Government of **Western Australia**
North Metropolitan Health Service

NMHS Radiation Management Plan

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Contents

This document can be made available in alternative formats on request.

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Scope and Administration

This document identifies the legal requirements, policies and procedures with respect to management of radiation safety within the North Metropolitan Health Service (NMHS). It provides traceability to the applicable Western Australian legislation and other documents that define the framework for radiation protection. In particular, it meets the requirements of the Code for Radiation Protection in Medical Exposure and the Code for Radiation Protection in Planned Exposure Situations.

This radiation management plan has been approved by the NMHS Radiation Safety Committee and applies to the following organisations:

- Anita Clayton Centre
- BreastScreen WA
- Dental Health Services
- King Edward Memorial Hospital
- Osborne Park Hospital
- Sir Charles Gairdner Hospital

This plan is maintained by the Department of Medical Technology and Physics Sir Charles Gairdner Hospital, and is reviewed every 12 months.

Other documented safety procedures and policies, which give detailed information specific to particular locations, equipment and actions, apply in addition to this radiation management plan and are referenced herein. The radiation information in these procedures and policies is to be approved by the organisation's radiation safety officer and must not be modified without consideration of the effect on the radiation management plan and other local working rules.

Terms Used

Where **must** is used the instruction is based on legislation. These instructions are requirements under law and must be followed in all circumstances.

Where **shall** is used the instruction is based on Department of Health policy, NMHS policy, national or international Codes of Practice, or Australian Standards that are not otherwise accounted for in the legislation. These instructions are requirements under NMHS management

and must be followed unless the NMHS or Hospital / Organisations Executive has given a specific exemption.

Where **should** is used the instruction is based on best practice and should be followed to ensure the safety of staff and patients, and to ensure that the NMHS fulfils its duty of care.

Roles and Responsibilities

Radiolocal Council and Radiation Health

The Radiological Council is an independent statutory authority appointed under the Radiation Safety Act 1975 (WA) in Western Australia to assist the Minister for Health to protect public health and to maintain safe practices in the use of radiation.

The Radiation Safety Act regulates the keeping and use of radioactive substances, irradiating apparatus (e.g. x-ray equipment) and certain electronic products (e.g. lasers and UV transilluminators). The Act applies to both ionising and non-ionising radiation. Registration of premises and radiation sources and licensing of individuals are the principal means by which the use of radiation is regulated.

Daily administration of the Act is undertaken by personnel of Radiation Health acting through the Secretary of the Radiological Council. Radiation Health has separate responsibilities to the Department of Health and is under the direction of the Managing Health Physicist.

Registrant

Radioactive substances, irradiating apparatus and prescribed electronic products as well as the premises at which they are used or stored must be registered with the Radiological Council. The registrant is the person in whose name the certificate of registration has been issued.

The registrants for each organisation are:

- Anita Clayton Centre: Dr Elizabeth Wylie
- BreastScreen WA: Dr Elizabeth Wylie
- Dental Health Services: General Manager
- King Edward Memorial Hospital: Director of Medical Services
- Osborne Park Hospital: Area Director, Clinical Services
- Sir Charles Gairdner Hospital: Area Director, Clinical Services

The registrant may delegate tasks to other persons; the roles and responsibilities of any person undertaking delegated duties must be clearly stated in writing. For further information, see the Responsibilities of the Registrant Fact Sheet.

Radiation Safety Officer

The registrant must appoint a radiation safety officer (RSO) to perform the duties outlined in Regulation 19 of Radiation Safety (General) Regulations 1983 (WA). A radiation safety officer must be appointed in respect of radioactive substances, irradiating apparatus and lasers (a laser safety officer), as relevant for the registered radiation sources. For further information, see the Responsibilities of the Radiation Safety Officer Fact Sheet.

The radiation / laser safety officer may commit an offence for failure to carry out prescribed duties; however, the registrant remains ultimately responsible for failure to comply with the Radiation Safety Act and Regulations.

The radiation / laser safety officers for each organisation are:

- Anita Clayton Centre: Helen Parry
- BreastScreen WA: Dr Elizabeth Wylie
- Dental Health Services: Catherine Alford
- King Edward Memorial Hospital: Janette Atkinson
- Osborne Park Hospital: Paul Merenda (x-ray equipment)
    - Dean Clair (lasers – physiotherapy)
    - Dr Patrick Teloken (lasers – medical)
- Sir Charles Gairdner Hospital: Janette Atkinson

Local Radiation and Laser Safety Officers

Some organisations may also have a local radiation safety officer in each department or area working with radioactive substances, irradiating apparatus or lasers to assist the organisation's radiation safety officer. The local radiation / laser safety officer duties are ultimately the responsibility of the organisation's radiation / laser safety officer even if they are delegated to another individual.

The local radiation / laser safety officer is responsible for the day-to-day management of radiation safety specific to their department or area and should ensure compliance with this plan and NMHS and organisational radiation safety policies and procedures. The local radiation /

laser safety officer should have sufficient seniority to be able to take action in the case of a breach of the Act, policies or procedures.

NMHS Radiation Safety Committee

NMHS has a Radiation Safety Committee which has oversight of all aspects of radiation safety within the NMHS. The committee meets every two months and exists to assist the organisation radiation safety officers regarding the safe and legal use of radiation and to formalise the reporting mechanism within the health service. Parties outside the NMHS may be invited to attend the Committee meetings where appropriate.

Radiological Medical Practitioner

The radiological medical practitioner (typically a licenced medical practitioner) is responsible for the conduct of procedures involving the exposure of patients to radiation and must ensure that such exposures are justified and optimised in accordance with Code for Radiation Protection in Medical Exposure.

In some cases, the medical practitioner will also be responsible for administration of radiation for diagnostic or therapeutic purposes and the operation of radiation producing equipment.

