

Australasian Health Facility Guidelines

Part B - Health Facility Briefing and Planning 0600 - Radiation Oncology Unit

Uncontrolled when printed

COPYRIGHT AND DISCLAIMER

Copyright

© 2015 Australasian Health Infrastructure Alliance

The Australasian Health Facility Guidelines (AusHFG) and the information in them are the copyright of the Australasian Health Infrastructure Alliance (AHIA). The information in the AusHFG is made freely available.

Australasian Health Facility Guidelines

Address: PO Box 1060, North Sydney NSW 2059
Website: <http://www.healthfacilityguidelines.com.au>
Email: webmaster@healthfacilityguidelines.com.au

The AusHFGs are an initiative of the Australasian Health Infrastructure Alliance (AHIA). AHIA membership is comprised of representatives from government health infrastructure planning and delivery entities in all jurisdictions in Australia and New Zealand.

Disclaimer

AHIA gives no warranty or guarantee that the information in the AusHFG is correct, complete or otherwise suitable for use. AHIA shall not be liable for any loss howsoever caused whether due to negligence or otherwise arising from the use of or reliance on this information.

AHIA recommends that those seeking to rely on the information in the AusHFG obtain their own independent expert advice.

Index

01 INTRODUCTION	4
01.01 Preamble	4
01.02 Introduction	4
01.03 Policy Framework	5
01.04 Description	5
02 PLANNING	8
02.01 Operational Models	8
02.02 Operational Policies	8
02.03 Planning Models	10
02.04 Functional Areas	11
02.05 Functional Relationships	14
03 DESIGN	15
03.01 Accessibility	15
03.02 Parking	15
03.03 Disaster Planning	15
03.04 Infection Control	16
03.05 Environmental Considerations	16
03.06 Space Standards and Components	17
03.07 Safety and Security	17
03.08 Finishes	18
03.09 Fixtures, Fittings & Equipment	19
03.10 Building Service Requirements	19
04 COMPONENTS OF THE UNIT	22
04.01 Standard Components	22
04.02 Non-Standard Components	22
AX APPENDICES	30
AX.01 Schedule of Accommodation	30
AX.02 Functional Relationships / Diagrams	35
AX.03 Checklists	35
AX.04 References	36
AX.05 Further Reading	37
AX.06 Brachytherapy	39

01 INTRODUCTION

01.01 Preamble

This Health Planning Unit (HPU) has been developed by the Australasian Health Infrastructure Alliance (AHIA). This revision has been informed by an extensive consultation process during 2014 which included clinical experts.

This document is intended to support the planning and design process for the design team, project managers and end users.

01.02 Introduction

GENERAL

Treatments for cancer may include surgery, chemotherapy, radiation therapy and supportive interventions such as palliative care, allied health and psycho-oncology. These treatments may also be used in combination.

Radiation therapy is the medical use of ionising radiation as part of cancer treatment of tumours and divides into two main types:

- external beam radiation therapy (EBRT) - delivered by linear accelerators; and
- brachytherapy using radioactive material (mostly a sealed source) brought into close contact with a treatment area (often by surgical means).

Superficial radiation therapy and orthovoltage radiation therapy refer to low energy, low penetration treatments for skin lesions and tumours just under the skin.

Radiation therapy may be used for definitive or curative cancer treatment and is also used as a palliative treatment with the aim of local disease control or symptom relief.

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

- Part A: Introduction and Instructions for Use;
- Part B: Section 80: General Requirements and Section 90: Standard Components, Room Data Sheets and Room Layout Sheets;
- Part C: Design for Access, Mobility, OHS and Security;
- Part D: Infection Prevention and Control;
- Part E: Building Services and Environmental Design; and
- Part F: Project Implementation.

This HPU outlines specific requirements for a Radiation Oncology Unit. Should this service be part of a cancer centre, refer to HPU 155 Ambulatory Care Unit for details relating to day therapy treatment services such as chemotherapy and outpatient clinics.

TERMINOLOGY

Radiation therapy uses terms including :

- course: a planned series of treatment sessions for either new or repeat patients;
- fraction: a patient treatment session, representing a single-treatment delivery of one radiation dose; and

- field: an individual beam of a radiation delivered to a specific area as part of a treatment fraction. There may be one or more beams of radiation delivered to make a fraction.

The process of patient treatment occurs in several phases.

01.03 Policy Framework

SPECIFIC POLICIES/GUIDELINES

Prior to undertaking a project, planners and project staff should familiarise themselves with individual state and territory specific policies, and with the following publications:

- Radiation Oncology Practice Standards (Tripartite Committee in Radiation Oncology, 2011); and
- Radiation Oncology Practice Standards Supplementary Guide (Tripartite Committee on Radiotherapy, 2011).

These publications are a Tripartite Initiative of the Royal Australian and New Zealand College of Radiologists (Faculty of Radiation Oncology), the Australian Institute of Radiography and the Australian College of Physical Scientists and Engineers in Medicine.

In 2013, an advisory group to the Ministry of Health New Zealand adapted these standards for use in New Zealand.

- Radiation Oncology Practice Standards for New Zealand (Tripartite Committee on Radiotherapy, 2013); and
- Radiation Oncology Practice Standards, Supplementary Guide New Zealand (Tripartite Committee on Radiotherapy, 2013, 2013).

A range of standards and guidelines relating to Radiation Oncology are listed in the Further Reading section of the Appendices.

01.04 Description

DEFINITION OF HEALTH PLANNING UNIT (HPU)

This HPU provides the information necessary to plan and design a Radiation Oncology Unit. A Radiation Oncology Unit may be provided as:

- a stand-alone unit, operating as a 'hub' centre;
- a 'spoke' service of a 'hub' centre; or
- a component of an integrated cancer centre.

Facility design should, where appropriate, meet all necessary criteria to reach accreditation standards with regards to design, equipment and radiation safety.

MODEL OF CARE

The diagnosis, treatment and management of cancer requires coordinated, multidisciplinary care.

Multidisciplinary patient centred clinics and case review meetings, often organised to focus on specific 'tumour groups', is considered a standard of care (refer to clause 600.006.007 in this document).

Radiation therapy is a major treatment modality. Approximately 48.3% of patients with a diagnosis of cancer should ideally have radiation therapy at some time during their treatment. Refer to Review of Optimal Radiotherapy Utilisation Rates (Barton, M et al, 2013).

Ideally, cancer services will be either collocated or located nearby related services to promote coordination and easy access for patients. Services in non-metropolitan locations will generally be networked to a major

site. Telemedicine is needed to support these hub-and-spoke models to ensure both patients and clinical staff has access to expert advice.

All Radiation Oncology Units will provide radiation therapy to adults.

Additional services provided by selected Radiation Oncology Units may include:

- total body irradiation (TBI) to prepare the body to receive a bone marrow transplant;
- total body electrons (TBE) for treating the entire skin surface;
- paediatric radiation oncology (usually one or two centres per state);
- stereotactic radiosurgery, which is a specialised type of external beam radiation therapy that focuses beams to target a well-defined tumour with extreme accuracy;
- fractionated stereotactic radiation therapy;
- brachytherapy: low dose rate brachytherapy for prostate seed implants and high dose rate brachytherapy (refer to Appendix for further details); and
- intraoperative radiation therapy.

The major phases of radiation therapy are described below.

PHASE 1 – INITIAL CONSULTATION

Patients are referred to a radiation oncologist by members of the multidisciplinary team for an initial consultation to assess their suitability for radiation therapy treatment.

PHASE 2B – TREATMENT PLANNING

Planning utilises information obtained during CT simulation to design and calculate the optimal treatment configuration for the patient. A three-dimensional treatment planning system is vital to ensure that radiation is delivered to precise parts of the body and that adjacent organs are protected. The planning process may take up to several days to complete and the patient is not in attendance during this process.

Treatment planning results in the establishment of a treatment plan which determines the dosage, number of treatment sessions, fields required etc. that comprise the 'course'. This includes dosimetry and includes target delineation, beam design and dose calculation to produce an optimal plan for delivering the dose to the tumour prescribed by a radiation oncologist.

A three-dimensional planning system requires a computer workstation, which is generally larger than a conventional PC. Sufficient workspace is vital for radiation therapists to perform radiation range of activities including engaging in multi-disciplinary discussion on planning issues.

Increasingly, major centres will utilise additional planning information using MRI and PET.

PHASE 2C – PRE-TREATMENT VERIFICATION

Quality assurance activities associated with a patient's treatment plan including a 'dry run' of planned treatment, independent checking of the plan, monitor unit calculations and measurements.

PHASE 3 - TREATMENT

Treatment commences once the final treatment plan has been approved by a radiation oncologist. A treatment course may vary from one treatment attendance to a course totalling up to 40 treatments over six to eight weeks with daily or twice daily attendance. Each daily treatment attendance will usually take between 10 and 30 minutes.

PHASE 4 – POST TREATMENT FOLLOW-UP

Following treatment, patients are reviewed by the radiation oncologist at between two and six weeks to monitor for side effects. Patients may then be seen at three, six and 12 monthly intervals and then other specialists and/or GP shared care arrangements are usually commenced. Ongoing follow-up may occur with children and patients on clinical trial protocols.

FUTURE TRENDS

Planning for a radiation oncology service may consider the following trends which may in turn impact on the facility design:

- combined modality treatment such as surgery and/or chemotherapy and radiation therapy occurring concurrently (e.g. intraoperative radiation therapy including intra-beam for the treatment of breast cancer);
- moving to CITRIX and cloud based computing, which should alleviate some local computing requirements in planning while increasing server requirements;
- expanding medical imaging requirements including increased use of 3D/4D PET CT and/or MRI. MRI-based simulation and planning is an emerging standard and should be considered;
- increased formal networking and exchange of clinical data between units, extended computer networks to rural and remote communities. This has major implications for bandwidth;
- increased complexity of individual treatment plans (and number of plans per patient). This will impact radiation therapist and physics resources towards the increased load and patient focused quality assurance;
- increased requirement for accuracy in treatment;
- technological advances in treatment improving the success rate of radiation therapy and expanding the number of cancer cases for which radiation therapy can be beneficial. Most jurisdiction have planning parameters and targets;
- capability for medium to long-term inclusion of newer technologies (e.g. VERO, helical tomography, cyber knife, MR linacs / cobalt). Particular attention should be made to shielding design for rotational therapy, room size to hold additional devices like Calypso or ultrasound, depth of floor concrete and weight capacity, extra conduit space, ceiling mounts etc.; and
- use of endorectal ultrasound for staging / treatment decision-making for patients with rectal cancers.

