

SESLHD PROCEDURE COVER SHEET



Health
South Eastern Sydney
Local Health District

NAME OF DOCUMENT	Minimising Radiation Exposure in Laboratories
TYPE OF DOCUMENT	Procedure
DOCUMENT NUMBER	SESLHDPR/541
DATE OF PUBLICATION	July 2023
RISK RATING	Medium
LEVEL OF EVIDENCE	National Safety and Quality Health Service Standards: Standard 1 – Clinical Governance Legislative requirements
REVIEW DATE	July 2026
FORMER REFERENCE(S)	SESLHNPD/60 Radiation Safety – Minimise Radiation Exposure in Laboratories
EXECUTIVE SPONSOR or EXECUTIVE CLINICAL SPONSOR	Executive Director Operations
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POSITION RESPONSIBLE FOR THE DOCUMENT	District Radiation Safety Officer SESLHD-RadiationSafetyOfficer@health.nsw.gov.au
FUNCTIONAL GROUP(S)	Radiation Safety
KEY TERMS	Radiation safety, ionising radiation, x-rays, radioactive substances, laboratory safety
SUMMARY	Procedure to limit the risk to health of staff arising from exposure to radiation from laboratory use of radioactive substances or x-ray devices.

COMPLIANCE WITH THIS DOCUMENT IS MANDATORY

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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.

2. BACKGROUND

Staff involved in laboratory procedures involving radioactive substances may be exposed externally to radiation from the source (mainly beta and gamma radiation) but may also be exposed internally if any of the radioactivity is inhaled or ingested. Radioactivity can also enter the body through open cuts. High standards of laboratory cleanliness and good laboratory techniques will minimise the likelihood of radioactive contamination.

3. RESPONSIBILITIES

3.1 Laboratory Managers

Laboratory managers will ensure that:

- staff are appropriately trained, including specific training in radiation safety;
- staff are made aware of the content of this document;
- staff are issued with personal radiation monitors where necessary; and
- all procedures are performed safely.

3.2 Laboratory Staff

Laboratory staff will:

- perform all procedures in accordance with the laboratory's written protocols and in compliance with the radiation safety procedures in this document;
- be familiar with decontamination and radiation monitoring procedures.

3.3 The Radiation Safety Officer (RSO)

The Radiation Safety Officer will:

- oversee and provide advice on radiation safety within laboratories using radioactive substances and/or x-ray apparatus;
- provide clearance for maintenance work to fixtures and plant.

4. PROCEDURE

4.1 Premises where radioactivity is stored or used

All users of radioisotopes must have areas designated specifically for the handling, storage and disposal of radioisotopes. These *premises* are required to be listed on the SESLHD Radiation Management Licence. Requirements are summarised below. Full details can be obtained from the Radiation Safety Officer.

Premises are categorised as low, medium or high level, according to the radionuclides used, the operations conducted with them, and the activities handled. The classification process will not be discussed here, but most hospital laboratories would be classed as low level. “Hot labs” may be medium level.

The minimum requirements for a low level radioisotope laboratory are detailed in the Australian Standard *Safety in Laboratories; Part 4 Ionizing Radiations* (AS 2243.4). There are additional requirements for medium and high level laboratories. These additional requirements are available from the RSO.

Note: a substance is only considered to be radioactive if its specific activity exceeds 100 Bq/g and the total activity exceeds the thresholds listed in Schedule 1 of the *Radiation Control Regulation 2013* (NSW). If a laboratory’s occupants are using substances with activities below this threshold (e.g. < 400 kBq of I-125 in a radio-iodination lab), then the lab does not need to be registered.

4.1.1 Requirements for Radiation Laboratories

There are specified limits to radiation dose rate levels around laboratories, especially in public areas. At a minimum, the dose rate in areas in which non-occupationally exposed persons occupy a space must not exceed that which would result in any person receiving 1 mSv per year from that exposure.

A sign must be conspicuously placed either in or near the entry to all registered labs listing:

- the Occupier (person in charge of the lab);
- the EPA Radiation Management Licence number covering the premises;
- the licence expiry date; and
- the name and telephone number of the person to contact in the event of an emergency affecting the premises.

