Queensland Government

Radiation Safety Act 1999

RADIATION SAFETY STANDARD

Standard for premises–ionising radiation sources (2021)

Standard for premises–ionising radiation sources (2021)

Preface

This radiation safety standard sets out the minimum performance expectations for premises in which ionising radiation sources are used to carry out a radiation practice, or in which radioactive substances are stored.

Persons who hold an appropriate Accreditation Certificate, issued under the *Radiation Safety Act 1999*, must be engaged from time to time to assess whether or not premises comply, or does not comply, with this radiation safety standard. Compliance with the tests means that the premises may continue to be used to carry out the radiation practice. Failure of any test means that the premises must not be used.

Notwithstanding the above, a possession licensee has an on-going obligation to take reasonable steps to ensure that the premises continue to comply with the radiation safety standard at all times when the practice is being carried out at the premises.

These premises requirements are made to assist the protection of all persons and the environment from the radiation emitted from a particular radiation source as a result of using the source to carry out a radiation practice, or as a result of storing radioactive substances.

I, Yvette D'Ath MP, Minister for Health and Ambulance Services and Leader of the House, pursuant to section 16(1) of the *Radiation Safety Act 1999*, hereby make the radiation safety standard *Standard for premises–ionising radiation sources (2021)*, for the purposes of the Act.

Yvette D'Ath

Yvette D'Ath MP
Minister for Health and Ambulance Services
and Leader of the House

13 / 08 / 2021

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Section 1 – General

1.1 Scope

This radiation safety standard sets out the minimum requirements for premises in which ionising radiation sources are used to carry out a radiation practice, or where radioactive substances are stored. Premises may comprise:

(a) a room or an area within a room, building or other structure in which a radiation source is used to carry out a radiation practice

(b) a room, building or other structure where radioactive substances are stored.

This standard does not apply to temporary premises which are used to store radioactive substances at a field site, provided the store is not used for more than 30 days in a 12 month period.

Additionally, this standard does not apply if the only sources being used in the premises are the following:

(a) mobile ionising radiation apparatus, used for medical imaging, which is not used regularly in a particular premises

Note: For the purposes of this standard, mobile ionising radiation apparatus (excluding dental X-ray equipment) is considered to be used regularly in a room if the radiation apparatus is used in the room to the extent that, during any one week period, the threshold amount of radiation is exceeded.

(b) radiation apparatus used for chemical or physical analysis

(c) radiation sources used for industrial gauging

(d) cabinet radiation apparatus

(e) sealed radioactive substances incorporated in radiation counters

(f) sealed radioactive substances incorporated in static eliminators

(g) self-contained irradiators

(h) sealed radioactive substances used for teaching where the activity of any one radionuclide is no greater than 200 kBq

(i) radioimmunoassay kits

This standard applies to all other premises, including:

1. Premises where dual energy X-ray absorptiometry X-ray equipment is used. These premises must comply with Section 2.1 *Principal requirement for all premises where ionising radiation related practices are carried out* and with Section 3.2 *Requirements, in addition to the principal requirement, for premises in which an ionising radiation apparatus is used to carry out medical imaging.*

2. Partially enclosed and fully enclosed sites which are used to conduct industrial radiography.

3. Premises used to carry out veterinary medical imaging, veterinary radiation therapy and veterinary nuclear medicine.

1.2 Expiry

This radiation safety standard expires on 31 August 2031.

1.3 Definitions

For the purpose of these tests, the following definitions apply:

'*cleanable*' means able to be cleaned using commonly available cleaning methods and products for the purpose of removing radioactive contamination.

'*control area*' means–

(a) an area in which a radiation source control panel is protected by a fixed barrier; or

(b) a room, housing a radiation source control panel, that is adjacent to a radiation source room.

'*de-energised*' or '*fully shielded*' means the condition in which a sealed source is in its fully stored position, or the irradiator is no longer producing radiation.

'*dose rate*' means the absorbed dose of radiation during a period expressed in terms of $\mu Gy.h^{-1}$.

'*energised*' or '*exposed*' means the condition in which a gamma irradiator is not fully shielded or an electron beam or X-ray irradiator is not de-energised.

'*fully enclosed site*' means premises used specifically for industrial radiography in which the irradiation area is completely enclosed by shielding, including walls, floor and ceiling, and within which no person is permitted to remain during a radiographic exposure.

'*gamma irradiator*' means an irradiator in which a sealed radioactive substance is contained in a storage pool (usually containing water), and the sealed radioactive substance is fully shielded when not in use; the sealed radioactive substance is exposed within an irradiation room which is maintained inaccessible during use by interlocked controls.

'*industrial gauging*' means a practice where a radiation source is used in a mining or manufacturing process or for a quality or process control application. This application uses radiation for the non-invasive measurement and control of the thickness, level, density, weight, composition or moisture content in an industrial production process. The radiation source is generally installed in a fixed position and can only be removed by the use of tools.

