# SESLHD PROCEDURE COVER SHEET

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| **POSITION RESPONSIBLE FOR THE DOCUMENT** | District Radiation Safety Officer<br>SESLHD-RadiationSafetyOfficer@health.nsw.gov.au |
| **KEY TERMS** | Radiotherapy; radiation safety; radiation management plan; protection |
| **SUMMARY** | Procedure to limit the risk to health of staff and members of the public arising from exposure to radiation from radiation therapy procedures at any facility within SESLHD. |



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# Protection of staff and the public during Radiation Oncology procedures

SESLHDPR/555

## 1. POLICY STATEMENT

South Eastern Sydney Local Health District (SESLHD) is committed, through a risk management approach, to protecting employees, contractors, students, volunteers, patients, members of the public and the environment from unnecessary exposure to radiation arising from systems and processes which use radiation apparatus and radioactive substances, whilst maintaining optimum diagnostic and therapeutic quality, therapeutic efficacy and patient care.

This document provides the procedures necessary to ensure compliance in relation to the protection of patients undergoing radiation therapy procedures.

## 2. BACKGROUND

### 2.1 Description of the procedure

Radiation therapy refers to the practice of using ionising radiation from external beam radiation sources (linear accelerators, superficial or orthovoltage units) or sealed radioactive sources (brachytherapy) for the treatment of patients with malignancies or other diseases.

### 2.2 Area description

A controlled area is a defined area in which specific protection measures and safety provisions are, or could be, required for controlling normal exposures or preventing the spread of contamination under normal working conditions (ICRP 103). In radiotherapy, controlled areas include:

- linear accelerator bunkers and their immediate surroundings. In some cases this may include the areas above and below the bunker.
- superficial and orthovoltage rooms for external beam radiation therapy
- remote afterloading brachytherapy rooms
- brachytherapy patient rooms
- radioactive source storage and handling areas
- operating rooms during brachytherapy procedures involving sources.

A supervised area is an area for which occupational exposure conditions are kept under review, even though no specific protection measures or safety provisions are normally needed (ICRP 103). Supervised areas may include areas surrounding brachytherapy patient rooms, or radioactive source storage or handling areas.

### 2.3 Nature of the hazard

The use of radiotherapy has overall social benefit but the high radiation doses involved with therapeutic exposures have the potential to cause harm to those who benefit from the treatment and to the health care staff and members of the public if inadvertent radiation exposure occurs.

## 3. RESPONSIBILITIES

### 3.1 The Radiation Medical Practitioner

- is responsible for the safety and protection of the patient in the prescription and delivery of radiotherapy.
- is required to ensure that the radiation dose to the patient is justified and optimised.

### 3.2 Persons administering radiation (Operator)

- administers ionising radiation for radiation therapy purposes.
- will usually be a qualified radiation therapist, but in some cases such as brachytherapy and IORT, this may be a physicist or a radiation medical practitioner.
- will deliver radiation in accordance with the radiation treatment plan approved by the radiation medical practitioner.
- will adhere to all relevant department operating procedures and provide continuous oversight of the radiation-producing equipment during radiation dose delivery.

### 3.3 Radiation Therapist

- will be involved in both the planning and treatment aspects of radiation therapy.
- will, in addition to the responsibilities outlined in 3.2, typically calculate and document the relevant treatment parameters for treatment planning and delivery, participate in the department's quality assurance program, manage quality control for patient-related treatment and planning activities, and adhere to safe practice procedures for operating radiotherapy equipment. Close interaction with the Radiation Medical Practitioner and the ROMP, particularly for more complex cases, should ensure that the most appropriate technique for planning and delivering the dose prescription is chosen.

### 3.4 Qualified Expert (Radiation Oncology Medical Physicist)

- will have suitable qualifications and experience in radiotherapy physics. A medical physicist with specialist experience in radiotherapy – a Radiation Oncology Medical Physicist – would satisfy these requirements.
- will give advice on optimisation of medical exposures and matters relating to radiation protection.
- is responsible for performing or supervising radiotherapy calibration, dosimetry and quality assurance.