All radiation laboratories must:

- have restricted access and minimal traffic;
- be able to be securely locked with entry only to authorised persons;
- display certain signs:
 - radiation warning signs (including on doors)
 - eating/drinking prohibition sign
 - safe use procedures
 - accident procedures
- have storage areas for both bulk radioisotopes and radioactive waste, shielded if necessary;

- have easily decontaminated walls and an easily decontaminated floor, preferably continuous vinyl with welded seams, coved to the wall;
- be equipped with benches with surfaces which lend themselves to decontamination (e.g. stainless steel), or are covered with an easily decontaminated, impervious and removable material;
- be equipped with hand washing facilities, preferably with sensor taps, or foot or elbow operated taps;
- be equipped with radiation monitors suitable for the radionuclides used;
- be equipped with protective clothing and basic decontamination equipment, including a shower;
- have a log of radioactive materials received, used and disposed of.

Any sink where low activity radioactive material may be disposed of must be designated and labelled, these sinks may not be used for any other purpose.

If required, any fume cupboard must comply with the relevant Australian Standard and have appropriate shielding for dispensing and handling high specific activity materials

Maintenance work to fixtures and plant should be carried out only after the Radiation Safety Officer has given clearance.

4.1.2 Facilities for dispensing radiopharmaceuticals

The radiopharmacy facility and equipment should be located, designed, constructed and maintained to suit the operations to be carried out. The layout and design should be such as to minimise the risk of errors and to permit effective cleaning and maintenance, the avoidance of cross contamination, the build-up of dust or dirt and any other influences that may adversely affect the quality of radiopharmaceuticals.

The facility needs to be designed to give proper radiation and contamination protection to personnel and the environment and to maintain the quality of the product. The standard principles for the layout of radioisotope laboratories, designed to protect the staff and the external environment in the event of radioactive contamination in the laboratory, should be followed (AS/NZS 2982.1).

All fume hoods and exhausted pharmaceutical handling cabinets must be designed to prevent uncontrolled discharge of radioisotopes. Associated plumbing and ducting must be marked with signs indicating the possible radiation hazard.

Laboratories and pharmaceutical dispensing areas should be equipped with eye washes and shower facilities to facilitate decontamination of staff in case of accidental exposures. Care should be taken in placement of these decontamination facilities so that when operated the drainage of waste water does not contribute to increased spread of contamination or electrical hazards.

Radiopharmaceutical storage facilities should be shielded and refrigerated if necessary. Storage areas should also be secure to prevent access by unauthorised staff or visitors during operational hours as well as after hours.

4.2 Procedures for the safe handling of unsealed sources of radioactivity

When using unsealed radioactive sources, care should be taken where possible to minimise internal and external contamination. Internal contamination may result from inhalation, ingestion, skin wounds or skin penetration.

- Precautions should be taken to avoid punctures, cuts and any open skin wounds.
- Wash hands thoroughly after using radionuclides.
- **Mouth pipetting of any radioactive substance is totally prohibited.**
- Use only self-adhesive labels in radiation working areas.

Food, beverages, smoking items, handbags, cosmetics, handkerchiefs and eating and drinking utensils are prohibited in laboratories where unsealed sources are used. Food and drinks must never be stored in a refrigerator or freezer designated for radioactive materials.

All containers must be clearly labelled with:

- the name of the radionuclide;
- its chemical form
- its radioactivity,
- the measurement time and date.

If the material is sterile, this must be clearly indicated. The name of the responsible person should also appear on the label.

All containers must be adequately shielded at all times.

For activities of greater than 50 MBq, the container must never be directly handled. Remote handling devices, such as tongs, must be used instead.

Glassware, forceps, scissors and other instruments for use with radioactivity should be marked as such, and not removed from the area.

Cover all working surfaces with absorbent paper and clearly mark the area as a radiation working area. Plastic backed “underpad” is particularly suitable for this purpose.

Contain waste appropriately and immediately.

At the end of each procedure the area should be completely cleaned and checked for any contamination.

Non-radioactive work, particularly record keeping, must not be performed in the area designated for radioactive work.

No new procedures involving radioactive substances are to be commenced until the Radiation Safety Officer has been consulted regarding radiation safety.

4.2.2 Special precautions for particular radionuclides

Carbon-14 on the skin may be absorbed into the body at a rate of 0.3% per minute (18% per hour).

Hydrogen-3 (Tritium, as tritiated water) may be absorbed through the skin at a rate of up to 23% per minute.

Radionuclides which emit gamma rays, such as Iodine-131, will require shielding with lead.

Pure beta emitters such as Phosphorus-32 and Sulphur-35 should be handled whilst standing behind a protective barrier made of a low atomic number material such as Perspex.

Radioisotopes of iodine, such as Iodine-125 and Iodine-131, can be volatile and should be handled in a fume cupboard if elemental iodine is being used. Activities greater than 10 GBq of iodine-131 in liquid form must be handled in a hot cell. All radio-iodination reactions where less than 10 GBq of iodine-131 in liquid form is used must be performed in an adequately shielded fume cupboard or fully enclosed pharmaceutical isolator. The fume cupboard performance should meet the requirements of AS/NZS 2243.8.