PATIENT NEEDS

Recognising the often depleted physical and emotional state of patients, their families and carers, it is important to develop a quality built environment that not only eases patient and carer anxiety but also provides staff with a work environment conducive to delivering optimal patient care. As far as is practicable a non-clinical, restful environment should be encouraged by wall paintings, soft colours etc.

Planning must recognise the need for patients and their families to discuss personal matters in a private and confidential environment and to minimise concerns regarding appearance and loss of self-esteem.

Access is required to services including:

- support and assistance with regard to affordable accommodation and travel that may be required for the duration of treatment particularly for patients from rural and remote areas;
- supportive care including palliative care, allied health and psycho-oncology;
- advice on available complimentary therapies (massage, stress management etc.) and provision of wigs. These services are usually provided as part of a broader integrated cancer service;
- patient and family counselling;
- education / information resources - brochures, computer access, support organisations, etc. is provided; and
- an interpreter service for patients from non-English background.

It must be noted that increasing survival due to early diagnosis and constantly improving technology is leading to an increase in the ongoing requirement for supportive care.

02 PLANNING

02.01 Operational Models

Where Radiation Oncology Units are provided as part of an integrated cancer centre, opportunities to share selected facilities should be explored to increase opportunities for collaboration and reduce duplication.

Examples include:

- outpatient clinics;
- patient holding areas;
- meeting rooms to support training and multidisciplinary team approaches;
- resources and wellness areas for patients and carers; and
- research including clinical trials and data management.

02.02 Operational Policies

GENERAL

Operational policies have a major impact on design requirements as well as capital and recurrent costs for health care facilities. Operational policies should be established at the earliest stages in planning with consideration given to local jurisdictional policies.

Unit specific operational policies are detailed below; a list of general operational policies is available from Part B: Section 80 General Requirements.

HOURS OF OPERATION

Opening hours are usually 8.00am to 5.00pm Monday to Friday. However, extended hours of operation providing sessions into the evening and on Saturdays may occur. Regular 'down time' is required for maintenance of major medical equipment. After-hours emergency access may be required for radiation therapy.

MULTIDISCIPLINARY CASE REVIEW

Cancer treatment is increasingly provided by multidisciplinary teams that may include medical oncology, radiation oncology, haematology and surgical oncology, radiologists, pathologists, palliative care, allied health, nursing and radiation technicians. The Radiation Oncology Unit may provide rooms for these multidisciplinary case reviews to occur where not located as part of an integrated cancer service. The case reviews may involve face-to-face interaction or may involve videoconferencing and viewing of images and other data remotely, particularly for 'spoke' services. Additional requirements will usually include a microscope.

These rooms can also be used for meetings, staff and student education and video conferences with other centres and clinicians.

ANAESTHESIA AND RECOVERY

Selected centres will provide specialist services including brachytherapy and radiation therapy for children. Anaesthesia, when needed, will routinely be delivered in the bunker (or brachytherapy room) and patients will be recovered in the patient holding area.

CLINICAL TRIALS

Clinical trials will be conducted in all centres and provision is needed for staff including office space and storage for pharmaceuticals, patient files and source documents. Trials involving patients will be conducted in the outpatient clinics and other planning and treatment areas of the Unit.

MEDICAL RECORDS, IMAGE AND DATA STORAGE

Ideally, an electronic record system will be in place. Some hard copy storage of existing paper records that may need to be accessed for historical reasons. The retention and disposal of medical records, including rational dose information, is subject to the legislative and regulatory requirements.

Image management and data storage should ideally be a picture archiving computer system (PACS). Provision should be made for the storage of some historical images retained on disk or CD. Radiation oncology information systems (ROIS) should have online storage and back-up capability.

For further information, refer to:

- Guidelines for Medical and Dosimetry Record Storage (RANZCR, 2011); and
- jurisdictional policies.

EDUCATION AND TRAINING

The extent of undergraduate and post-graduate training for all disciplines to be undertaken in the Radiation Oncology Unit will need to be established to ensure that the necessary teaching and office space is provided. Most tertiary radiation oncology services will be affiliated with a university.

FOOD AND NUTRITION SERVICES

Provision of beverages and vending machines for outpatients and visitors are essential either within the Unit or located nearby.

Light refreshments should be available for patients who may be in the Unit for extended periods when receiving multiple treatments or extended stays in the patient holding / recovery area.

Storage may be required for dietary supplements and resource material provided by a dietician.

MAINTENANCE

Each item of treatment and associated equipment should have a program of planned maintenance following manufacturer's recommendations. Additional days planned for quality assurance and technique development are preferred.

Service contracts should be in place for all major equipment (including software), or provided by radiation oncology-trained biomedical engineers or technicians to undertake adjustments and normal maintenance.

Space will be required to accommodate spare parts and vendor engineer desk space.

MANAGEMENT OF CHILDREN, ADOLESCENTS AND YOUNG PEOPLE

Children will only receive treatment at centres designated for the purpose.

The design of Radiation Oncology Units that treat children should consider the needs of children and their families such as the provision of private, discreet waiting areas close to the treatment area, and suitable distractions such as toys.

Units routinely treating adolescents and young adults should provide access to age-appropriate waiting space and information.

MEDICAL EMERGENCIES

Policies and procedures will be in accordance with overall health service policy where a Radiation Oncology Unit is located on a hospital campus. A resuscitation trolley, with defibrillator, should be readily accessible from the Planning area in case of adverse patient reaction to intravenous contrast. Others may be required in the patient holding / recovery area and treatment bunkers.

PHARMACY

Where a Radiation Oncology Unit is located within an integrated cancer centre, a cytotoxic suite may be provided. Otherwise, some access to medications is required and stock will be stored in the clean utility room located within the patient holding / recovery area.

TRANSPORT

A trolley / wheelchair holding area will be located near the reception and be used by staff to transport patients to and from the Radiation Oncology Unit. External transport may be provided by volunteers or ambulance officers.

VOLUNTEERS

Volunteers play a considerable role in assisting patients and their families in a range of duties including transport. Consideration should be given to their needs depending on their duties such as a workstation for a co-coordinator, small workroom, lockers and access to a pantry.

STAFFING

The staff establishment of the Radiation Oncology Unit will generally include:

- radiation oncologists - specialists and registrars;
- radiation therapists;
- nursing staff including cancer nurse co-coordinators;
- medical physicists and medical physics registrars;
- administration staff;
- mould room technician;
- a range of support staff including a quality assurance officer and IT support;
- allied health staff;
- clinical trials staff;
- biomedical engineers or electronics / mechanical technician;
- students / research staff; and
- volunteers.

A detailed staffing profile will be needed to ensure that adequate office, planning and support space is provided within the Unit. Units offering services for children and/or specialised treatments will affect staffing numbers.

02.03 Planning Models

LOCATION

A Radiation Oncology Unit should generally be on ground level or underground due to the shielding requirements, the weight of equipment and for ease of installation and replacement of specialised equipment.

The Unit should provide ready access for outpatients, including access for people with disabilities, and ambulances, and inpatients on beds / trolleys.

If the Unit is a free-standing facility on a hospital campus, enclosed links should be provided between the Unit and the main hospital for inpatients and, the transfer of goods and supplies, and access to other departments such as medical imaging.

02.04 Functional Areas

FUNCTIONAL ZONES

The Radiation Oncology Unit comprises the following functional zones and the scope will be dependent on the service level, size and if the service is integrated as part of a larger cancer centre. These zones include:

- entry / reception / waiting;
- outpatient clinics (may be shared if the Radiation Oncology Unit is integrated with a cancer centre);
- patient zone, including imaging and mould room, treatment areas (linear accelerator, brachytherapy and, in selected cases, superficial / orthovoltage machines), and patient holding areas;
- planning areas;
- clinical support areas; and
- staff offices and amenities.

ENTRY / RECEPTION / WAITING

There should be a single public entry to the Radiation Oncology Unit leading to the main reception desk, patient administration (e.g. appointments, billings) and a main waiting area. Additional sub-waits will usually be located nearby outpatient clinics, planning and treatment areas.

A child play area may be incorporated into the main waiting area. This area will accommodate visitor amenities. Facilities for volunteers and transport staff may also be located in this area.

A dedicated area for patient and family resources / education facilities, including computers for patient education and completing quality of life data for clinical trials, will be located in an area adjacent to the main entry. These facilities would be shared if provided as part of an integrated cancer centre.

OUTPATIENT CLINICS

The size and role of the outpatient clinics will vary depending on the service configuration (i.e. part of an integrated cancer centre or a stand-alone service). Details of anticipated occasions of service and session requirements also need to be considered to determine the number of consulting rooms.

Clinics should be located on the perimeter of the Unit with direct access from the entry for easy access.

Patients are usually assessed weekly (or fortnightly) by a radiation oncologist or registrar throughout the course of their treatment. Follow-up clinics will also need to be accommodated. A meeting room will be required for multidisciplinary clinical review of patients. It should be equipped to enable video conferencing and the digital display of clinical information, images and related information.

A procedure room large enough to conduct endoscopic examinations such as head and neck examinations, pleural taps, peritoneal drains will also be required.

The main reception or other staff base will oversight waiting areas. Good access is required to all utility rooms. Ideally these will be shared with the patient holding / recovery area.

Corridors and clinical rooms will permit trolley access.

IMAGING AND MOULD ROOM

This area consists of simulation / CT and mould room. These two functions should be located in close proximity to facilitate patient flow.

Simulation / CT

Facility requirements for treatment planning include:

- simulator / CT suite (noting additional modalities, such as MRI may be included in the future);
- resuscitation trolley bay;

- patient and visitor amenities (change cubicles, toilets, sub-waiting, trolley bay);
- computer planning room and if included, a brachytherapy high dose rate (HDR) planning room, where included. Clinical computer systems such as computer planning and radiation oncology information systems require an associated room for a server and back-up storage space. Special air-conditioning is likely to be required to handle the large number of computers in this area;
- workroom space for medical physicists and radiation therapists (working in dosimetry); and
- office space to accommodate QA checking and data transfer, discreet from the busy planning area for the high level of concentration required.

Mould Room / Appliance Fabrication

This area will comprise a fitting room that will accommodate a trolley and the numerous positioning accessories used and set-up lasers. Ideally this will accommodate a water bath of a size that will accommodate full-sized thermoplastic sheets / cut-outs.