### 3.4 Radiation Safety Officer

- will oversee and provide advice on radiation safety within radiation therapy departments.

## 4. PROCEDURE

### 4.1 Procedure required

For procedures for correct identification of the patient, procedure and sites prior to commencing treatment refer to the NSW Ministry of Health Policy PD2017_032 – Clinical Procedure Safety.

Each radiotherapy centre will have their own operating procedures which should be adhered to, tailored to the equipment available in the department. The following general procedures give steps to limit the risk to health of staff and members of the public arising from exposure to radiation from radiation therapy procedures.

#### *4.1.1 CT or Simulator*

- Before an exposure is made, check that all doors leading into the CT/Simulator room are closed.
- Before an exposure is made, check that all persons (except the patient) have left the room. If it is absolutely essential that a staff member stay in the room during an exposure, that staff member must wear a lead apron.
- Radiation exposure from a CT or simulator is small compared to the therapeutic dose, however it is still good practice to minimize unnecessary x-ray exposure.
- In an emergency, the beam can be turned off by pressing any one of the emergency off buttons.
- All staff having cause to enter the CT/simulator room must familiarize themselves with the locations of the emergency off buttons.
- Defects in equipment which may affect safety must be reported to the responsible Medical Physicist immediately. In the meantime, the equipment should be labelled as defective or, if appropriate, disabled until corrective action has been taken and the equipment is safe to return to use.
- Prescribed safety checks must be performed routinely by qualified personnel. For details see the quality assurance protocols of the Medical Physics and Radiation Therapist groups within the radiation therapy department.

#### *4.1.2 Superficial and Orthovoltage therapy*

- When warming up the machine, a lead filter must be used to limit radiation risk.
- Check that any cone used on the machine is firmly attached.
- Ensure that the support stand and x-ray tube locks are tight before treating the patient
- Before the beam is turned on, check that all persons (except the patient) have left the treatment room, that all the doors are shut.
- In an emergency, the beam can be turned off by pressing the x-rays off or emergency off buttons.
- Defects in equipment which may affect safety must be reported to the responsible Medical Physicist immediately. In the meantime, the equipment should be labelled as defective or, if appropriate, disabled until corrective action has been taken and the equipment is safe to return to use.

- Prescribed safety checks must be performed routinely by qualified personnel. For details see the quality assurance protocols given in Section 8 of the Radiation Management Plan.

### *4.1.3 Linear accelerator*

- Do not enter the treatment room while the "Beam On" sign is illuminated.
- Do not stand unnecessarily close to the treatment room door.
- Access to the treatment rooms during clinical operation is only permitted when authorised by the Radiation Therapist in charge of the machine at that time.
- Access to the treatment rooms during testing, maintenance and calibration is only permitted when authorised by the Physicist in charge of the machine at that time.
- Ask permission to enter the treatment room in the following circumstances:
  - a patient is being set up for treatment and you are not part of the treatment team
  - service or physics work is being performed and you are not part of those teams.
- It is the responsibility of the person activating the door safety interlock (button with audible alarm) to ensure that all people except the patient have left the room.
- Under no circumstances should a member of staff or a visitor be present in the treatment room during the treatment period.
- The treatment room door must be shut by the last person to leave the room. Under no circumstances shall the door be shut whilst staff are in the room.
- Before commencing irradiation, check that all persons (except the patient) have left the treatment room. Check visually with the TV monitors and use the intercom if in any doubt.
- In an emergency, the radiation beam can be turned off by pressing any one of several available emergency-off buttons.
- All staff having cause to enter a linear accelerator radiation treatment room must familiarise themselves with the locations of the emergency off buttons.
- Whenever you are within the treatment room, be vigilant for indications that others may have intent to activate the radiation beam, e.g. listen for activation of the door safety interlock button with its audible alarm.
- Defects in the equipment which may affect safety must be reported to the responsible Medical Physicist immediately. If such a defect is found by a Radiation Therapist, they must also report it to the machine senior who in turn informs the Chief Radiation Therapist. In the meantime, the equipment should be labelled as defective or, if appropriate, disabled until corrective action has been taken and the equipment is safe to return to use.
- Prescribed safety checks must be performed routinely by qualified personnel. For details see the quality assurance protocols of the Medical Physics and Radiation Therapist groups within the radiotherapy centre.
- Radiation therapists and other staff should be aware of the low level neutron activation that can occur when photon energies greater than 10 MV are used. In an adequately shielded bunker the photo-neutrons themselves pose no threat to staff outside the bunker. However, some parts of the linac and linac accessories may become mildly radioactive as a result of these neutrons. The half-life of this activity is generally only a few minutes at most, is localised around the linac head and will contribute very little to staff exposure. Applying the principle of ALARA local physicists

