 x 4 (o)	delivered directly into unit. May be combined with Waste Holding Store
	Hot Lab / Therapy Dispensing		1 x 10	1 x 12	Fume hood, dose calibrator, balance, centrifuge etc
	Radioactive Waste Holding Store		1 x 4	1 x 6	
BES	Bay - Emergency Shower	Yes	1 x 2	1 x 2	Decontamination
	Discounted Circulation %		15	15	

STAFF AREAS

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2 2 Cameras	Qty x m2 6 Cameras	Remarks
OFF-S12	Office - Single Person, 12m2	Y	1 x 12	1 x 12	Unit director
	Office - Workstation, 5.5m2		1 x 5.5 (o)	1 x 5.5	Secretary to Director
OFF-S9	Office - Single Person, 9m2	Y	9.0	9.0	Number depends on staff establishment. Staff Specialists.
	Office - Workstation, 5.5m2		5.5	5.5	Number depends on staff establishment. Registrars.
OFF-S9	Office - Single Person, 12m2	Y	1 x 9 (o)	1 x 12	Chief Physicist.
	Office - Workstation, 5.5m2		5.5 (o)	5.5	Number depends on staff establishment. Physicists.
	Office - Single Person, 9m2	Y	1 x 9 (o)	1 x 9	Chief Technologist, Radiopharmacist, NUM.
	Office - Workstation, 5.5m2		5.5	5.5	Number depends on staff establishment. Technologists.
	Office - Workstation, 5.5m2		5.5	5.5	Number depends on staff establishment. Medical Typists.
SRM-15	Staff Room	Y	1 x 15	1 x 25	Includes beverage bay
MEET-12	Meeting Room, 12m2	Y	1 x 12	2 x 12	
PROP-2	Property Bay - Staff	Y	1 x 2	2 x 2	Size depends on staff establishment
SHST	Shower - Staff, 3m2	Y	1 x 3	1 x 3	
WCST	Toilet - Staff, 3m2	Y	2 x 3	2 x 3	*Number will depend on staff establishment
CLRM-5	Cleaner's Room, 5m2	Y	1 x 5	1 x 5	*May be shared with adjoining unit
	Discounted Circulation %		25	30	

AX.02 Functional Relationships / Diagrams

The following diagram illustrates the functional relationships between zones in a Nuclear Medicine Unit:



AX.03 Checklists

Refer to the Planning Checklists at the end of Parts A, B, C and D of these Guidelines for general planning checklists.

AX.04 References

LEGISLATION AND STANDARDS

Refer to References section.

SERVICE CAPABILITY

- NSW Health 2002, Guide to the role delineation of health services, 3rd edn, Statewide Services Development Branch, NSW Health.
- NSW Health 2005, PD 2005_602: Area Healthcare Service Plans - NSW Health Guide for Development, NSW Health.
- Queensland Health 2004, Clinical Services Capability Framework, V 1.0, Queensland Health.
- Queensland Health 2005, Clinical Services Capability Framework - V 2.0, Queensland Health.

ORGANISATIONS

- Australian and New Zealand Society of Nuclear Medicine (ANZSNM), www.anzsnm.org.au
- Australian Nuclear Science and Technology Association (ANSTO), www.ansto.gov.au

GUIDELINES

- DHS Victoria 2004, Design Guidelines for Hospitals and Day Procedure Centres, Department of Human Services Victoria.
- NHS Estates 2003, Schedules of Accommodation, NHS Estates.
- NHS Estates 2001, Health Building Note 6: Facilities for Diagnostic Imaging and Interventional Radiology, NHS Estates.

GENERAL POLICIES

- NSW Health 2005, PD 2005_576: Office Accommodation Policy, Public Health Organisations and Ambulance Service, NSW Health.
- NSW Health 2005, PD 2005_132: Waste Management Guidelines for Health Care Facilities, NSW Health.
- NSW Health 2005, PD 2005_409: Workplace Health and Safety, Policy and Better Practice Guide, NSW Health.
- NSW Health 2005, PD 2005_339: Protecting People & Property, NSW Health Policy / Guidelines for Security Risk Management in Health Facilities, NSW Health.
- Queensland Health 2008, Work Place and Office Accommodation Policy and Guidelines, Queensland Health.

WEBSITES

The following websites are a source of valuable information:

- Austin Health 2010, Nuclear Medicine and Centre for PET, Austin Health Victoria, viewed 21 June 2010, www.austin.org.au/nmpet
- Northcoast Nuclear Medicine (NCNM) n.d., Northcoast Nuclear Medicine, viewed 21 June 2010, http://www.ncnm.com.au/index.html
- Radiology Society of NorthAmerica (RSNA) & American College of Radiology 2010, The radiology information resource for patients, Radiology Society of NorthAmerica, viewed 21 June 2010, www.radiologyinfo.org/
- Royal Adelaide Hospital, n.d., Department of Nuclear Medicine, PET & Bone Densitometry Website, Royal Adelaide Hospital, viewed 21 June 2010, www.rah.sa.gov.au/nucmead/index.htm

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- ARPANSA 2002, Radiation Protection Series 4 - Recommendations for the Discharge of Patients Undergoing Treatment with Radioactive Substances, Australian Radiation Protection and Nuclear Safety Agency.
- ARPANSA 2007, Radiation Protection Series 11: Code of Practice for the Security of Radioactive Sources, Australian Radiation Protection and Nuclear Safety Agency.