4.3 Personal protective equipment

Protective clothing reserved specifically for radioactive work, shall be worn at all times in the laboratory, even for very low levels of activity. The following shall apply:

- For work in low level laboratories, a normal laboratory coat or overall is sufficient.
- For work in medium level laboratories, the laboratory coat shall have elasticized sleeve cuffs and a crossover front with high neck fastened with hook and loop fastening fabric. Pockets are not recommended.
- **NOTE:** Velcro strips have been found suitable.

In high level laboratories, in addition to coats or overalls, overshoes or similar, specially designated footwear shall be worn to prevent the transfer of radioactive contamination from laboratory floors.

No unsealed radioactive sources should be manipulated with unprotected hands. Suitable gloves should always be worn.

It should be remembered that penetration of gloves may occur when handling some iodine compounds. A second pair of gloves is recommended in this case.

Gloves should be removed in the proper surgical manner (remove one glove, hold in the other hand and fold the second glove over the first) and disposed of correctly after use, to avoid contamination of hands.

Safety glasses should be worn whenever working with material at high temperature or pressure.

Paper towels and tissues, which can be discarded as active waste after a single use, shall be used for personal purposes in the laboratory.

All protective clothing worn in radioisotope and radiological laboratories shall be removed before leaving, and left in, or immediately outside, the laboratory; the latter place shall then be regarded as an 'active' area, i.e. possessing a potential contamination hazard. Contaminated protective clothing shall not be laundered with uncontaminated items.

Monitor personal radiation exposure by:

- self-monitoring after working with unsealed sources;

- wearing a body personal radiation monitor and/or finger monitors if appropriate; and
- periodic thyroid counting after performing iodination procedures.

4.4 Emergency procedures

4.4.1 Spills

Spills of radioactive material are not to be regarded as an unavoidable hazard in the day-to-day operation of the laboratory. Any spill has a degree of risk and acceptance of minor spills could lead to a casual approach to major spills. All accidents involving spills of radioactive material must be reported to the Radiation Safety Committee of the hospital via the Radiation Safety Officer. They may also need to be reported to the NSW EPA.

The following procedure should be followed on discovery of a contamination problem:

- All persons involved in the incident are to vacate the immediate vicinity but are not to move freely around the department, as this involves a danger of spreading contamination.
- IMMEDIATELY notify the person responsible for radiation safety in the laboratory and the Radiation Safety Officer.
- If the contamination is due to a container spill of liquid and the hands are protected with gloves, right the container and ensure that it is adequately shielded. If the problem is due to a leaky container, place suspect item in a labelled plastic bag.
- Seal off the area involved and ensure that personnel do not walk on any potentially contaminated floor area. Discard any clothing which is contaminated and place it in a labelled plastic bag.
- Consult with Radiation Safety Officer to determine disposal of bags and waste items

4.4.2 Incidents involving contaminated or exposed persons

Refer to SESLHDPR/558 Handling, investigation and reporting of radiation incidents.

5. DOCUMENTATION

- SESLHD Radiation Management Licence
- Written protocols for all procedures involving radioactive substances

6. AUDIT

The following records should be available for audit:

- Inventory of Radioactive Substances (receipts, usage, disposal);
- Radiation user licences of laboratory staff;
- Training records for laboratory staff;
- Records of laboratory staff radiation dose.

7. REFERENCES

- [1] *Radiation Control Regulation 2013* (NSW)

- [2] AS/NZS 2243.4. Australian Standard 2243.4:2018 Safety in laboratories – Ionizing radiations, Standards Australia
- [3] AS/NZS 2243.8. Australian and New Zealand Standard 2243.8:2014 Safety in laboratories – Fume cupboards, Standards Australia.
- [4] SESLHDPR/558 Handling, investigation and reporting of radiation incidents

8. VERSION AND APPROVAL HISTORY

Date	Version	Version and approval notes
August 2010	Draft	Brent Rogers
November 2010	Revised draft	Richard Smart – reformatted to procedure template and took into account received comments
February 2011	0	Approved by Combined Clinical Council
October 2012	1	Broken link to SESLHNP/53
December 2015	2	Periodic Review
October 2016	2	Updates endorsed by Executive Sponsor
December 2019	3	Updates endorse by Executive Sponsor
14 July 2023	3.1	Minor review: minor wording changes, addition of section 4.1.2. Approved by Executive Sponsor.