may recommend that pregnant staff do not enter the bunker immediately following a treatment using photon energies >10 MV. For linacs with a maximum photon energy >10 MV any major service that involves removal of the target or flattening filter should be conducted with the assistance of the radiation oncology physicist. The components may contain longer lived neutron activation products. The physicist should survey the components removed from the linac to ensure they do not pose an exposure risk and implement suitable storage arrangements if necessary.

## 4.2 Facilities required

Treatment room shielding shall comply with that specified by the ACPSEM (1997). Sufficient radiation shielding shall be provided for the doors, walls, floor and ceiling of any room in which a therapeutic ionising radiation emitting device is installed to ensure that no person receives a dose equivalent in excess of the relevant radiation protection limit (Refer to Schedule 2 of the NSW Radiation Control Regulation) as a result of operating the device. Assumptions made for radiation shielding calculations shall be conservative estimates in line with the ALARA principle.

All calculations regarding radiotherapy radiation shielding and the design of treatment rooms shall be performed by a radiation oncology medical physicist or a physicist who is recognised as a consulting radiation expert (CRE) in radiotherapy bunker shielding. Where an independent CRE is engaged for this role the accredited radiation oncology physicist should work closely with the CRE and verify all assumptions and calculations made by the CRE. Where megavoltage beams with energies exceeding 10 MV are to be used neutron shielding must be considered. This includes neutron moderating and absorbing materials for the bunker door.

A thorough radiation survey of the whole bunker (including neutrons for photon energies greater than 10 MV) shall be conducted by the radiation oncology physicist as soon as the installed linac is able to produce radiation and before any other work involving beam on.

## 4.3 Personal Protective Equipment

### *4.3.1 CT*

Lead aprons, thyroid shields and other personal protective devices should meet minimum design criteria as outlined in the Australian Standard (AS/NZS 4543.3:2000).

### *4.3.2 Manual brachytherapy*

Devices for handling sources, such as forceps, should be available. Hand carried transport containers bearing the radiation symbol should be provided and the lids of the containers should be securely fastened. Movable shields may be provided for nurses and visitors of brachytherapy patients. If lead aprons are used, they should meet the criteria outlined in the Australian Standard (AS/NZS 4543.3:2000).

### 4.4 Arrangements for appropriate isolation of hospital in-patients undergoing treatment with sealed or unsealed radioactive sources

Low dose rate brachytherapy may be delivered in the form of temporary plaques, inserted applicators or permanently implanted sources. Procedures should be in place to avoid the unnecessary irradiation of others from prolonged close proximity to a patient with these sealed radioactive sources in situ. The recommendations provided by ARPANSA Radiation Protection Series 4 (2002) and section 9 of the ARPANSA Radiation Protection Series 14.3 (2008) should be noted and followed. The recommendations of the safety guide are outlined below.

### 4.5 Ward Care for a Patient undergoing LDR Brachytherapy

Staff should follow the general principles of radiation protection by:

- minimising the period of time with the patient
- maximising the distance from the patient.