Operator

The person administering radiation (typically a Medical Imaging Technologist, Nuclear Medicine Technologist, Radiation Therapist or radiological medical practitioner) to a patient must do so in accordance with Code for Radiation Protection in Medical Exposure as well as the conditions, restrictions and limitations attached to the organisation's registration and individual's licence, as well as other relevant documents.

Justification and Optimisation

Procedures involving the exposure of individuals to radiation should only be undertaken if they are considered to provide sufficient benefit to the individual or to society to offset the risk of radiation detriment caused by the exposure.

Medical radiation exposures should be optimised to provide the required diagnostic or therapy exposure, for the lowest risk from radiation. The radiation doses that arise from medical radiological procedures, including those received by occupationally exposed persons and members of the public, must be kept as low as reasonably achievable (ALARA).

Special attention is required for exposures of paediatric patients, for individuals undergoing health screening, for volunteers in medical research, where a female patient is or might be pregnant or is breastfeeding, carers or comforters of patients after radionuclide therapy and radionuclide therapy patients who provide close care of a child.

For more information on justification and optimisation, see the Code for Radiation Protection in Medical Exposure.

Referral of a Radiological Procedure by Approved Practitioners

All procedures involving exposure to radiation, other than for an approved health screening program or a patient undergoing an emergency procedure, must not be conducted without a written referral. The conditions of registration for each organisation may specify from whom referrals may be accepted.

Policies relating to referrals for procedures involving radiation shall be maintained by the local radiation safety officer. These policies shall include such details as to identify:

- the minimum information required in the referral;
- types of practitioners from whom referrals can be accepted and for what procedures;
- who may accept referrals and types of referrals that need to be individually reviewed by a specialist medical practitioner.

Diagnostic Reference Levels

Radiation doses administered to a patient for diagnostic purposes shall be compared with established Australian Diagnostic Reference Levels (DRLs) at least annually. If DRLs are consistently exceeded or the radiological procedures do not provide useful diagnostic information or yield the expected medical benefit, then the radiological procedure shall be reviewed to ensure that radiation protection is being optimised.

The organisation's radiation safety officer shall be responsible for ensuring that a DRL program is developed, implemented and appropriately documented. The program should also attempt to establish local DRLs for imaging procedures where national DRLs are still being produced.

Patient Dosimetry

Patient dosimetry must be performed using calibrated dosimeters and following internationally or nationally accepted protocols, and must be documented. This includes:

- for diagnostic radiological procedures, typical doses to patients for common procedures
- for image guided interventional procedures, typical doses to patients
- for radiotherapy procedures, absorbed doses to the planning target volume for each patient treated with external beam therapy and/or brachytherapy and absorbed doses to relevant tissues or organs as determined by the radiological medical practitioner
- for therapeutic or diagnostic nuclear medicine procedures, the radiopharmaceutical and the confirmed activity delivered

Research

All research projects involving the exposure of individuals to radiation, where the irradiation is above standard of care as determined by a relevant medical practitioner, shall be submitted to the organisation's radiation safety officer and requires Human Research Ethics Committee approval. Depending on the radiation dose, the project may also need to be forwarded to the Radiological Council for approval. Further information can be found in the Code for Radiation Protection in Medical Exposure, and the Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes or by contacting the Radiological Council.

For adult participants, effective doses of more than 20 mSv require approval from the Radiological Council. Different effective dose limits apply for children. Consult the organisation's radiation safety officer for further information or if in doubt.

Radiological Procedures

Patient and Procedure Identification

Immediately before conducting a radiological procedure on a patient, the operator must take reasonable steps to ensure that the patient is correctly identified and that the procedure performed on the patient is that which is prescribed.

All organisations shall have policies for patient identification and procedure matching in accordance with the Code for Radiation Protection in Medical Exposure. It is the responsibility of each organisation to determine how they meet the standards. The departments and patient care personnel shall be aware of their organisations patient identification and procedure matching policies.

Patient Consent

All organisations shall adhere to the Department of Health Consent to Treatment Policy and the NMHS Consent to Treatment Policy.

Radiotherapy and Radioisotope Therapies

The radiological medical practitioner must obtain informed consent from the patient (or guardian) prior to treatment, in accordance with ARPANSA RPS 14.2 Safety Guide for Radiation Protection in Nuclear Medicine (2008) and ARPANSA RPS 14.3 Safety Guide for Radiation Protection in Radiotherapy (2008).

Diagnostic Imaging and Procedures

Patient consent should be obtained before a diagnostic radiological procedure, in accordance with ARPANSA RPS 14.1 Safety Guide for Radiation Protection in Diagnostic and Interventional Radiology (2008).

Consent requirements must reflect the level of risk associated with each radiological procedure.

Documents relating to patient consent must be kept and maintained and should include information on:

- The levels of consent required for procedures performed in the area.
- The responsible person who will give information on the expected benefits of the radiological procedure and / or the associated risks.

The Department of Health standards for Diagnostic Imaging Accreditation Scheme (DIAS) outline the full set conditions an organisation must follow to obtain accreditation.

Pregnant or Potentially Pregnant Patients

All organisations that perform diagnostic imaging procedures on pregnant or potentially pregnant patients shall follow the NMHS Imaging Pregnant Patients Procedure. Policies relating to pregnant or potentially pregnant patients involving radiation shall be maintained by the radiation safety officer of each department or area where the procedures are undertaken.

Note that this policy does not apply to Nuclear Medicine or Radiation Oncology procedures, these departments should have their own policies relating to the management of patient or potentially pregnant patients. These policies should comply with Code for Radiation Protection in Medical Exposure, the ARPANSA Safety Guides for Radiation Protection in Nuclear Medicine and Radiotherapy (RPS 14.2 and RPS 14.3 respectively) and shall include such details as to identify:

- steps taken to determine the pregnancy status of female patients;
- procedures for examination of pregnant patients;
- information provided to pregnant patients undergoing procedures involving radiation.