- ARPANSA 2008a, Radiation Protection Series 14.1 - Safety Guide for Radiation Protection in Diagnostic and Interventional Radiology. Australian Radiation Protection and Nuclear Safety Agency.
- ARPANSA 2008b, Radiation Protection Series 14.2 - Safety Guide for Radiation Protection in Nuclear Medicine. Australian Radiation Protection and Nuclear Safety Agency.
- ARPANSA 2008c, Radiation Protection Series 16 - Safety Guide for the Predisposal Management of Radioactive Waste. Australian Radiation Protection and Nuclear Safety Agency.
- Nestor, C. 2007, The OR Challenge: New technologies lead to increased complexity, Health Facilities Management, vol. 20, no. 4.
- NSW Department of Environment and Climate Change 2008, Draft Guideline 7: Radiation shielding design assessment and verification requirements, NSW Government.
- NSW Health 2007, TS-11 - Engineering Services & Sustainable Development Guidelines. Sydney, NSW Health.
- NSW Health & CHAA UNSW 2009, TS-7 - Floor Coverings in Healthcare Buildings V1.1, NSW Health.
- Queensland Health 2005, Clinical Services Capability Framework,Version 2.0 Queensland Health www.eatwellbeactive.qld.gov.au/publications/corporate/CSCF/docs/cscfv2_s4.pdf
- Stds Aust 1994, AS 1319: Safety Signs for the Occupational Environment, SAI Global.
- Stds Aust 1998a, AS/NZS 2243:4: Safety in laboratories - Ionizing radiations, SAI Global.
- Stds Aust 1998b, AS 2896: Medical gas systems - Installation and testing of non-flammable medical gas pipeline systems, SAI Global.
- Stds Aust 2010, AS 1428.(Set): Design for Access and Mobility, SAI Global.
- WA Health 2006, Western Australia Health Facility Guidelines for Engineering Services, Government of Western Australia.
- Worksafe Victoria 2007, Designing Workplaces for Safer Handling of People, Worksafe Victoria.

AX.05 Iodine I-131 Bedroom

IODINE-131
Iodine-131 (I-131) is used for the treatment of thyroid cancer. The isotope has a half-life of approximately eight days. Patients undergoing treatment are nursed in a radiation-shielded room for a period of 3-4 days. During this period, the patient is an external radiation hazard to persons nearby and an internal radioactivity hazard to persons who may come in contact with the patient's body fluids including urine, saliva, sweat, vomit, and contaminated items and surfaces.

RADIATION SHIELDING
Provide radiation shielding in accordance with regulations.

BEDROOM
The bedroom will be part of an inpatient unit but located so as to minimise passing traffic and consequent radiation exposure and therefore minimise shielding needs. This may be achieved by locating the room at the end of a corridor or by locating the ensuite and storage between bedroom and public corridor and/or adjacent to unoccupied areas.
During the planning phase, consider positioning the room to allow the patient a short path of travel external to the bedroom, ideally with access to a small window bay in the corridor or a sitting area. This will assist to relieve, to some extent, the confinement (up to 3-4 days), enable the patient to stretch his / her legs, and provide a differing outlook from the bedroom.
With the exception of the radiation shielding, the bedroom will be identical to other inpatient unit bedrooms with regard to furniture, fixtures and fittings. Refer to Standard Component - One Bed Room - Single.
Collocation with a brachytherapy room in an Oncology Inpatient Unit has numerous advantages with regard to shielding, multipurpose use and staff training.

ENSUITE SHOWER / TOILET
A dedicated ensuite shower / toilet accessible from inside the bedroom is required. This will be used only by the room occupant. Connection to a delayed holding tank may be required by the local water or regulatory authorities. If required the contents should be monitored before discharge to the sewerage system.
Should delay holding tanks not be required, it may be appropriate to consider radiation shielding of plumbing stacks particularly if the I-131 bedroom is located on an upper level with drainage lines passing through

habitable accommodation areas of the floors below. Advice should be obtained from the Radiation Protection Officer. Toilets should NOT be dual flush system as low volume flush may lead to blockage.
Consider installation of a water outlet suitable for use with a portable haemodialysis machine. Paper towel dispensers should NOT be installed in the bedroom or ensuite to reduce the risk of toilet blockage.
Inpatient unit toilets used by inpatients being treated with radioiodine should be clearly marked and used only by those patients. Refer to Standard Component Ensuite 5m2 for basic details.

ANTEROOM
A handbasin with emergency eyewash fitting is required plus storage space for decontamination kits and protective clothing. Note: Eye contamination of staff should be dealt with locally and immediately. More extensive decontamination could be carried out in the ensuite shower. Refer to Standard Component - Anteroom 6m2 for basic details.

GENERAL DISPOSAL
A small cleaner's room should be provided to be accessed from the anteroom for dedicated cleaning equipment and supplies and slop hopper / sluice.

DELAY HOLDING TANKS
These tanks accumulate the radioactive body substances such as urine, faeces, and vomit. After a period to allow radioactive decay, the contents are discharged into the sewerage system. Assess capacity based on bedroom occupancy. Two tanks will be required.
To avoid leakage problems, the tanks should be located such that the drainage line from the toilet to the tanks does not cross a building expansion joint.
Where Iodine - 131 bedrooms and ensuites are provided within the facility (usually as part of inpatient unit) delayed holding tanks will may be required to be connected to the ensuite facility. Advice on size will be required from the Radiation Safety Consultant and guided by the local water authority requirements.
Note: The issue of delay tanks for Iodine-131 treatment rooms is contentious. The information on disposal to sewer in the 1985 NHMRC Code is to be replaced by a Schedule in Version 2 of the National Directory of Radiation Protection (ARPANSA 2008b). Even so, a local water authority may have the right to require a hospital to install tanks even if the discharge level is exempt under NDRP.
Refer to the Safety Guide on the Predisposal Management of Radioactive Waste (ARPANSA 2008c).

FINISHES
Finishes should be impervious and easily cleaned. Provide sealed vinyl floors.