The dose-rates to nearby occupied areas should be assessed by a Radiation Oncology Medical Physicist (ROMP) or RSO and any necessary steps taken to minimise exposure of other patients, staff and the general public. The maximum allowable contact time for each patient/radionuclide configuration should be determined by a ROMP. This information should be given to the nursing staff and displayed as appropriate.

The radiation shielding requirements for ward rooms used for brachytherapy patients depend upon the type of radiation emitted from the radioactive sources, the activity of the sources and the general distance to surrounding areas that may be occupied by staff or the public. The shield requirements should be specified by a ROMP experienced in brachytherapy techniques. The estimates of dose levels in adjacent areas for the various types of treatments should be confirmed by a dose rate survey carried out by the facility's ROMP or RSO.

A warning sign should be posted at the brachytherapy patient's room entrance. The radiation warning sign on the door should have an additional instruction such as 'Visitors must contact the Ward Sister-in-Charge before entering'. Any special conditions should be listed and contact telephone numbers of the facility's RSO, ROMP or deputy should be displayed in case of a radiation emergency. The bed of a patient undergoing treatment should also be marked with a warning sign indicating the presence of a radioactive source in the patient.

A suitably shielded container should be located in the patient's room in case a radioactive source becomes dislodged during the course of the treatment and for use when the radioactive sources are removed at the end of the patient's treatment. The shielded source container should be able to be securely fastened, preferably lockable. If a dislodged source is stored in the container, details of the source and time of removal should be attached to the container. The Nurse in Charge of Shift, the ROMP or the RSO, and the Radiation Medical Practitioner should be informed as soon as possible.

All dressings, bed linen and bedpans from the patient should be checked using a radiation monitor before disposal to guard against the loss of radioactive sources. The person carrying out these checks should be suitably trained.

### 4.6 Ward Staff

A ROMP and/or RSO should provide radiation safety tuition for all staff involved with caring for brachytherapy patients. Nursing staff should be familiar with the precautions to be undertaken for brachytherapy patients, including safety requirements for domestic staff and visitors, and the nature and duration of the hazard. The ROMP or RSO should provide individual protocols for the different types of brachytherapy and actions to take when unexpected interruptions occur. Documentation on radiation safe practices and treatment procedures should be readily available for staff. Nursing staff should be instructed to wear a personal dose meter. Nursing staff who are, or might be, pregnant should not be involved in the care of patients with sealed radionuclides.

### 4.7 Visitors to LDR Brachytherapy Patients

A ROMP or the RSO should specify the maximum duration of visit and minimum distance away from the patient for visitors to the brachytherapy patient's ward room. When low energy radioactive sources such as iodine-125 or similar radionuclides are used, minimal restrictions may be needed.

In general, women of reproductive capacity and children under 16 years of age should not be permitted to visit patients undergoing brachytherapy treatment, but, where their visiting is permitted, adherence to time and distance constraints should be strictly observed.

### 4.8 Movement of the Patient within the Facility

In the unlikely event that an LDR brachytherapy patient needs to be transferred from the ward to elsewhere, the source should first be removed from the patient. If this cannot be done, the ROMP or the facility's RSO or their delegate should be consulted for advice on precautions and procedures.

### 4.9 Discharge of a Patient Undergoing LDR Brachytherapy

The recommendations and principles contained in ARPANSA Radiation Protection Series (RPS) 4 should be followed. In general, patients with temporary sealed implants or moulds should not be discharged without removal of the source(s) (penetrating radiation from sources such as caesium-137 or iridium-192 presents a greater radiation hazard to the general community). In certain instances, however, such as the use of iodine-125 seed eye plaques, it may be permissible for a patient to be treated at home. This is permissible when effective doses to members of the public and to adult persons who care for the patient are unlikely to exceed the dose limits and constraints given in ARPANSA RPS C-1 (2019).