Protection of an Infant or Child

When a radiopharmaceutical is administered to a patient who is breastfeeding or providing close care of a child, the radiological medical practitioner shall take reasonable steps to ensure that any exposure of the child is eliminated or minimised. The policy relating this shall be maintained by the radiation safety officer in the department where the procedure is undertaken.

Administration of Radiation

The protection of the patient from unnecessary exposure to radiation must be optimised. Policies relating to the administration of radiation shall be maintained by the local radiation

safety officer of each department or area where the procedures are undertaken. These policies shall include all necessary details to identify:

- patient consent requirements;
- planning and delivery of radiotherapy doses;
- preparation and dispensing of radiopharmaceuticals;
- observation of the patient throughout procedures where dosimetry or image quality could be affected by patient movement.

Radiation workers must not support or restrain patients. A protective apron shall be provided to anyone required to hold neonate / paediatric patients. No unnecessary persons, other than the patient, shall be in the procedure room, unless behind a protective barrier, during the administration of radiation. No person, including their individual body parts (e.g. hands), except for the patients are to be within the direct path of the x-ray beam.

Patients Undergoing Radioisotope Therapy

The conditions, restrictions and limitations applied to an organisation's registration under Section 36 of the Radiation Safety Act require that a medical physicist is present during administration of radioisotope therapy and for radiation safety follow-up where necessary.

Policies relating to patients undergoing radioisotope therapy shall be maintained by the local radiation safety officer of the department where the procedure is undertaken. These policies shall include such details as to identify:

- the procedure for involvement of a physicist;
- which procedures require notification to the Radiological Council of the administration;
- the restrictions on locations where therapy can be administered, appropriate isolation of patients and the discharge of patients;
- the procedure in the event of death of a patient following administration of radionuclides;

any necessary contamination control procedures (e.g. for Iodine-131 patients).

Training and Licensing Requirements

Training

The Western Australian radiation safety legislation and occupational safety and health legislation require that all workers are provided with adequate training and instruction. All NMHS staff who may be occupationally exposed to radiation must have appropriate training or instruction that relates to:

- type of work being undertaken;
- radiation source and related ancillary equipment that the individual may be required to use;
- any potential radiation hazards associated with the practice; and
- means of protection and minimisation of unwanted radiation exposure.

Staff that will be working in areas using radiation and / or lasers must undertake radiation / laser safety training. The type of training required will depend on the situation. In some cases, in-house training will be adequate, while in other cases, attendance at a recognised course and / or completion of an examination will be required. For further information, contact either the Department of Medical Technology and Physics or the Radiological Council.

Procedures for the induction or training of staff in radiation safety shall be maintained by the local radiation safety officer of each department or area where radiological procedures are performed. The records of staff training in radiation safety must be maintained by the local radiation safety officer and will be inspected during radiation safety audits.

Licensing

All persons who use, operate or otherwise deal with radioactive substances, irradiating apparatus or prescribed electronic products must hold a relevant current licence issued under the Radiation Safety Act, work under the direction and supervision of an appropriate licence holder (as permitted), or be exempted from licensing.

The conditions attached to the organisation's registration(s) specify who can use or supervise the use of radioactive substances, irradiating apparatus or prescribed electronic products, including who must be licensed and who can work under the direction and supervision of a licensee. The relevant registration conditions must be brought to the attention of persons working in departments or areas where radiation is used.

The radiation safety officer of each department or area where the procedures are undertaken should be responsible for checking and maintaining licence records.

For information on whether a licence is required contact the Department of Medical Technology and Physics, Sir Charles Gairdner Hospital or the Radiological Council.

Across the NMHS organisations there are many licence purposes that may apply to its staff (Appendix 1: Licence Purposes). Two licence types that are commonly required and often overlooked by medical practitioners are for fluoroscopy and lasers:

Fluoroscopy Licences for Non-Radiologist Medical Specialists

To be eligible for a licence to use fluoroscopic x-ray equipment, a person must have attended a recognised Fluoroscopy Radiation Safety Course and be registered as a medical specialist with the Australian Health Practitioner Regulation Agency (AHPRA). Information on Fluoroscopy Radiation Safety Course dates provided by Medical Technology and Physics, Sir Charles Gairdner Hospital can be found here.

Persons other than Radiologists registered as medical specialists with AHPRA and using fluoroscopy should hold their own fluoroscopy licence and are not permitted to work under the supervision of another licensee. Persons training for specialist qualifications may work under the supervision of a licence holder.

A medical imaging technologist must also be present **at all times** during the use of fluoroscopic equipment.

Laser Licences

To be eligible for a licence to use class 3B or class 4 lasers, staff must have attended a recognised Laser Safety Course and be registered as either a medical practitioner, nurse (division 1), dentist, physiotherapist or podiatrist with AHPRA. Physiotherapists are restricted to the use of class 3B lasers only.

Registered medical practitioners, nurses, dentists, physiotherapists and podiatrists who do not hold a WA licence to use class 3B and class 4 lasers are permitted to use these lasers under the direction and personal supervision of another licensee, see the conditions attached to the organisation's registration for further information.

Information including Laser Safety Course dates provided by Medical Technology and Physics, Sir Charles Gairdner Hospital can be found here.

Personal Radiation Monitoring

The registrant must ensure that an approved personal monitoring device is issued to every designated radiation worker on the registered premises and that the workers are instructed on how to use the device. Each person issued with monitoring device(s) must wear it as instructed and must not permit the device(s) to be worn by any other people. The devices must not be tampered with, unnecessarily exposed to radiation, heat or chemical agents.
Personal monitoring devices are only permitted to be worn for the period specified. Depending on the type of work being undertaken this will either be for 1 or 3 months.