A separate dirty workroom to accommodate drills etc. may also be required depending on the facility size. Storage for materials used to manufacture immobilisation devices and hold heavy positives used to make the masks for the duration of a patient's treatment. A workstation for staff will also be provided within this space.

RADIATION TREATMENT AREAS

This treatment area includes all aspects of radiation treatment with associated administration and support function as in other services:

- bunkers, mazes;
- control areas;
- adequate storage for large personalised immobilisation devices and treatment accessories;
- staff workroom / off-line image review room;
- change cubicles;
- patient toilets (noting some treatments require a full bladder); and
- sub-waiting - seats and trolley bay located so the patient is not observed by members of the public.

PATIENT HOLDING / RECOVERY

Patient bays will be provided to hold selected patients before and after treatment or to recover following selected procedures. Other nursing care may also be provided including treatment reaction management. These patient bays will be arranged so they are easily observed from a staff station. Each bay will be curtained (to maintain privacy) and require power, oxygen and suction.

Utility rooms and other support space will be collocated but also arranged so they are accessible by other areas within the Radiation Oncology Unit.

Ideally, a consult room will be located nearby to support care or consultation that requires privacy. A resuscitation trolley bay may be needed if distance to the trolley bay in the planning area is too distant.

CLINICAL SUPPORT

A range of clinical support rooms will be needed to support the Radiation Oncology Unit including:

- medical physics laboratories and equipment rooms; and
- biomedical engineering workrooms and equipment storage.

MEDICAL PHYSICS AND BIOMEDICAL ENGINEERING

Medical physics is responsible for the radiation physical aspects of radiation treatment and radiation safety of all staff, patients and others.

Medical physicists provide scientific support for all treatment machines, simulators, CT, MRI and PET imaging, computer planning systems, brachytherapy sources and equipment as well as dosimetry, quality assurance and radiation safety. Medical physicists are specialised in advanced technique development.

Biomedical engineering services may be provided in-house or by external contractors. The service provides maintenance and service support to an extensive range of treatment and non-treatment equipment in radiation oncology.

Biomedical engineers work closely with the medical physicists to provide regular calibration and compliance checks of all treatment delivery and diagnostic machines.

Some of the equipment may be custom manufactured and not commercially available (e.g. compensators for individual treatments, planning / design and installation of rigid attachments for patient hoists, and calibration jigs).

Facility requirements include:

- office space for medical physicists, medical physics registrars, electronics / biomedical engineers;
- workstations for students and visitors;
- physics / electronics laboratory;
- dosimetry laboratory;
- storage for medical physics equipment - bulky water tanks and phantoms;
- technical support (IT office and work area / storage); and
- meeting and breakout spaces (with projector and white board).

PLANNING AREAS

Radiation therapists will require workroom space to accommodate planning activities, QA checking and data transfer, discreet from the busy planning area for the high level of concentration required.

These workroom areas will be located near imaging rooms in a staff only zone. Planning workstations used by radiation therapists need to be sized to accommodate two large monitors.

Quiet office space for medical staff is required so they can undertake planning activities. Bookings staff will usually be located nearby.

STAFF AREAS

The number of offices and workstations for staff will depend on the envisaged staff establishment when the Unit is fully functional (e.g. if a bunker is planned in shell, the additional staffing requirements when commissioned will be factored in to the original plans). Provision of offices and workstations will comply with jurisdictional policies.

Clinical Trials / Research

It is anticipated that radiation oncology services will be involved in clinical patient trials. Research may also involve data collection and analysis. Student activity and amenities will need to be assessed.

Staff Amenities

Amenities will include:

- staff toilets and shower - depending on the overall size of the Unit / cancer centre, toilets may need to be dispersed into the various zones for ease of access;
- staff room with beverage making facilities; and
- meeting room/s for multidisciplinary audit and review meetings.

Allocation of space for staff amenities will be dependent on the staff establishment and service location.

02.05 Functional Relationships

EXTERNAL

The Radiation Oncology Unit, when located on a hospital campus, has functional relationships with:

- other cancer treatment services, both inpatient and outpatient services;
- external education and research facilities;
- medical imaging (CT and MRI);
- nuclear medicine / PET;
- palliative care; and
- haematology and medical oncology.

INTERNAL

The Radiation Oncology Unit has many components. The main entry / reception / waiting area will stream visitors to various areas including outpatient clinics, imaging and mould room and treatment areas. The planning areas will be close-by imaging areas to support work flows.

03 DESIGN

03.01 Accessibility

EXTERNAL

The building both internally and externally must be accessible and non-threatening.

Level, undercover access is required for outpatients and inpatients in wheelchairs, trolleys and beds. A discreet, separate entry should be provided for patients arriving on a trolley or bed so they are not pushed through general public areas.

Disabled parking spots and patient drop-off and pickup points should be located close to the entry to the Radiation Oncology Unit or integrated cancer centre. Ready access should be provided from the public car park to minimise stress for patients attending on a daily basis. If located on a hospital campus, access is required for deliveries (e.g. supplies) and waste removal.

After-hours access for urgent radiation therapy cases must be easy for inpatients and external (ambulance) patients. Delivery and replacement of large heavy equipment will be required.

INTERNAL

Internal circulation routes in all patient areas should allow for the efficient movement of wheelchairs and beds. Treatment and planning areas should not be used as thoroughfares. Wherever possible, a separation between patient circulation and staff / material circulation within the Unit is preferred, especially where patients are transferred on beds.

Some access routes and circulation systems, particularly in the radiation treatment area, must allow delivery paths for large pieces of equipment. Height, width, and floor loads must be considered in the design of these access routes.

03.02 Parking

The following areas will be required:

- undercover patient parking adjacent to main entry for patients with minimal mobility;
- ambulance access; and
- parking area for volunteer drivers.

Patients attending the service as outpatients may do so on consecutive days and/or for up to eight weeks and may require a space on a short term basis or for up to five hours. Patients are often adversely affected by the rigours of the treatment and the provision of subsidised or dedicated 'user friendly' parking facilities reduces the associated stress in attending the Unit. When planning new services, health services should ideally have a process in place to ensure access to affordable parking, close-by the Unit, for patients who visit daily for treatment.

For staff parking, refer to Part C: Section 790, Safety and Security Precautions for further information.

03.03 Disaster Planning

Refer to Part B: Section 80 General Requirements for further information.

03.04 Infection Control

For further information, refer to:

- Part D: Infection Prevention and Control; and
- jurisdictional policies.

03.05 Environmental Considerations

TOXIC WASTE

Considerations include:

- safe handling and air exchanges for chemicals in the mould room etc.;
- provision of effective extraction systems to areas such as the mould room / appliance fabrication room;
- drainage systems designed to meet the requirements of the relevant sewerage authority and health department; and
- safe storage and disposal of irradiated material.

ACOUSTICS

The appliance fabrication area of the mould room should be acoustically treated so noise associated with this activity is minimised.

All examination, consultation rooms and offices will be acoustically treated to protect patient privacy. Where an MRI is included, appropriate noise controls will be needed.

Modulators can be located within a bunker but a separate room is often provided in a location adjacent to the bunker to reduce heat and noise.

INTERIOR DÉCOR

The environment should have a comfortable and welcoming appearance while not compromising clinical practice or safety. Treatment areas such as the simulator room and 'bunkers' should be decorated in a manner that is calming while providing positive distractions during treatment.

Visual distraction is becoming the norm in rooms such as bunkers. This may include ceiling effects including a backlit photo mural or very large LED screens for images to be displayed on. Patients can often customise the images.

PATIENT PRIVACY

Waiting areas for patients who have changed into a gown should be located so they are not observed by members of the public. Patients also require privacy to discuss billing and private health related concerns with staff.

Consideration of the movement of patients through the department should be considered to maximise privacy where possible.

NATURAL LIGHT

As much natural light as possible should be provided, especially into public spaces, waiting areas and those treatment areas that patients and staff occupy for long periods of time.

03.06 Space Standards and Components

ERGONOMICS

The design and construction of Radiation Oncology Units should protect patients, visitors and maintenance and other staff from avoidable risks of injury and/or radiation hazard.

The height, depth and design of desks in the radiation treatment area need to take into account the constant up and down nature of the tasks undertaken and the distance to the wall of the emergency stop button.

Many staff within Radiation Oncology Unit use dual screens to plan radiation treatment requirements. Refer to Part C: Section 730, Human Engineering - Access and Mobility for more details.

HUMAN ENGINEERING

The design should permit effective, appropriate safe and dignified use by all people, including those with disabilities. Also refer to Part C: Design for Access, Mobility, OHS and Security, Space Standards and Dimensions for information.

ACCESS AND MOBILITY

Where appropriate, design must comply with AS 1428 (Set) 2010 Design for access and mobility Set (SAI Global).

Also refer to Part C: Design for Access, Mobility, OHS and Security, Space Standards and Dimensions for information.

DOORS AND CORRIDORS

Doors and corridors must be wide enough to accommodate large items of equipment and enable calibration equipment and trolleys / beds to pass through with ease. Special consideration needs to be given to any bariatric bed that may travel from inpatient units of the hospital inpatient units.

Within the mould room / appliance fabrication areas, the number of doors between shop areas should be minimised to facilitate the movement of equipment. Double doors will be provided to all workshop areas.

The need for neutron doors to the maze will depend on overall design of the maze. Ideally the space will be designed such that this is not required. Refer to Part C: Design for Access, Mobility, OHS and Security, Space Standards and Dimensions for information.

03.07 Safety and Security

GENERAL

Safety and security involves people and policies as well as physical aspects. Security of the facility must be addressed at each stage of the planning and design process. A safety audit via a risk analysis of potential hazards should be undertaken during the design process. Security may include:

- emergency 'stop' buttons in treatment bunkers and control rooms;
- 'last man out' systems;
- access control to rooms storing high cost equipment;
- radioactive source security as provided for brachytherapy services;
- fixed and personal duress alarms; and
- controlled staff access after-hours.

The Radiation Oncology Unit should only be accessible to authorised persons and must be locked and an alarm activated once the area is vacated after hours. Care should be taken with wayfinding and signage to discourage accidental entry to these areas.