### 4.10 Emergency procedures

The Radiation Safety Officer of the facility should assess the nature and scope of the radiation hazard and implement any action required to bring the incident under control. The incident must be immediately reported to the Responsible Person and to the NSW EPA Radiation Control Section. The circumstances of the incident should be investigated. Measurements and calculations should be performed in order to determine the optimum corrective action plan and estimate the dose to the operators and members of the public

involved in the incident. The necessary resources should be assembled and the required corrective action performed, taking into account any advice given by the Responsible Person and the regulatory authority. A detailed report should be prepared as soon as possible after the incident and submitted, within 7 days, to the relevant regulatory authority, through the Responsible Person. The radiation safety officer should advise the regulatory authority and the Responsible Person on the changes required to prevent the recurrence of a similar incident.

Refer to SESLHDPR/558 Handling, Investigation and Reporting of Radiation Incidents, for more detailed information on emergency procedures.

Emergency Contacts

Emergencies should be referred to the on-duty or on-call Radiation Oncology Physicist and the site Radiation Safety Officer.

### 4.11 Contact procedures

Radiation safety enquiries relating to radiation therapy should be directed initially to the person with local responsibility within the appropriate radiation therapy department (usually the chief physicist in that department).

Emergencies should also be referred to the facility Radiation Safety Officer

After hours enquiries can be directed to the on-call radiation oncology physicist via the hospital switchboard.

| SESLHD Radiation Therapy Contact Numbers | |
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| Northern Sector Radiation Therapy (Prince of Wales Hospital): | Radiation Oncology Physicist (02) 9382 2572<br>Radiation Safety Officer (02) 9382 8067<br>After hours ring Switchboard (02) 9382 2222 |
| Southern Sector Radiation Therapy (St. George Hospital): | Radiation Oncology Physicist (02) 9113 3904<br>Radiation Safety Officer (02) 9113 3130<br>After hours ring Switchboard (02) 9113 1111 |

## 5. DOCUMENTATION

- SOPs for radiation therapy administration.

## 6. AUDIT

The following documents should be available for audit:

- Patient treatment records.
- Staff occupational dose records.
- Equipment Quality Assurance records.
- Records of equipment faults and repairs performed.

## 7. REFERENCES

[1] SESLHDPR/558 Handling, Investigation and Reporting of Radiation Incidents

[2] PD2017_032 NSW Health Policy Directive: Clinical Procedure Safety

[3] Radiation Control Regulation (2013) NSW Government

[4] ARPANSA RPS C-1 (2016) Radiation Protection in Planned Exposure Situations ARPANSA, Yallambie

[5] ARPANSA RPS 4 (2002) Recommendations for the Discharge of Patients Undergoing Treatment with Radioactive Substances ARPANSA, Yallambie

[6] ARPANSA RPS C-5 (2019) "Code for Radiation Protection in Medical Exposure", ARPANSA, Yallambie

[7] ARPANSA RPS 14.3 (2008) “Safety guide for Radiation Protection in Radiotherapy” ARPANSA, Yallambie

[8] Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM) (1997), “Recommendations for the Safe Use of External Beams and Sealed Brachytherapy Sources in Radiation Oncology, ACPSEM 20 (3), Supplement.

[9] ICRP 103 The 2007 Recommendations of the International Commission on Radiological Protection.

[10] AS/NZS 4543.3:2000 Australian/New Zealand Standard (2000) “Protective devices against diagnostic medical X-radiation Part 3: Protective clothing and protective devices for gonads”

## 8. REVISION AND APPROVAL HISTORY

| Date | Revision No. | Author and Approval |
|---|---|---|
| August 2010 | Draft | Jo McNamara, Radiation Oncology Medical Physicist and Martin Carolan, RSO SHN |
| November 2010 | Revised draft | Richard Smart, Area Radiation Safety Officer |
| February 2011 | 0 | Approved by Combined Clinical Council |
| October 2012 | 1 | Broken link to SESLHNPD/53 fixed |
| January 2016 | 2 | Periodic Review |
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