The personal monitoring service providers for each organisation and the department responsible for the provision, maintenance and collection of personal monitoring devices from radiation workers are:

- Anita Clayton Centre
  Responsible Department: Clinical Physics, Health Technology Management Unit, Department of Health
  Provider: SGS Australian Radiation Services

- BreastScreen WA
  Responsible Person: Chief MIT, BreastScreen WA
  Provider: Landauer

- Dental Health Services
  Personal Radiation Monitoring is not required

- King Edward Memorial Hospital
  Responsible Person: Senior MIT, Medical Imaging, Perth Children's Hospital & Supervising MIT, Radiology, King Edward Memorial Hospital
  Provider: Landauer

- Osborne Park Hospital
  Responsible Person: Chief MIT, Radiology & Surgical Services – Theatre Clinical Nurse Manager
  Provider: SGS Australian Radiation Services

- Sir Charles Gairdner Hospital
  Responsible Department: Medical Technology and Physics
  Providers: Landauer and Global Medical Solutions

In organisations with local radiation safety officers in each department that uses radiation, those local radiation safety officers should be responsible for ensuring each radiation worker is provided with and appropriately wears a suitable personal radiation monitoring device, and that the device is returned to the provider for assessment at the end of the monitoring period.

Procedures for the personal radiation monitoring program at each organisation, including instructions for lost or accidentally exposed badges, shall be documented by and are available from the above responsible departments. The radiation safety officer for each organisation must maintain the records of staff radiation doses.

Reportable Doses

Regulation 15 of the Radiation Safety Regulations requires certain actions to be taken when a person receives a reportable dose (Table 1). In some organisations, additional internal reporting thresholds may exist for lower unexpected doses or for the hands and lens of the eye. Policies relating to the reporting of doses both internally and to the Radiological Council shall be maintained by the organisation's radiation safety officer.

Table 1: Actions required by the Radiation Safety Regulations for radiation doses received by individuals.

Whole Body Effective Dose (mSv) for Specified Monitoring Period		Required Action
1 Month	3 Month	
0.5 – 1.65	1.5 – 5	Immediately investigate the circumstances concerning the receipt or possible receipt of the dose and place a report on radiation workers file.
1.65 – 8.3	5 – 25	Immediately investigate the circumstances concerning the receipt or possible receipt of the dose and provide a written report of the matter to the Radiological Council within 7 days of the discovery of the dose.

> 8.3	> 25	Immediately report all facts concerning the receipt or possible receipt of the dose to the Radiological Council.

Pregnant Staff

The Radiation Safety Regulations apply additional restrictions to a radiation worker that has notified her employer that she is pregnant. For external radiation exposure, an equivalent dose to the surface of her abdomen for the remainder of her pregnancy of 2 mSv. The Code for Radiation Protection in Planned Exposure Situations also applies a dose limit of 1 mSv to the embryo or foetus.

The duties for pregnant staff involved in administering radiation shall be managed on a case-by-case basis in accordance with the NMHS Policy Fitness For Work. The CAHS Pregnancy and Safe Work Policy provides guidelines for issues to be discussed with pregnant workers and options for provision of duties. Local radiation safety officers and Department of Medical Technology and Physics, Sir Charles Gairdner Hospital may be consulted for advice regarding specific circumstances.

Facilities Approvals

This section encompasses structural shielding, the layout of facilities, and plumbing and ventilation infrastructure as relevant to the type of practice.

Warning Signs

Warning signs bearing the appropriate warning symbol and wording must be posted in areas where radiation producing equipment, lasers or radioactive substances are operated, used, stored or otherwise dealt with. Further information can be found in the Code for Radiation Protection in Planned Exposure Situations and AS/NZS IEC 60825.1 Safety of Laser Products Part 1: Equipment classification and requirements.

For rooms containing fixed x-ray equipment, a warning light displaying the words ‘CAUTION X-RAYS’ or similar should be installed at eye level adjacent to any doorway into the room. The light must illuminate at ‘prep’ and remain illuminated for the duration of the exposure.

Structural Shielding

Work procedures and premises are designed to keep the exposure of radiation workers and members of the public as low as reasonably achievable. The plans or structural shielding assessments for areas in which radioactive substances or radiation producing equipment are to be used must be provided to the Radiological Council for approval prior to use. These shall be submitted to the Radiological Council via the registrant, radiation safety officer or their delegate.

Each organisation’s radiation safety officer must maintain the records relating to structural protection assessments and facilities approvals.

The dose limits for radiation workers and members of the public are specified in Schedule I of the Radiation Safety Regulations. A summary of these dose limits is attached in Appendix 2: Dose Limits for Radiation Workers. The Radiological Council has adopted more conservative dose constraints for the design, construction, shielding and maintenance of a facility in which radiation is used. These constraints are 10% of the occupational and 50% of the public annual effective dose limits respectively.

Any changes to sources of radiation, the building, the type or location of radiation sources, or the purpose, use or occupancy of adjoining areas may invalidate previous structural protection assessments. The local radiation safety officer should contact their medical physics / radiation safety service provider if any changes are planned. This must be done before any changes are made. The Radiological Council must be notified of any changes and a radiation survey shall be required to ensure the adequacy of existing work procedures and shielding.

Policies regarding actions to be taken if doses are found to exceed the dose constraints in areas, or adjacent to areas, where radiation is used shall be maintained by the organisation's radiation safety officer, and must meet the requirements of the Radiation Safety Regulations, as detailed in the Appendix 2: Dose Limits for Radiation Workers section.

All shielded walls, windows, screens and barriers should be labelled with their lead equivalence at a specified energy (e.g. 1.2 mm lead equivalence at 140 keV).

Security

Adequate security must be in place to ensure that there is no unauthorised access to or use of radioactive substances or radiation producing equipment.