RADIATION SAFETY

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) publish Codes of Practice or Standards detailing requirements for radiation safety. Refer to the Radiation Protection Series (Website) (ARPANSA, 2015) including at least the following:

- Fundamentals for Protection Against Ionising Radiation (F-1), Radiation Protection Series (ARPANSA, 2014);<http://www.arpansa.gov.au/pubs/rps/rpsF-1.pdf>
- National Directory for Radiation Protection (RPS 6) (ARPANSA, 2014);http://www.arpansa.gov.au/pubs/rps/rps6_6.pdf
- Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation (RPS-14), Radiation Protection Series (ARPANSA, 2008);
- Safety Guide for Radiation Protection in Radiotherapy, Radiation Protection Series (ARPANSA, 2008); and
- Code of Practice for the Security of Radioactive Sources (RPS-11), Radiation Protection Series (ARPANSA, 2007).

Each jurisdiction has legislation in place to regulate and control radiative substances, radioactive sources and related equipment. Refer to:

- Radiation Safety Act 1975 - 1999 (Act No 44 of 1975) (Government of Western Australia, 2004);
- NSW Radiation Control Act 1990 (amended 2002) (NSW Government, 2002) and the Radiation Control Regulation 2003 (under the Radiation Control Act 1990) (NSW Government, 2003) administered by Environment Protection Authority;
- Radiation Protection Act (Northern Territory Government, 2009), as in force at 2 July 2012;
- Queensland Radiation Safety Act 1999 (Queensland Government, 2013) and the Queensland Radiation Safety Regulation 2010 (Queensland Government, 2014);
- South Australia, Radiation Protection and Control Act 1982 (Government of South Australia, 2012);
- Tasmania, Radiation Protection Act, 2005 (Tasmanian Government, 2005); and
- Victoria Radiation Regulations 2007 (S.R. No. 89/2007), Radiation Act 2005 (State Government of Victoria, 2009) and Radiation Amendment Act 2013 (State Government of Victoria, 2013).

03.08 Finishes

WALL PROTECTION

The wall surfaces in the Unit areas should be washable. Refer to Part C: Design for Access, Mobility, OHS and Security, Space Standards and Dimensions.

FLOOR FINISHES

Non-slip flooring is essential for all work areas. The floor surface in clinical areas should be impervious, easy to clean, sealed with coving at the edges and have adequate drainage. Refer to Part C: Design for Access, Mobility, OHS and Security, Space Standards and Dimensions.

CEILING FINISHES

Refer to Part C: Design for Access, Mobility, OHS and Security, Space Standards and Dimensions.

03.09 Fixtures, Fittings & Equipment

GENERAL

Room Data and Room Layout Sheets in the AusHFG define fixtures, fittings and equipment (FFE).

Refer to the Standard Components - Room Data Sheets (RDS) and Room Layout Sheets (RLS), Australasian Health Facility Guidelines (AHIA, 2015) and:

- Part C: Section 710, Space Standards and Dimensions; and
- Part F: Section 680 Furniture Fittings and Equipment.

EQUIPMENT - GENERAL

All items of equipment will need to be itemised and dimensions of larger items obtained during the design phase to ensure:

- equipment is housed to enable its operation and maintenance. In particular, room sizes and specifications for linear accelerator and electronic cabinet rooms should accommodate the equipment manufacturer's recommendations, as space requirements vary from one machine to another and one manufacturer to another. Equipment requiring services such as water, air and special power must be noted and project engineers advised;
- cable length between parts of major equipment should be checked and adequate in-floor conduit space provided;
- doors are sized to allow passage of equipment;
- heat loads are estimated and catered for; and
- weight loads are estimated and checked structurally.

Space allocations should be sufficient to accommodate a range of vendor equipment as replacement is required every 10 to 15 years.

Adequate space must also be provided for the maintenance of major equipment. Note that electronic control cabinets are bulky and need special access to three sides.

LINEAR ACCELERATOR MACHINES

Ideally, linear accelerator machines should be 'paired' within a Unit. This ensures that treatment can continue to be delivered should a machine malfunction. This paired machine would deliver the same beam energy and quality.

Linear accelerator rooms (bunkers) require radiation protection that will include concrete walls, floors and ceiling to a specified thickness. The radiation protection needs of the Unit shall be assessed by a certified physicist or radiation safety consultant in accordance with National standards and legislative and regulatory requirements for each jurisdiction.

Reference should be made to local radiation licensing requirements and regulations.

Note that the schedule of accommodation indicates the bunker size including the maze rather than the actual treatment room which would be in the order of 150m². This is to ensure that sufficient 'footprint' is allowed during early planning stages.

03.10 Building Service Requirements

FUTURE PROOFING

Selected services may seek to future-proof facilities to anticipate new or emerging technologies. For example, shielding for primary beams other than in sentinel directions may be required if cyber knife technology is being considered.

Selected Units may include additional imaging modalities such as MRI and PET. Retrofitting these modalities is problematic (especially PET) so ideally, facility requirements should be considered in planning project stages. In addition, extra space may be required within particular rooms to accommodate planning equipment. For further information, refer to:

- Part B: HPU 440 Medical Imaging Unit; and
- Part B, HPU 480 PET (Positron Emission Tomography) Unit.

STRUCTURAL

Radiation treatment bunkers, CT simulation rooms and brachytherapy treatment rooms need radiation protection built into the facility. Bunkers need special construction to ensure they meet radiation safety requirements.

The flooring for a Radiation Oncology Unit will be designed to meet the load requirements for equipment and patient care.

Ceiling mounted equipment should have properly designed rigid support structures located above the finished ceiling sufficient to support heavy ceiling-mounted equipment such as frames of data monitors. A lay-in type of ceiling should be considered for ease of installation, service, and remodelling.

A minimum three metre ceiling height is required in procedure rooms, with a minimum one metre space above for heating, ventilating and air conditioning systems.

The flooring for a Radiation Oncology Unit shall be adequate to meet the load requirements for equipment, patient and personnel.

COMMUNICATIONS AND INFORMATION SYSTEMS

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

- voice / data systems;
- telephone and video conferencing capacity;
- duress call - fixed and personal (if required);
- CCTV monitoring systems of entry points;
- infrastructure for PACS (usually a separate system from the medical imaging PACS), electronic health records and ROIS;
- large bandwidths to support the movement of images from hub and spoke locations; patient / nurse and emergency call systems (that should be consistent with existing systems);
- the use of Citrix systems allows for planning activities to be undertaken at workstations throughout the Unit;
- dedicated, air-conditioned rooms for servers, with capacity to accommodate current and future capacity;
- alarm systems - drug fridges, medical gases, entries etc. that register in an area manned 24 hours per day; and
- patient viewing cameras, treatment delivery computers and intercoms to allow the radiation therapist to monitor and communicate with the patient during treatment when the patient is alone in the treatment room.

ELECTRICAL SERVICES

Sufficient power should be provided for current need and future expansion of services.

An uninterruptible power supply (UPS) and an emergency back-up system should be available for high priority equipment and illumination.

Cable ducts and/or conduits should be provided in the floors, walls and ceilings as required for specialised equipment.

There should be a maximum distance of 7.5 metres for the cable run between the simulator and the generator. Minimal distances are preferable to minimise the degradation of cable operation. Cable runs in the radiation treatment control area need careful planning.

MECHANICAL SERVICES

Appropriate air exchanges and exhausts for chemicals in the appliance workroom.

Sufficient air-conditioning capacity and compressed air in radiation treatment and CT rooms; access for future expansion of service.

Appropriate air-handling systems in computer equipment rooms.

General air conditioning needs to cool equipment but not blow over partially undressed patients on beds.

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 / heat detectors in radiation treatment and simulator rooms must be of the type not sensitive to radiation (i.e. photoelectric) and require special consideration.

MEDICAL GASES

Oxygen and suction will be required in all bunkers, simulation, treatment and patient bed bays. Nitrous oxide, medical air and scavenging may additionally be required in rooms where general anaesthesia may be administered.

RADIATION PROTECTION

Linear accelerator rooms require additional radiation protection that will include concrete walls, floors and ceiling to a specified thickness. Primary beam protection may be enhanced by the use of steel plate inserts. The radiation protection needs of the Unit shall be assessed by a certified physicist or consulting radiation expert to ensure compliance with the requirements of jurisdictional authorities.

This assessment is to specify the type, location and amount of protection to be installed in accordance with final approved department layout and equipment selection. The radiation protection requirements shall be incorporated into the final plans and specifications.

LIGHTING

Lighting in the Radiation Oncology Unit will need to be of various types and will be dependent on the task. The main lighting requirements are:

- even distribution of luminance throughout the non-working areas;
- walls that do not show reflections of luminaires, particularly at eye-height of staff when working;
- fully dimmable lighting in bunkers, simulator areas, planning areas and office areas where medical staff undertake planning activities;
- special three level lighting in radiation treatment bunkers; and
- lasers for patient positioning in bunkers and CT simulator rooms with high level luminance available for maintenance and repairs.

HYDRAULIC SERVICES

The trade waste plumbing and drainage system must be designed to meet the requirements of the relevant sewerage authority and the health departments. Information of the quality of chemicals to be used / discharged must be provided by the client to the hydraulics engineer.

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; and
- *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

RESOURCE ROOM

Description and Function

This room provides a location for the storage of and access to resources related to cancer etc. Resources may also be accessed by computer so patient access is facilitated. This area may also provide a small meeting table so visitors can discuss issues with staff or volunteers.

Location and Relationships

Centrally located in the entry / reception / waiting area so that all visitors can access.

Considerations

May be provided in a central, shared location if provided as part of an integrated cancer centre.

VOLUNTEERS WORKROOM

Description and Function

A base for volunteers who may work in the Unit, should volunteers be part of the service model. This base may provide a worktable, storage and lockers.

Location and Relationships

Location may depend on roles undertaken by volunteers. For example, if volunteers assist with wayfinding and provide support within the resource room, then a location near the entry would be ideal.

Considerations

Requirements may change depending on the roles undertaken by volunteers.

IMAGE REVIEW ROOM

Description and Function

A room for staff to review treatment verification images off-line. The space is also used to conduct weekly chart checks and any associated image trend analysis.

Pre-treatment plan review beams-eye view and plan information updates.

Location and Relationships

This room should be collocated with treatment bunkers and nearby to facilitate staff movement between tasks. A minimum of one room per two bunkers is recommended.

Considerations

Image review rooms should be considered as separate to control rooms where the linear accelerator operators should be working in a distraction-free environment. Image review rooms are not for equipment storage for patient devices and other linear accelerator equipment which requires a separate room. Equipment storage can also be shared with another linear accelerator at the same rate of one per two bunkers.

APPLIANCE FITTING ROOM

Description and Function

Where patients are measured for immobilisation devices, masks etc.

Location and Relationships

Direct access from the corridor and into the Workroom. Away from other patient areas due to possible noise and fumes.

Considerations

This space could be combined with clean moulding room especially for two machine service. Patient privacy needed and the doorway screened. Bed / trolley access is needed. FF&E will include:

- hand basin;
- plinth;
- benches and cupboards;
- plaster dust extraction system and plaster trap;
- fume extraction system;
- large sink and plater trap;
- water bath (built-in or free-standing);
- heavy dusty stainless steel benching;
- shelving and cupboards;
- instruments-drill, hot wire cutter, vacuum former;
- alloy melting pot;
- block cutters (a divergent block hot wire device that mimics the set-up of the linear accelerators is required as well as a non-divergent hot wire cutter for electron cut-outs etc.);
- surge protection for electrical equipment;
- RCD protection for staff especially where water bath are in use;
- dust and fume extraction;
- acoustic containment; and
- storage space for low melting point alloy shielding plates, compensator mounts.

MOULDING ROOM – CLEAN

Description and Function

Used for the manufacture of immobilisation devices. Storage space is required for the large volumes of material used to create the appliances.

While the shell forming for head and neck patients is predominantly thermoplastic based - there still may be patients that require plaster impressions and appliance room specific consult and mark-up.

Location and Relationships

Direct access from the fitting room but away from other patient areas due to possible noise and fumes.

Considerations

If this room is combined with the appliance fitting room then equipment listed below should not be duplicated. Surge protection for electrical equipment. RCD protection for staff especially where water baths are in use.

The moulding room requires air extraction for the molten metal used to fabricate photons and electron shielding. Bulky foam cutters for personalised stabilisation products and/or vacuum formers may be required to manufacture custom masks.

Acoustic containment. FF&E will include:

- plaster dust extraction system and plaster trap;
- fume extraction cabinet;
- large sink and plaster trap;
- water bath (built-in or free-standing);
- heavy duty stainless steel benching;
- shelving and cupboards;
- instruments - drill, hot wire cutter, vacuum former;
- alloy pot; and
- block cutter.

Possible use of 3D printing technology.

WORKSHOP - DIRTY

Location and Relationships

Direct access from the moulding room but away from other patient areas due to possible noise and fumes.

PLANNING CT / SIMULATOR ROOM

Description and Function

A planning CT is typically a wide bore CT scanner with a specialised flat, indexed couch top. There may be a conventional 2D simulator (plain x-ray) but if this equipment is used there will still need to be an adjoining CT Room or ready access to a CT. It is expected however that modern radiation therapy units will install CT scanners. A simulator must have image intensifier and CT inter-working capability.

A CT simulator combines the functionality of a conventional CT with features and image processing and display tools of a three-dimensional radiation treatment planning (3D) system (TPS).

A diagnostic C-arm mobile unit may be used for similar purposes in the planning and verification of high dose rate brachytherapy if in an operating theatre otherwise the CT scanner will be used.

Fan noise from various computer systems may create noise making it difficult to converse with patients. The amount of noise varies greatly depending on which equipment is used. A large cupboard with floor to ceiling access to house x-ray generator and reconstruction computers discreetly within the CT room may be required. The cupboard should have separate air flow for cooling needs.

Location and Relationships

Adjacent to the control room.

Ready access to change cubicles, sub-waiting and patient toilets.

Ready access to a resuscitation trolley (where intravenous contrast is administered).

Near the moulding room where stabilisation appliances / masks may be manufactured.

Considerations

- space for a bed to enter, turn and be placed along either side of the simulator;
- lead glass viewing window to the control room;
- radiation screening to standards;
- temperature and humidity control to manufacturer's specifications;
- dimmable lighting controls;
- emergency 'stop' button;
- oxygen and suction on medical services panel;
- emergency / nurse call buttons;
- CCTV camera and intercom system - patient to control room;
- hand basin;
- benches;
- wall and ceiling mounted x-ray laser lights (that require a steel plate mounted to the building stud fixed at the floor and ceiling to ensure stability when mounted); and
- x-ray transformer.

CT-SIMULATOR CONTROL ROOM

Description and Function

Control area for the simulator.

Location and Relationships

Directly adjacent to the simulator room.

Considerations

FF&E will include:

- CT control console and computer or simulator control panel;
- virtual simulation workstation;
- PACS viewing monitors and x-ray viewing panels for review of mammograms and x-rays of patients from rural areas;
- emergency 'stop' button;
- patient viewing monitor and microphone; and
- work benches.

PLANNING WORKROOM

Description and Function

The area used by the radiation therapists who work individually using computer terminals with dual screens to review plans and produce radiation dosage profiles.

Location and Relationships

Ready access to the planning modalities including CT.

Easy access to the computer server data storage room for retrieval of archived data.

Considerations

Specialised FF&E will include:

- work benches sized to suit the planning computers with dual screens;
- planning computers – one per staff member;
- printer; and
- PACS terminals at a ratio of one per TPS workstation.

MEDICAL PHYSICS LABORATORY

Sufficient space for computers and a work area to carry out dosimetry measurements, dosimetry equipment QA and ultrasound and LDR brachytherapy QA.

Location and Relationships

Ready access to the bunkers.

Considerations

Sealed vinyl floor, laminated bench tops.

Hands-free telephone.

FF&E will include:

- workbenches;
- light boxes; and
- office furniture.

Note that IntraBeam dosimetry measurements require a shielded space. Several QA procedures may happen at one time, with one or more using radioactive sources. There must be a dedicated radioactive source handling area, including a fume hood extraction system separate from rest of the laboratory that complies with radiation safety regulations.

WORKSHOPS – ELECTRICAL AND MECHANICAL

Description and Function

Maintenance of electrical equipment divided into 'clean' and 'dirty' zones.

Location and Relationships

Part of the medical physics area.

Considerations

Light-coloured, antistatic flooring.

Electrostatic earthing throughout the area.

Hands-free telephone.

FF&E will include:

- compressed air outlet;
- benches - general and for electronic work in a clean work area;
- sink;
- peg board;
- mobile fume extraction unit;
- drill and lathe in a 'dirty' work area; and
- general office furniture.

PHYSICS STORE

Description and Function

This room will house very expensive equipment and instruments for use by the physicists in the checking and calibrating of the linacs, including the water phantom machine, approximately 1m x 1m and 1.8m high.

Location and Relationships

Ready access to the physics laboratory.

Easy access to a deep sink in the cleaner's room for filling and emptying of the water tank.

Considerations

Access for large items of equipment including manoeuvring the water phantom trolley.

Safe for radioactive materials.

Cable storage and heavy duty shelving for numerous phantoms.

LINEAR ACCELERATOR TREATMENT ROOM (BUNKER)

Description and Function

Treatment rooms or bunkers are the rooms in which EBRT irradiation occurs. They require a maze-like corridor at the entrance of the room for radiation protection.

The maze, entrance and entry to the treatment room must allow access for the treatment machine, service equipment, hospital beds and gantry frames.

Linear accelerators with 18 MV photon beams may require additional shielding at the maze entrance (i.e. neutron door); however, particular attention should be given to the bunker and maze design in an attempt to avoid the use of a maze shielding door.

Location and Relationships

Immediately adjacent to the control area so that access can be monitored.

The treatment rooms should be located with ready access to patient amenities (change cubicles, sub-waiting, and toilets), treatment planning and support areas including patient accessory storage and utility rooms.

Considerations

Layouts shall be designed to prevent radioactive particles from escaping. Openings into the room, including doors, ductwork, vents and electrical raceways and conduits shall be baffled to prevent direct exposure to other areas of the facility.

Services requirements including electrical, hydraulics, and air-conditioning will be according to the equipment manufacturer's specifications.

Provide special cable access to the treatment rooms for physics measurements.

Linear accelerators need special air exchanges and the floor needs protection when machines are installed.

FF&E will include:

- linear accelerator;
- oxygen and suction on medical services panel;
- emergency 'stop' switch;
- multiple PTZ capable CCTV cameras;
- hand basin;
- benches and storage cupboards for patient machine accessories;
- laser lights for positioning;
- treatment set-up information viewing such as large LCD TV screens;

- monitors and audio equipment for patient contact;
- ceiling art (fixed or projected) and music systems for patient distraction;
- 'last man out' interlock;
- fixed duress;
- a significant number of power outlets; and
- nurse call system, including emergency call.

CONTROL ROOM – LINEAR ACCELERATOR

Description and Function

Radiation therapists will perform all control and patient monitoring functions in the control room.

Patient radiation treatment records and planning images may be displayed in the control room area for each treatment unit throughout the course of the therapy. Patient viewing cameras, treatment delivery computers and intercoms allow the radiation therapist to monitor and communicate with the patient during treatment when the patient is alone in the treatment room.

Location and Relationships

Direct access to treatment bunker.

Considerations

Cable trays must be easily removable for access by maintenance staff.

FF&E will include:

emergency stop switch;

intercom;

patient viewing monitors;

portal imaging computers;

workstation for image and chart viewing, access to the scheduling system, and space to store treatment records (if not electronic);

linear accelerator control console;

PACS monitor; and

benches / shelving units to suit equipment.

BRACHYTHERAPY ROOM

Description and Function

A radioactive source is delivered internally through a tube or applicators implanted or inserted during surgery. The radiation source is inserted manually or, more commonly, performed by a remote after loading machine.

In centres where LDR brachytherapy seed implantation is performed, the room shall be of sufficient size and equipped as an operating room.

Location and Relationships

Adjacent to:

- induction bay;
- scrub room;
- recovery bay;
- seed implant store and loading room;

- other radiation treatment rooms;
- exit buy; and
- sterile store.

Considerations

Radiation safety of radioactive materials.

Access to oxygen, suction, medical air, nitrous oxide and scavenging needed.

Controlled access to brachytherapy facility and radioactive materials.

ORTHOVOLTAGE ROOM

Description and Function

A specialised room use to treat superficial skin cancers. The treatment uses low to medium energy radiation to treat cancer. Radiation shielding is required.

Location and Relationships

Immediately adjacent to the Control Area so that access can be monitored.