Registered Assets

All x-ray equipment, non-exempt radioactive substances and prescribed electronic products, as well as the premises where the equipment, substances and / or products are manufactured, used, stored or otherwise dealt with, must be registered under the Radiation Safety Act.

The Radiological Councils registration certificates for each organisation, as well as the list of registered assets and any related records shall be maintained by the organisation's radiation safety officer.

The local radiation safety officer shall notify the organisation's radiation safety officer, through the Department of Medical Technology and Physics, Sir Charles Gairdner Hospital, of any changes to the use of radiation producing equipment or radioactive substances. Changes may include the decommissioning or acquisition of radiation producing equipment or radioactive substances, or a change in the location or use of the radiation producing equipment or radioactive substances.

The registrant or radiation safety officer must notify the Radiological Council of all changes to the radiation sources which affect the accuracy of information already supplied.

Ordering of Radioactive Substances

Radioactive substances and sources may only be ordered with the express permission of the organisation's radiation safety officer or in accordance with approved protocols.

Personal Protective Equipment

Personal protective equipment (PPE) is required to be used in a range of circumstances involving the medical use of radiation.

In all organisations, the PPE required for specific radiation related work shall be available and readily accessible. PPE must conform to the requirements outlined in the Radiation Safety Regulations and any applicable Australian / New Zealand Standards. Policies relating to the use, maintenance and replacement of PPE shall be maintained by the local radiation / laser safety officer of each department or area where radiation is used.

Issues relating to PPE should be raised with the local radiation / laser safety officer and escalated to the organisation's radiation safety officer if necessary.

PPE shall be stored so that it is not damaged (e.g. protective lead aprons need to be stored on hangers and not folded).

Diagnostic X-ray Procedures

Protective aprons of at least 0.25 mm lead equivalence must be worn by persons who remain in the room during radiographic or fluoroscopic procedures and who are outside of a suitably protected area. Operators and other staff should use thyroid shields in all cardiology and interventional radiology suites. Protective gloves should be provided to all relevant staff who wish to use them, however, they should only be used as protection from scattered x-rays and no body part (e.g. hands) other than the patients' should ever be in the primary x-ray beam.

During interventional procedures, any persons in the screening room are required to wear a protective lead apron and thyroid collar with a minimum of 0.25 mm of lead equivalent. In addition to this, any persons standing in close proximity to the patient for the majority of the procedure are required to wear additional lead glasses with side shields. The lead equivalence of protective aprons should be determined in accordance with the Safety Guide for Radiation Protection in Diagnostic and Interventional Radiology which recommends more stringent PPE requirements for high workload environments. Individuals who are continually involved in interventional radiology should wear aprons of at least 0.35 mm lead equivalence, if not 0.50

mm lead equivalence. Recommended designs are those comprising a separate vest and skirt that wrap around fully, open back designs are not recommended.

It is the responsibility of the operator to ensure that all personnel are wearing protective clothing or standing behind a protective screen during exposures.

The inspection, maintenance, and replacement of protective garments shall be conducted by the local radiation safety officer. All personal protective clothing should be examined under fluoroscopy at least annually to confirm its shielding integrity. Visual inspections should be carried out on 6 monthly intervals to confirm the Velcro, straps and stitching are still functional. The rejection criteria recommended for use in the NMHS is referenced from Inspection of Lead Aprons: Criteria for Rejection (Lambert and McKeon, 2001). This paper strongly suggests that lead garments be replaced if the following defects are greater than:

- 15 mm^2 over critical organs (gonads)
- 670 mm^2 over non-critical organs (along seams, overlapped areas or backs of aprons)
- 11 mm^2 for thyroid shields

It is recommended that new lead garments should be tested for their lead equivalency and screened for manufacturer defects before the garment is put into clinical use.

The quality assurance of Lead aprons should follow the standards described in the document Protective Garment Quality Assurance Program: General Information.

Staff at NMHS are instructed to follow the Protective Garment Quality Assurance Program: Inspection Guide set by Medical Technology and Physics.

Lasers

All staff present in the nominal ocular hazard area when a Class 3B or Class 4 laser is used must utilise appropriate eye protection for that type of laser. It is the responsibility of the operator to ensure that all persons present in the area are wearing suitable eye protection and are using any other PPE required for the specific laser in use, as outlined in the Local Working Rules that are kept with each laser.

All laser eye protection shall be clearly labelled to indicate the specific laser with which it should be used. This label must not cover the optical density, wavelength or level information of the laser safety goggles.

The local laser safety officer must ensure that the eye protection is correctly labelled, inspected periodically for appropriate use and defects, and replaced where necessary.

Lasers must be serviced by an appropriately trained engineer and the services should be carried out at a frequency recommended by the manufacturers' service schedule or at an approved frequency given by the Laser Safety Officer.

Radioisotope Handling

Staff handling unsealed radioisotopes shall wear disposable gloves and a protective lab coat or gown whilst in a radioisotope handling area. Staff handling patients and potentially contaminated waste shall wear gloves. Overshoes may be required in certain areas. Within the hospital, radioactive sources must be transported within specially designed containers and placed securely on trolleys. When these containers are used for unsealed radioisotopes they must also be protected by sufficient absorbent material to completely absorb all liquids in case of a spill.

The local radiation safety officer shall ensure that staff are advised of the specific PPE requirements relating to their radiation work. For small sources, care should be taken to ensure that loss does not occur and that all sources are accounted for at the end of the day. Any loss of damage of a source should be reported to the radiation safety officer **immediately**. A radiation survey meter calibrated for the types of energies of radiation used must be available on the premises, be in good working order, and should be calibrated as recommended by the manufacturer.

Regulations are also in place to determine the appropriate labelling and design constraints of transported radioactive packages. The labelling and structural design requirements are determined by the activity being transported, which varies for each radioisotope. More dangerous radioisotopes must be transported in smaller quantities or with greater safeguards and warnings. Packages to transport material undergo leakage assessments, and testing (such

as impact, bending and heat testing) to minimise the possibility of radioactive material being dispersed in transit.

Radiological Incident Response

The PPE for staff involved in a Code Yellow Radiological incident response shall be maintained by the local radiation safety officer as required.

Quality Assurance

A comprehensive equipment Quality Assurance (QA) program must be established for all radiation producing equipment and the use of radioactive substances.

Policies relating to quality assurance shall be maintained by the local radiation safety officer of each department or area where radiation is used.

Radioactive Substances

Radiation detection equipment must be appropriately performance tested or calibrated according to the specific use and requirements.

Areas where radioactive substances are manufactured, used, stored, or otherwise dealt with shall be surveyed and wipe tested regularly. Records should be maintained by the local radiation safety officer and will be checked during radiation audits.

Compliance Testing of X-Ray Equipment

The Radiological Council's Diagnostic X-ray Equipment Compliance Testing Program requires that the below diagnostic x-ray equipment is tested and complies prior to use on humans. The prescribed intervals for compliance testing are:

Mammographic	12 months
C-arm or U-arm fluoroscopy (fixed or mobile)	12 months
Other fluoroscopy	24 months
Radiographic	24 months
CT	24 months
Dental cone-beam CT	24 months
Intraoral and OPG Dental	36 months

The organisation's radiation safety officer shall ensure that relevant x-ray equipment is compliance tested, records relating to compliance testing are maintained and compliance labels are attached to the x-ray equipment.

Equipment covered by the Program and that does not have current compliance, or other Radiological Council approval, must not be used. DEXA and pQCT units are not covered by the compliance testing program.

Radiotherapy Equipment

A quality assurance program that meets the requirements of Code for Radiation Protection in Medical Exposure and Safety Guide for Radiation Protection in Radiotherapy shall be followed.

Lasers

Each Class 3B or Class 4 laser shall have safety rules written for it which explain the hazards of that particular laser and give instructions for its safe use. Quality control of the laser is outlined in each individual laser's safety rules, a copy of which should be kept with the laser. The local laser safety officer is responsible for the maintenance of these procedures. These procedures include instructions for regular inspection of the lasers (e.g. to check alignment, cable condition) and regular servicing of the laser by the manufacturer, or other licensed service provider.

Radiation Audits

Radiation safety audits shall be conducted at regular intervals by the organisation's radiation safety officer or delegate. Such intervals should not exceed 2 years, with a frequency of 1 year recommended for more hazardous radiation practices. Policies relating to radiation audits shall be maintained by the organisation's radiation safety officer who shall disseminate information relating to radiation audits as necessary.

Radioactive Substances – Storage and Waste

Storage of Radioactive Material

The storage of radioactive substances must comply with Regulation 30 of the Radiation Safety Regulations and any applicable conditions, restrictions and limitations applied under Section 36 of the Radiation Safety Act. Radioactive substances are only permitted to be stored in areas that are appropriately registered. These areas shall only be accessed by authorised personnel.

Policies and procedures relating to the storage of radioactive substances shall be maintained by the organisation's local radiation safety officer. For further information on labelling and handling radioactive substances, please see the Radioisotope Handling section.

For further information on the storage of radioactive waste, please see the Radioactive Waste Management section.

Transport of Radioactive Material

The transport of radioactive substances must comply with the Radiation Safety Act, Radiation Safety Regulations and Radiation Safety (Transport of Radioactive Substances) Regulations 2002 (WA) which also require compliance with the Code for the Safe Transport of Radioactive Material. Persons transporting radioactive substances must either hold a licence for transport or work under the direction and supervision of a licensee. A person who holds a licence for the use of a particular radioactive substance may also transport that substance.

All organisations must only use transport companies that hold an appropriate transport licence from the Radiological Council in WA.

These transport requirements do not apply to radioactive materials transported within a site, or patients who have been either implanted with radioactive materials or treated with radiopharmaceuticals. Local radioactive material transport procedures and policies shall be maintained by the local radiation safety officer and adhered to.

For further information on handling radioactive substances for transport, please see the Radioisotope Handling section.

Radioactive Waste Management

Staff handling radioactive waste must receive suitable training in radiation safety procedures to comply with the regulatory requirements for radioactive waste storage and disposal.

All organisations shall adhere to SCGH HP079 Waste, Disposal and Environment Management Policy.

Specific policies relating to the management of radioactive waste shall be maintained by the organisation's radiation safety officer. These policies must meet the requirements of Regulations 31 and 31(A) of the Radiation Safety Regulations, as well as any other applicable legislation, and shall include such details as to identify:

- provision of the necessary equipment and instructions for safe handling of radioactive waste;
- procedures for storage and disposal of radioactive waste;
- procedures for storage and disposal of mixed waste hazards;
- procedures for discharge of waste into a sewerage system;
- procedures for discharge of gaseous radioactive waste;
- any arrangements with other organisations for waste management.

The organisation's radiation safety officer shall be notified immediately of the occurrence or potential occurrence of a discharge in excess of the regulatory limits, a spill of the radioactive waste or any other improper or excessive disposal.

The Radiological Council must be notified in accordance with Regulation 15 of the Radiation Safety Regulations of any release of radioactive material which exceeds the limits in Schedule VIII.

Security of Radioactive Sources

Registration conditions applied under Section 36 of the Radiation Safety Act to relevant registrations for radioactive substances require compliance with the Code of Practice for the Security of Radioactive Sources.

Radiation Incidents and Emergency Response

Radiation Incidents

All radiation incidents and accidental exposures must be documented locally and reported to the local radiation / laser safety officer. Reportable incidents are defined by legislation and must be reported to the Radiological Council within 30 days. Incidents that are required to be reported to the Radiological Council are specified under regulation 19A of the Radiation Safety Regulations in addition to those required under the conditions, restrictions and limitations attached to an organisations' registration (Appendix 3:Medical Incident Reporting Requirements).