Considerations

FF&E includes:

- a control room - orthovoltage should be attached to the room;
- 'beam on' warning lights will be required at the room entrance;
- an interlocked door linked to the beam on is required and should be shielded in lieu of needing a treatment room maze;
- a cooling unit will need to be accommodated in the facility. This may be in the treatment room but due to associated noise it is recommended it be planned to be housed outside the treatment room but nearby. Consider distance to plan room;
- the room will accommodate a superficial orthovoltage unit. A cupboard with exhaust will be required within the room to accommodate the generator;
- custom storage for treatment cones and treatment shield is required;
- medical services panel with oxygen and suction; and
- nurse call system including emergency call.

AX APPENDICES

AX.01 Schedule of Accommodation

A schedule of accommodation follows for a two bunker and a four bunker unit with an optional brachytherapy bunker for the four bunker unit. The space allocations shown in this Schedule of Accommodation assumes a stand-alone or self-contained service.

Increasingly, radiation oncology services are being included as part of a cancer centres. Where this model is adopted, opportunities should be sought to share infrastructure and reduce duplication. Examples include outpatient clinics, holding and recovery, wellness and patient resources, volunteer spaces, visitor and staff amenities etc.

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 / WAITING

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2	Qty x m2	Remarks
			2 Bunkers	4 Bunkers	
AIRLE-10	Airlock - Entry, 10m2	Yes	1 x 10	1 x 10	Assumes 2 sets of double automatic doors double 900mm leaf. Not required if entry is provided through an internal entry.
WAIT-20	Waiting, 20m2	Yes	1 x 20	1 x 20	In 2 bunker scenario, waiting space is shared with clinics.
RECL-10	Reception / Clerical, 10m2	Yes	1 x 20	1 x 20	2 staff.
OFF-2P	Office - 2 Person Shared, 12m2	Yes	1 x 12	1 x 15	2 and 3 staff.
STPS-8	Store - Photocopy / Stationery, 8m2	Yes	1 x 8	1 x 8	
BWC	Bay - Wheelchair	Yes	1 x 4	1 x 6	Trolleys and wheelchairs.
WCPU-3	Toilet - Public, 3m2	Yes	2 x 3	2 x 3	
WCAC	Toilet - Accessible, 6m2	Yes	1 x 6	1 x 6	
BPH	Bay - Public Telephone	Yes	1 x 1	1 x 1	Taxi phones.
BVM-3	Bay - Vending Machines	Yes	1 x 3(o)	1 x 3(o)	Optional, depending on local approaches and service location.
	Resource Room		1 x 12	1 x 15	Education and/or information.
	Volunteers' Workroom		1 x 12	1 x 12	Optional.
	Discounted Circulation		30%	30%	

Space allocations provided assume a stand-alone Radiation Oncology Unit. The organisation of space and opportunities for sharing may be possible if provided as part of a cancer centre.

OUTPATIENT CLINICS

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2	Qty x m2	Remarks
			2 Bunkers	4 Bunkers	
CONS	Consult Room	Yes	4 x 12	7 x 12	
CONS	Consult Room	Yes	2 x 14	3 x 14	Sized to accommodate up to 3 staff.
PROC-16	Procedure Room, 16m2	Yes	1 x 16	1 x 16	
INTF	Interview Room	Yes	1 x 12	1 x 12	
OFF-CLW	Office – Clinical Workroom	Yes	1 x 12	1 x 15	A coordination / staff write-up space. Also used for clinical review.
WCPT	Toilet - Patient, 4m2	Yes	shared with reception	1 x 4	
WAIT-30	Waiting, 30m2	Yes	shared with reception	1 x 30	
BBEV-OP	Bay - Beverage, Open Plan, 4m2	Yes	1 x 3	1 x 3	
	Discounted Circulation		30%	30%	

Notes:

- this schedule of accommodation assumes that scopes and other probes would be reprocessed in the local Sterile Supply Unit; and
- the room numbers provided assumes dedicated use by a Radiation Oncology services. The arrangement of rooms and numbers will be different if provided as part of a cancer centre.

PATIENT AREAS – PLANNING AND TREATMENT

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2	Qty x m2	Remarks
			2 Bunkers	4 Bunkers	
WAIT-S	Waiting - Sub, 5m2	Yes	1 x 5	1 x 10	
	Toilet / Change - Patient		1 x 5	1 x 5	
	Planning CT / Simulator		1 x 45	2 x 45	Simulation and planning.
CTCR	CT Scanning, Control Room	Yes	1 x 14	2 x 14	
	Image Review Room		-	1 x 10	
	Bay - Patient Trolley		1 x 4	1 x 6	
BS-1	Bay - Storage	Yes	1 x 2	1 x 2	Space to store a blanket warmer and ice machine.
BRES	Bay - Resuscitation	Yes	1 x 1.5	1 x 1.5	
STEQ-14	Store - Equipment	Yes	1 x 9	1 x 12	
OFF-S9	Office, Single Person, 9m2	Yes	-	1 x 9	RT Head of Planning.
	Discounted Circulation		30%	30%	

Notes:

- increasingly MRI is being used as to plan treatment. Should this modality be approved as part of the clinical services plan, refer to HPU 440 Medical Imaging Unit for details on planning and space requirements;
- additional information related to CT room requirements is contained in HPU 440 Medical Imaging Unit; and
- assumes cannulation where required, occurs in the CT room. Alternatively, contrast may be administered in a collocated treatment room.

MOULD ROOM / APPLIANCE FABRICATION

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2	Qty x m2	Remarks
			2 Bunkers	4 Bunkers	
	Fitting Room		-	1 x 10	In 2 room units, CT simulation room can be used.
	Moulding Room - Clean		1 x 15	1 x 15	
	Workroom - Dirty		1 x 9	1 x 9	Noisy machinery used.
STEQ-14	Store - Equipment	Yes	1 x 6	1 x 6	
	Discounted Circulation		30%	30%	

PLANNING AREAS

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2	Qty x m2	Remarks
			2 Bunkers	4 Bunkers	
OFF-S9	Office - Single Person, 9m2	Yes	9	9	To be allocated to Manager Planning and Manager Planning Treatment.
OFF-2P	Office - 2 Person Shared, 12m2	Yes	12	12	For booking clerks.
	Planning Room		1 x 50	1 x 90	
	Discounted Circulation		35%	35%	

Notes:

- space allocated for each planning room is indicative and needs to be tested against staffing numbers. A standard workstation allocation will be used; and
- this area will be located closer to planning areas.

TREATMENT - BUNKERS

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2	Qty x m2	Remarks
			2 Bunkers	4 Bunkers	
WAIT-10	Waiting, 10m2	Yes	1 x 7	1 x 12	Family etc.
CHPT	Change Cubicle - Patient, 2m2	Yes	2 x 2	4 x 2	
CHPT-D	Change Cubicle - Accessible, 4m2	Yes	1 x 4	2 x 4	
WCPT	Toilet - Patient, 4m2	Yes	1 x 4	2 x 4	
INTF	Interview Room	Yes	1 x 9	2 x 9	May also provide private waiting.
WAIT-S	Waiting - Sub, 5m2	Yes	2 x 3	4 x 3	Located outside each bunker for those changed into gowns.
	Linear Accelerator		2 x 150	4 x 150	See first note above re. 150m2 spatial allocation.
	Control Room – Linear Accelerator		2 x 22	4 x 22	
	Orthovoltage Room		-	1 x 45(o)	Includes HT generator within room. Inclusion may depend on range of cases treated.
	Control Room - Orthovoltage		-	1 x 12(o)	
BLIN	Bay - Linen	Yes	1 x 2	1 x 2	
BHWS-B	Bay – Handwashing, Type B	Yes	1 x 1	1 x 1	
STEQ-14	Store - Equipment	Yes	1 x 9	2 x 9	Includes space for patient specific immobilisation equipment.
	Discounted Circulation		35%	35%	

Notes:

- 150m2 spatial allocation for one linear accelerator bunker includes maze and radiation shielding wall. Bunker size depends on equipment selected (including space if needed for a modulator) and radiation shielding recommendation from radiation safety consultant. Should a separate room for a modulator be recommended, then additional space will need to be added (15m2 for 2 bunkers and 2 x 15m2 for 4 bunkers);
- no patient lockers are provided. Assumes patients carry their belongings with them. Increasingly, patients are issued with a gown that they use and launder for the course of their treatment; and

- where children are treated, a separate waiting space should be provided.

TREATMENT - BRACHYTHERAPY SUITE

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2	Qty x m2	Remarks
			2 Bunkers	4 Bunkers	
	Brachytherapy Bunker		-	1 x 130	Assumes permanent seed implantation.
	Control Room		-	1 x 15	
SCRB-6	Scrub-Up / Gowning, 6m2	Yes	-	1 x 6	2 sinks.
PBTR-H-9	Patient Bay - Holding / Recovery	Yes	-	1 x 9	
	Seed Store and Loading		-	1 x 9	
STGN-9	Store - General, 9m2	Yes	-	1 x 9	Sterile consumables associated with procedures.
	Toilet / Change - Patient		-	1 x 5	
	Discounted Circulation			35%	

Notes:

- inclusion of this suite will be dependent on jurisdictional requirements; and
- facility requirements will be dependent on work being undertaken in the room (e.g. permanent seed and gynaecological applications). Change room facilities may need to be considered if operating room conditions are required; and
- assumes dirty utility used to dispose of waste and store dirty instruments prior to transfer to Sterile Supply Unit.