In the event of a radiation incident the first point of contact shall be the local radiation / laser safety officer. Issues will then be escalated depending on their severity. If the incident relates to occupational safety of a staff member an OSH Hazard / Incident Form must also be completed and submitted. If the incident involved a patient a report must be submitted through the Clinical Incident Management System CIMS in accordance with NMHS Clinical Incident Management Policy.

Incidents that must be reported to the Radiological Council include but are not limited to:

- Any procedure other than as prescribed, including any diagnostic procedure or therapeutic treatment delivered:
  - to the wrong patient;
  - to the wrong site on the patient;
  - using the wrong modality, beam type or beam quality;
  - using the wrong radionuclide.
- Any diagnostic procedure resulting in an observable acute radiation effect.
- When during the administration of a radioactive substance (sealed or unsealed) for therapeutic purposes, the activity administered differs from that prescribed by 15% or more.
- When during the administration of a therapeutic dose of radiation from irradiating apparatus or a sealed radioactive source, the dose delivered differs from the total prescribed treatment dose by more than 10%.
- Inadvertent or unjustified radiation exposure of a pregnant patient that has or is likely to result in a radiation dose to the embryo or foetus of more than 1 mSv.
- Inadvertent or unjustified administration of a radioactive substance to a lactating patient where the radiation dose to the nursing child is likely to be in excess of 1 mSv.

- Where a patient dies with radioactive substances above the relevant exemption level in situ; and where the situation has not been dealt with according to approved procedures.
- Any procedure involving the use of a class 3B or 4 laser where there is actual injury, or the potential for injury, as a result of operator error, damage or malfunction of equipment, or failure of management systems.
- Other incidents warranting reporting, for example near-miss situations where there is a potential benefit for other users to be alerted.

The registrant must comply with Section 19A (2) and 19A (3) of the Radiation Safety Regulations, which outline the follow-up actions and reporting requirements for incidents captured above.

In the event of an incident or accident, the person responsible must include in their report:

- cause of the incident or accident
- consequences of the incident or accident
- steps taken to remedy the situation
- steps taken to prevent a recurrence

Any fault related to radiation producing equipment or radiation related equipment, shall be reported immediately to the local radiation safety officer and progressed to the organisation's radiation safety officer if necessary. This includes faults with or damage to the equipment or source itself, its protective housing and radiation barriers such as protective screens, windows and shielded walls. If the fault compromises staff or patient safety, diagnosis or treatment, then use of the radiation source shall cease immediately.

Where a patient has been involved in a radiation incident they must be informed as soon as possible that the incident occurred, what the consequesnces are and that the incident will be investigated. This is usually performed by a medical practitioner.

Local policies relating to radiation incident management, investigation and reporting (including internal reporting to the organisation's radiation safety officer and registrant) shall be maintained by the local radiation safety officer of each department or area where radiation is used.

Emergency Response

All organisations must have arrangements made to prevent and mitigate accidents, and acts with malicious intent, that may give rise to radiation risks. The Radiological Council must be notified **immediately** where there has been a loss or theft of a source of radiation.

Where unsealed radioisotopes are used, the local radiation safety officer must ensure that a radioactive spill kit available to respond in the case of a radioactive spill. Radioactive spill kits, emergency procedures, and adequate training must be provided to ensure the department can respond to radiation contamination in their area.

Code Brown (Radiological Incident)

If an external emergency involving radioactive material occurs, contaminated patients may present at Sir Charles Gairdner Hospital. The Hospital has responsibilities under the State Hazard Plans and is required by the WA Department of Health to be able to respond to an incident. The procedures for a Hazardous Materials Emergency shall be available in relevant departments and shall be adhered to (State Hazard Plan – Hazardous Materials Emergencies [HAZMAT] Version 1.03).

References

Legislation

Radiation Safety Act 1975 (WA)

Radiation Safety (General) Regulations 1983 (WA)

Radiation Safety (Transport of Radioactive Substances) Regulations 2002 (WA)

Radiation Safety (Qualifications) Regulations 1980 (WA)

Work Health and Safety Act 2020 (WA)Work Health and Safety (General) Regulations 2022 (WA)

ARPANSA (Australian Radiation Protection and Nuclear Safety Agency)Regulatory Publications

ARPANSA Fundamentals for Protection Against Ionizing Radiation RPS F-1 (2014)

ARPANSA Code for Radiation Protection in Planned Exposure Situations RPS C-1 Revision 1 (2020)

ARPANSA Code for the Safe Transport of Radioactive Material RPS C-2 Revision 1 (2019)

ARPANSA Code for Disposal Facilities for Solid Radioactive Waste RPS C-3 (2018)

ARPANSA Code for Radiation Protection in Medical Exposure RPS C-5 (2019)

ARPANSA Code for Disposal of Radioactive Waste by the User RPS C-6 (2018)

ARPANSA Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes RPS 8 (2005)

ARPANSA Code of Practice and Safety Guide for Radiation Protection in Dentistry RPS 10 (2005)

ARPANSA Code of Practice for the Security of Radioactive Sources RPS 11 (2019)

ARPANSA Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation RPS 12 (2006)

ARPANSA RPS 14.1 Safety Guide for Radiation Protection in Diagnostic and Interventional Radiology (2008)

ARPANSA RPS 14.2 Safety Guide for Radiation Protection in Nuclear Medicine (2008)

ARPANSA RPS 14.3 Safety Guide for Radiation Protection in Radiotherapy (2008)

Department of Health Mandatory Policies

Department of Health Consent to Treatment Policy

Department of Health MP 0170/21 Emergency Management Policy (2021)

Department of Health MP 0122/19 Clinical Incident Management Policy (2019)

Department of Health MP 0162/21 Research Governance Policy (2021)