PATIENT HOLDING AND RECOVERY

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2	Qty x m2	Remarks
			2 Bunkers	4 Bunkers	
SSTN-10	Staff Station	Yes	1 x 12	1 x 12	Open plan with Treatment Bays.
PBTR-H-9	Patient Bay - Holding, 9m2	Yes	2 x 9	3 x 9	Open plan with Staff Station.
1BR-H-12	1 Bedroom – Holding, 12m2		-	1 x 12	May accommodate a bed or recliner chair and provide isolation if required.
BHWS-B	Bay - Handwashing, Type B	Yes	1 x 1	1 x 1	
ENS-ST	Ensuite - Standard, 5m2	Yes	-	1 x 5	
WCPT	Toilet - Patient, 4m2	Yes	1 x 4	1 x 4	
BLIN	Bay - Linen	Yes	1 x 2	1 x 2	Part of open plan area.
BRES	Bay Resuscitation	Yes	1 x 1.5	1 x 1.5	Part of open plan area.
OFF-S9	Office – Single Person, 9m2	Yes	1 x 9	1 x 9	For nursing manager.
CLUR-12	Clean Utility / Medication Room	Yes	1 x 12	1 x 14	Accessible to other areas of the Unit.
DTUR-10	Dirty Utility, 10m2	Yes	1 x 10	1 x 10	Accessible to other areas of the Unit.
BBEV-OP	Bay - Beverage, Open Plan, 4m2	Yes	-	1 x 4	
	Discounted Circulation		30%	30%	

CLINICAL SUPPORT AREAS

AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2	Qty x m2	Remarks
			2 Bunkers	4 Bunkers	
	Physics Laboratory		1 x 25	1 x 40	
	Physics Store		1 x 15	2 x 15	Locate close to bunkers so access to water tank is facilitated.
	Workshop - Electrical		1 x 30	1 x 45	Includes write-up space for technicians / visiting contractors and storage for spare parts.
	Workshop - Mechanical		1 x 5.5	1 x 5.5	Noise generated in this room.
CLRM-5	Cleaner's Room, 5m2	Yes	1 x 5	1 x 5	
DISP-8	Disposal Room, 8m2	Yes	1 x 8	1 x 8	If combined with Dirty Utility, 1 x 14m2.
	Discounted Circulation		30%	30%	

STAFF OFFICES AND AMENITIES

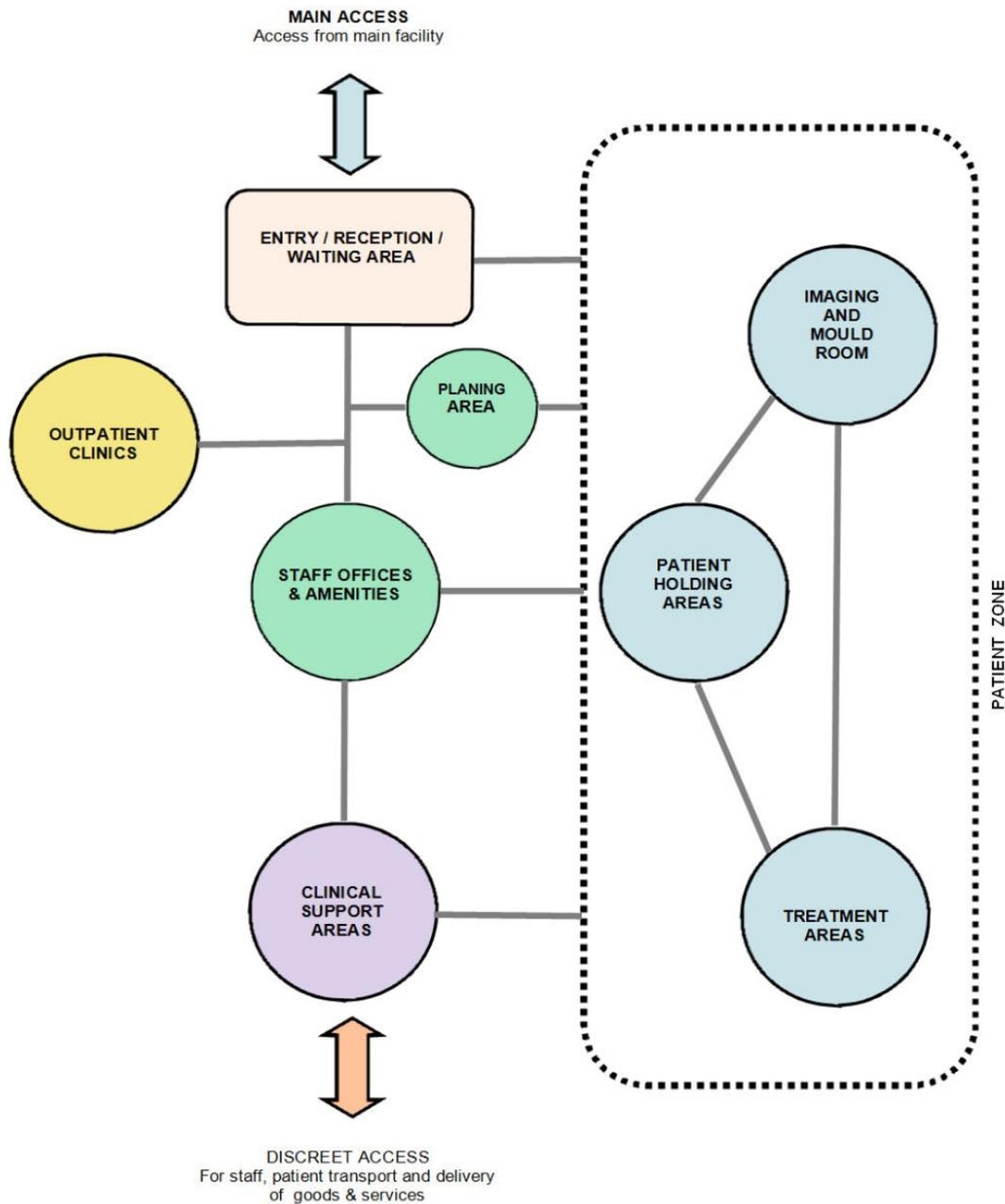
AusHFG Room Code	Room / Space	SC / SC-D	Qty x m2	Qty x m2	Remarks
			2 Bunkers	4 Bunkers	
OFF-S12	Office - Single Person, 12m2	Yes	1 x 12	1 x 12	Clinical Director.
OFF-S9	Office - Single Person, 9m2	Yes	9	9	To be allocated to staff specialists and department heads (e.g. Radiation Therapy, Medical Physics etc). Numbers will be dependent on organisational structure and staff establishment.
	Office - Workstation, 5.5m2		5.5	5.5	To be allocated to staff including clerical, data managers, IT staff, educators, clinical nurse consultants, medical physicists, registrars and researchers etc. Number will be dependent on staff establishment.
	Office - Workstation, 4.4m2		2 x 4.4	4 x 4.4	Hot desks for visiting staff and students.
MEET-L-30	Meeting Room, 30m2	Yes	1 x 30	1 x 30	
MEET-L-20	Meeting Room, 20m2	Yes	-	1 x 20	
MEET-9	Meeting Room, 9m2	Yes	1 x 9	1 x 9	
STPS-8	Store – Photocopier / Stationery, 8m2	Yes	shared	1 x 8	
SRM	Staff Room	Yes	1 x 20	1 x 35	
PROP-2	Property Bay – Staff	Yes	1 x 3	1 x 6	
WCST	Toilet - Staff, 3m2	Yes	3 x 3	5 x 3	To be distributed throughout the Unit.
SHST	Shower - Staff, 3m2	Yes	1 x 3	1 x 3	
	Discounted Circulation		25%	25%	

Notes

- the office spaces listed below are indicative only. A fully developed workforce profile will be needed to inform the development of office and associated space. Some office space will be distributed close to planning and treatment areas;
- while an office, workstation space has been provided, a mix of shared offices (i.e. 2, 3 and 4 person) and workstations may be preferred; and
- meeting room – large would be shared if provided as part of a Cancer Centre development as this room is sized for MDT meetings.

AX.02 Functional Relationships / Diagrams

A diagram of key functional relationships is shown below.



AX.03 Checklists

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

AX.04 References

- AHIA, 2010, Part C: Design for Access, Mobility, OHS and Security, Australasian Health Facility Guidelines (AHIA, 2010), Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney, NSW.
- AHIA, 2010, AusHFG Part B: Section 90, Standard Components, Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney, NSW.
- AHIA, 2010, Part B: Section 80 General Requirements, Australasian Health Facility Guidelines (AHIA, 2010), Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney NSW.
- AHIA, 2015, Part D: Infection Prevention and Control, Australasian Health Facility Guidelines (AHIA, 2015), Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney, NSW.
- AHIA, 2010, Part C: Section 730, Human Engineering, Australasian Health Facility Guidelines (AHIA, 2010), Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney, NSW.
- AHIA, 2010, Part C: Section 710, Space Standards and Dimensions, Australasian Health Facility Guidelines (AHIA, 2010), Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney, NSW.
- AHIA, 2015, Part C: Section 790, Safety and Security Precautions, Australasian Health Facility Guidelines (AHIA, 2015), Australasian Health Facility Guidelines, AHIA, Sydney, NSW.
- AHIA, 2010, Part F: Section 680 Furniture Fittings and Equipment, Australasian Health Facility Guidelines (AHIA, 2010), Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney, NSW.
- AHIA, 2013, Part B: HPU 440 Medical Imaging Unit, Australasian Health Facility Guidelines (AHIA, 2013), Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney NSW.
- AHIA, 2015, Standard Components - Room Data Sheets (RDS) and Room Layout Sheets (RLS), Australasian Health Facility Guidelines (AHIA, 2015), Australasian Health Facility Guidelines, AHIA, North Sydney, NSW.
- AHIA, 2015, Part B: HPU 600 Radiation Oncology Unit, Australasian Health Facility Guidelines (AHIA, 2015), Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance, Sydney, NSW.
- AHIA, 2010, Part B, HPU 480 PET (Positron Emission Tomography) Unit, Australasian Health Facility Guidelines (AHIA, 2010), Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney, NSW.
- ARPANSA, 2014, Fundamentals for Protection Against Ionising Radiation (F-1), Radiation Protection Series (ARPANSA, 2014), Radiation Protection Series, no. F-1, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), Sydney, NSW.
- ARPANSA, 2014, National Directory for Radiation Protection (RPS 6) (ARPANSA, 2014), National Directory for Radiation Protection, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), Sydney, NSW.
- ARPANSA, 2008, Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation (RPS-14), Radiation Protection Series (ARPANSA, 2008), Radiation Protection Series, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), Barton, ACT.
- ARPANSA, 2008, Safety Guide for Radiation Protection in Radiotherapy, Radiation Protection Series (ARPANSA, 2008), Radiation Protection Series, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), Barton, ACT.

- ARPANSA, 2007, Code of Practice for the Security of Radioactive Sources (RPS-11), Radiation Protection Series (ARPANSA, 2007), Radiation Protection Series, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), Barton, ACT.
- ARPANSA, 2015, Radiation Protection Series (Website) (ARPANSA, 2015), Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), Barton ACT.
- Government of South Australia, 2012, South Australia, Radiation Protection and Control Act 1982 (Government of South Australia, 2012), Government of South Australia, Adelaide, SA.
- Government of Western Australia, 2004, Radiation Safety Act 1975 - 1999 (Act No 44 of 1975) (Government of Western Australia, 2004), Government of Western Australia, Perth, WA.
- Northern Territory Government, 2009, Radiation Protection Act (Northern Territory Government, 2009), Northern Territory Government, Darwin, NT.
- NSW Government, 2002, NSW Radiation Control Act 1990 (amended 2002) (NSW Government, 2002), NSW Government, Sydney.
- NSW Government, 2003, Radiation Control Regulation 2003 (under the Radiation Control Act 1990) (NSW Government, 2003), NSW Government, Sydney.
- Queensland Government, 2013, Queensland Radiation Safety Act 1999 (Queensland Government, 2013), Queensland Government, Brisbane, Qld.
- Queensland Government, 2014, Queensland Radiation Safety Regulation 2010 (Queensland Government, 2014), Queensland Government, Brisbane, Qld.
- RANZCR, 2011, Guidelines for Medical and Dosimetry Record Storage (RANZCR, 2011), Royal Australian and New Zealand College of Radiologists (RANZCR), Sydney, NSW.
- Standards Australia, 2010, AS 1428 (Set) 2010 Design for access and mobility Set (SAI Global), Standards Australia, Sydney, NSW.
- State Government of Victoria, 2009, Victoria Radiation Regulations 2007 (S.R. No. 89/2007), Radiation Act 2005 (State Government of Victoria, 2009), Radiation Act 2005, State Government of Victoria, Melbourne, Vic.
- State Government of Victoria, 2013, Radiation Amendment Act 2013 (State Government of Victoria, 2013), State Government of Victoria, Melbourne, Vic.
- Tasmanian Government, 2005, Tasmania, Radiation Protection Act, 2005 (Tasmanian Government, 2005), Tasmanian Government, Hobart, Tas.
- Tripartite Committee in Radiation Oncology, 2011, Radiation Oncology Practice Standards (Tripartite Committee in Radiation Oncology, 2011), The Royal Australian and New Zealand College of Radiologists (RANZCR), Sydney, NSW.
- Tripartite Committee on Radiotherapy, 2011, Radiation Oncology Practice Standards Supplementary Guide (Tripartite Committee on Radiotherapy, 2011), Royal Australian and New Zealand College of Radiologists (RANZCR), Sydney, NSW.
- Tripartite Committee on Radiotherapy, 2013, Radiation Oncology Practice Standards for New Zealand (Tripartite Committee on Radiotherapy, 2013), Royal Australian and New Zealand College of Radiologists (RANZCR), Sydney, NSW.
- Tripartite Committee on Radiotherapy, 2013, 2013, Radiation Oncology Practice Standards, Supplementary Guide New Zealand (Tripartite Committee on Radiotherapy, 2013, 2013), Royal Australian and New Zealand College of Radiologists (RANZCR), Sydney, NSW.

AX.05 Further Reading

- Adams P, Hardwick J, Embree V, Sinclair S, Conn B, Bishop J. Literature Review: Models of Cancer Services for Rural and Remote Communities. Sydney: Cancer Institute NSW, March 2009.

- Australian / New Zealand Standards 3200.2.1, 1999, Medical electrical equipment – Particular requirements for safety – Electron accelerators in the range of 1 MeV to 50 MeV
- Australian / New Zealand Standards 3200.2.11, 1999, Medical electrical equipment – Particular requirements for safety – Gamma beam therapy equipment
- Australian / New Zealand Standards 3200.2.44, 2005, Medical electrical equipment – Particular requirements for safety – X-ray equipment for computed tomography
- Australian / New Zealand Standards 3200.2.29, 2000, Medical electrical equipment – Particular requirements for safety – Radiotherapy simulators
- Australian / New Zealand Standards 3200.2.8, 1994, Medical electrical equipment – Particular requirements for safety – Therapeutic X-ray generators
- Australian / New Zealand Standards 3200.2.8, 1994/Amdt 1:1999, Approval and test specification - Medical electrical equipment – Particular requirements for safety – Therapeutic X-ray generators
- Australian / New Zealand Standards 3200.2.32, 1994, Approval and test specification - Medical electrical equipment – Particular requirements for safety – Associated equipment of X-ray equipment
- Australian / New Zealand Standards 3200.2.9, 1997, Approval and test specification – Medical electrical equipment – Particular requirements for safety – Patient contact dosimeters used in radiotherapy with electrically connected detectors
- Australian / New Zealand Standards 3200.2.43, 2002, Medical electrical equipment – Particular requirements for safety – X-ray equipment for interventional procedures (IEC60601-2-43:2000, MOD)
- Australian / New Zealand Standards 3200.1.3, 1996, Approval and test specification - Medical electrical equipment – General requirements for safety – Collateral Standard: Requirements for radiation protection in diagnostic X-ray equipment
- Australian / New Zealand Standards 3200.1.1, 1995, Approval and test specification - Medical electrical equipment – General requirements for safety – Collateral Standard: Safety requirements for medical electrical systems
- Australian / New Zealand Standards 3200.1.1, 1995/Amdt 1:1997, Approval and test specification - Medical electrical equipment – General requirements for safety – Collateral Standard: Safety requirements for medical electrical systems
- Australian / New Zealand Standards 3200.1.2, 2005, Medical electrical equipment, General requirements for safety – Collateral standard: Electromagnetic compatibility – Requirements and tests
- Australian / New Zealand Standards 3200.1.0, 1998, Medical electrical equipment – General requirements for safety – Parent Standard
- Australian / New Zealand Standards 4434.2, 1996, Medical electrical equipment, Medical electron accelerators – Periodic function performance testing
- Australian / New Zealand Standards 4434.1, 1996, Medical electrical equipment, Medical electron accelerators – Functional performance characteristics
- Australian / New Zealand Standards 4213.1, 1994, Radiotherapy stimulators – Functional performance characteristics
- Australian / New Zealand Standards 4213.2, 1994, Radiotherapy stimulators – Guidelines for functional performance characteristics
- Australian / New Zealand Standards 3824, 1998, Guidelines for radiotherapy treatment rooms design
- Australian / New Zealand Standards 4513, 1995, Medical electrical equipment – Fundamental aspects of safety Standards

- Australian / New Zealand Standards 4580, 1999, Medical electrical equipment – Digital imaging and communications in medicine (DICOM) – Radiotherapy objects
- Australian / New Zealand Standards 4537, 1999, Medical electrical equipment – Dosimeters with ionization chambers as used in radiotherapy
- Australian / New Zealand Standards 4495, 1997, Radiotherapy equipment – Coordinates, movements and scales
- Australian / New Zealand Standards 2900.10, 2002, Quantities and units – Space and time
- Australian / New Zealand Standards 4358, 1996, Medical diagnostics X-ray equipment – Radiation conditions for use in the determination of characteristics
- Australian / New Zealand Standards 2982.1, 1997, Laboratory design and construction: Part 1: General requirements
- Australian / New Zealand Standards 2243.4, 1998, Safety in laboratories – Ionizing radiations
- Australian / New Zealand Standards 1319, 1994, Safety signs for the occupational environment
- Australian / New Zealand Standards 4543.1, 1999, Protective devices against diagnostics medical X-radiation – Determination of attenuation properties of material
- NSW Cancer Plan 2011–15 Cancer Institute NSW, Sydney, November 2010
- Northern Territory Cancer Plan 2013 – 2016 Northern Territory Department of Health, 2013
- Queensland Statewide Cancer Treatment Services Plan 2010 – 17, Queensland Health, December 2009
- Cancer Care Statewide Health Service Strategy 2014, Department of Health, Queensland Government
- Radiotherapy Services in NSW – Strategic Plan to 2016. NSW Department of Health, Sydney, June 2010.
- Statewide Cancer Control Plan 2011 – 2015, Government of South Australia, February 2011
- The Royal Australian and New Zealand College of Radiologists, Planning for the Best: Tripartite National Strategic Plan for Radiation Oncology 2012-2022, version 1, June 2012
- Victoria's Cancer Action Plan 2008-2011, Department of Health, Victoria, December 2008
- Victorian Paediatric Integrated Cancer Service Strategy: Strategic Plan 2013-2016
- WA Cancer Plan 2012-2017. Perth: WA Cancer & Palliative Care Network, Department of Health, Western Australia 2011.

AX.06 Brachytherapy

BRACHYTHERAPY

Brachytherapy (also called internal radiation therapy) involves placement of radioactive material directly inside the body. It allows a higher total dose of radiation to be administered to treat a smaller area and in a shorter time than is possible with EBT.

Brachytherapy may be used to treat cancers throughout the body, including the prostate, female reproductive organs, head and neck and gallbladder.

Brachytherapy may be either temporary or permanent, low dose rate (LDR) or high dose rate (HDR).

TEMPORARY BRACHYTHERAPY

In temporary brachytherapy, the radioactive material is placed inside or near a tumour for a specific amount of time and then withdrawn. It can be administered at a low-dose rate (LDR) or high-dose rate (HDR). A delivery device, such as a catheter, needle, or applicator is placed into the tumour using fluoroscopy,

ultrasound or CT to help position it. The physician may insert the radioactive material at the same time manually through the delivery device and later remove the material and delivery device

Alternatively, the patient may be moved to a hospital room where the delivery device is connected to a remote-controlled machine (after-loader), which pushes the radioactive material to the tumour site. After a specified amount of time, the radioactive material is withdrawn back into the machine and disconnected from the delivery device. The delivery device is then removed from the patient.

PERMANENT BRACHYTHERAPY

Also called seed implantation, permanent LDR brachytherapy involves placing radioactive seeds or pellets in or near the tumour and leaving them there permanently. After several weeks or months, the radioactivity level of the implants eventually diminishes to nothing. The seeds then remain in the body with no lasting effect on the patient.

HIGH DOSE RATE (HDR) BRACHYTHERAPY

High-dose rate (HDR) brachytherapy is usually an outpatient procedure. A specified dose of radiation is delivered via a remote-controlled machine to the tumour in a short burst, lasting only a few minutes. This may be repeated several times in a day before the delivery device is removed and the patient returns home. Patients may receive up to 12 separate HDR brachytherapy treatments over one or more weeks.

LOW DOSE RATE (LDR) BRACHYTHERAPY

In a non-permanent LDR brachytherapy procedure, the patient is treated with radiation delivered at a continuous rate over several hours or days. This treatment may be delivered using a manually or remotely after-loaded implant. A patient receiving LDR brachytherapy stays overnight at the hospital so the delivery device can remain in place throughout the treatment period.