State Hazard Plan – Hazardous Materials Emergencies [HAZMAT]

North Metropolitan Health Service Policies

NMHS Consent to Treatment Policy

NMHS Imaging Pregnant Patients Procedure

NMHS Policy Clinical Incident Management

NMHS Policy Employee Induction and On-Boarding

NMHS Policy Fitness For Work

NMHS Policy Incident / Hazard Reporting and Investigation

NMHS Policy Occupational Safety and Health

NMHS Policy Personal Protective Equipment (PPE)

NMHS Policy Radiation Safety

NMHS Risk Management Policy

Women and Newborn Health Service Policies

Women and Newborn Health Service Policy Manual – Human Research Requests for Approval

Women and Newborn Health Service Policy Manual – Patient Identification

Women and Newborn Health Service Policy Manual – Patient Identification and Procedure Matching in Medical Imaging

Women and Newborn Health Service Policy Manual – Waste Management

Sir Charles Gairdner Hospital Policies

SCGH Policy Patient Identification and Procedure Matching

Osborne Park Hospital Policies

OPH Policy Correct Patient, Correct Procedure, Correct Site

OPH Policy Patient Identification

Useful References

Medical Technology and Physics, 2017. Protective Garment Quality Assurance Program: General Information

Medical Technology and Physics, 2017. Protective Garment Quality Assurance Program: Inspection Guide

Radiological Council, 2019, Responsibilities of the Radiation Safety Officer Fact Sheet.

Radiological Council, 2019, Responsibilities of the Registrant Fact Sheet

Radiological Council, 2015 Diagnostic X-Ray Equipment Compliance Testing Program Requirements.

Appendix 1: Licence Purposes

The Radiological Council issues licences or exemptions to individuals using radiation during the course of their business. The following purposes may be relevant for staff using radiation within the North Metropolitan Health Service (this list is not comprehensive):

- Bone Densitometry
- Compliance Testing – Diagnostic X-ray Equipment
- Cyclotron Operation
- Cyclotron Servicing
- Education
- Fluoroscopy – Medical
- Fluoroscopy – Medical (Exemption)
- Lasers – Dental
- Lasers – Medical
- Lasers – Physiotherapy
- Medical Physics
- Medical Radiation Technology – Diagnostic Nuclear Medicine
- Medical Radiation Technology – Medical Imaging
- Medical Radiation Technology – Radiation Therapy
- Medical Radiology
- Nuclear Medicine
- Nuclear Medicine – CT (X-ray / SPECT)
- Nuclear Medicine – Diagnostic
- Nuclear Medicine – Therapeutic
- Pathology Tests
- Radiography – Forensic
- Radiopharmaceuticals Manufacture and Dispensing
- Radiotherapy – Medical (Radioactive Substances)
- Radiotherapy – Medical (X-rays)
- Research
- Research – Unsealed Radioactive Substances
- Service of X-ray Equipment – Diagnostic
- Transilluminators
- Transport

Appendix 2: Dose Limits for Radiation Workers

Dose limits for radiation workers and members of the public are shown in the table below.

	Radiation Worker	Member of Public
Effective dose limit	20 mSv[a] per year	1 mSv per year
Annual equivalent dose limit		
Lens of the eye	20 mSv	15 mSv
Skin[b]	500 mSv	50 mSv
Hands and feet	500 mSv	-

[a] When a pregnancy is declared by a radiation worker, an equivalent dose limit of 2 mSv to the surface of the abdomen for the remainder of the pregnancy applies.

[b] Averaged over 1 cm^2 of skin regardless of area exposed.

Appendix 3:Medical Incident Reporting Requirements

RADIATION SAFETY ACT 1975
CONDITIONS, RESTRICTIONS AND LIMITATIONS (SECTION 36)
MEDICAL INCIDENT REPORTING

1. This condition details the reporting requirements for medical incidents in addition to those specified under Section 19A of the Radiation Safety (General) Regulations 1983.
2. The registrant must ensure that the following incidents are reported in writing to the Radiological Council as soon as practicable and within 30 days from the date of the incident:
   - 2.1. any procedure other than as prescribed, including any diagnostic procedure or therapeutic treatment delivered:
     - 2.1.1. to the wrong patient;
     - 2.1.2. to the wrong site on the patient;
     - 2.1.3. using the wrong modality, beam type or beam quality;
     - 2.1.4. using the wrong radionuclide.
   - 2.2. any diagnostic procedure resulting in an observable acute radiation effect.
   - 2.3. when during the administration of a radioactive substances for therapeutic purposes, the activity administered differs from that prescribed by 15% or more.
   - 2.4. when during the administration of a therapeutic dose of radiation from irradiating apparatus or a sealed radioactive source, the dose delivered differs from the total prescribed treatment dose by more than 10%[a].
   - 2.5. inadvertent or unjustified radiation exposure of a pregnant patient that has or is likely to result in a radiation dose to the embryo or foetus of more than 1 mSv.
   - 2.6. inadvertent or unjustified administration of a radioactive substance to a lactating patient where the radiation dose to the nursing child is likely in excess of 1 mSv.
   - 2.7. where a patient dies with radioactive substances above the relevant exemption level in situ; and where the situation has not been dealt with according to approved procedures.
   - 2.8. any procedure involving the use of a class 3B or 4 laser where there is actual injury, or the potential for injury, as a result of operator error, damage or malfunction of equipment, or failure of management systems.
   - 2.9. other incidents warranting reporting, for example near-miss situations where there is a potential benefit for other users to be alerted.

3. The registrant must comply with Section 19A (2) and 19A (3) of the Radiation Safety (General) Regulations 1983, which outline the follow up actions and reporting requirements for incidents captured under point 2 above.

NOTES

a. This value is more stringent than the value of 15% as prescribed in Section 19A of the Radiation Safety (General) Regulations 1983.

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