'*industrial radiography*' means the use of ionising radiation to obtain information non-destructively (usually in the form of an image) about the physical condition of objects and materials.

'*irradiator*' means a device used for irradiating things, using electron beam, X-ray or gamma radiation, for purposes such as sterilisation, disinfestation and decontamination.

'*loaded state*' means the state during the operation of ionising radiation apparatus when ionising radiation is being produced.

'*medical imaging*' means a practice in which images of parts of a body or internal organs are produced, whether by direct or computer assisted means, to assist with the clinical diagnosis or treatment of a disease or condition, including radiotherapy treatment planning, or for research purposes.

'*partially enclosed site*' means a premises used specifically for industrial radiography in which all objects exposed to direct radiation are completely contained inside a permanent, shielded enclosure:

(a) having walls at least 2.1 metres high;

(b) which is typically open at the top to permit the transfer in and out of the objects to be radiographed; and

(c) within which no person is permitted to remain during a radiographic exposure.

'*preparatory state*' means the state during the operation of radiation apparatus when the apparatus is ready to produce radiation (i.e. the state of the apparatus immediately before pressing the exposure button).

'*radiation level*' means absorbed dose in a specified period.

'*radiation shield*' means the material which has as its primary function the attenuation of radiation emitted by a radiation source.

'*radiation source room*' means:

(a) a room, or a fixed and discernable part of a room, or an identifiable discrete part of the room, in which a particular radiation source is energised or used to carry out a radiation practice; or

(b) a room, or a fixed and discernable part of a room, or an identifiable discrete part of the room, which is used to store radioactive substances; or

(c) in the case of a nuclear medicine facility, the controlled area within the facility, and includes the drainage system.

Note: For the purpose of this definition, 'controlled area' means the defined area in which specific protection measures and safety provisions are required for:

(i) controlling normal exposures or preventing the spread of contamination during normal working conditions; and

(ii) preventing or limiting the extent of potential exposures.

'*self-contained irradiator*' means a device used for irradiating things for purposes such as disinfestation, decontamination, sterilisation or specialist radiation-related research studies in which the source of radiation is a sealed radioactive substance, securely enclosed within the device, and for which the shielding required for safe operation of the device and safe and secure storage of the source when the device is not in use, is an integral part of the device.

'*store*' (*n*) means a specifically nominated place where access to radioactive substances is controlled, and no use occurs. For clarification, a place is not a store merely because it is in a location where a radioactive substance is placed to one side during intermittent use of the substance.

'*store*' (*v*) means to place a radioactive substance in a specifically nominated place where access is controlled, and no use occurs. For clarification, a radioactive substance placed to one side during intermittent use is not considered to be being stored.

'*threshold amount of radiation*' means, for apparatus used for medical imaging, an amount of radiation equivalent to the amount generated if:

(a) an ionising radiation apparatus without a primary beam stop is operated at a potential of 90 kV and workload of 1 mAmin; or

(b) an ionising radiation apparatus incorporating a primary beam stop is operated at a potential of 90 kV and workload of 10 mAmin.

Section 2 – Principal Requirements

2.1 Principal requirements for all premises where ionising radiation related practices are carried out

The following table sets out the minimum test requirements for all premises the subject of this standard.

Test	Compliance Test	Criteria for Passing the Test
2.1.1	Total effective dose	As a result of the radiation practice being carried out in the radiation source room being assessed, an individual must not be able to receive a total effective dose greater than: (a) 10 µSv per week in a Type 1 area (b) 40 µSv per week in a Type 2 area (c) 40 µSv per week in a Type 3 area Where: '**Type 1 area**' is - (i) any area or place external to the radiation source room being assessed, and (ii) able to be accessed by members of the public or persons who are occupationally exposed but who are not involved in carrying out a radiation practice for the possession licensee at the premises. '**Type 2 area**' is - (i) any area or place within the premises but outside of the radiation source room being assessed, and (ii) normally only occupied by occupationally exposed persons involved in carrying out a radiation practice for the possession licensee at the premises. '**Type 3 area**' is any area, within the radiation source room being assessed, that is protected by fixed or movable protective barriers or screens (e.g. operator consoles). Note: For this test– (a) An individual is not considered to be a member of the public or a person who is occupationally exposed to radiation if the person is the subject of a diagnostic or therapeutic procedure in the radiation source room. (b) The circumstances for each source will be unique and hence all variables, such as orientation variations of the source, workload in particular orientation, occupancy within and outside the room, radiation type and level of emission, need to be considered. (c) Consideration must be given to the location and the use of each of the sources within the room. (d) A place is able to be accessed if there are no mechanisms preventing a person from gaining access.
2.1.2	Radiation warning labels	Each entrance to the radiation source room must display a conspicuous radiation warning sign which contains the radiation warning symbol (trefoil), and: • for premises in which X-rays are used, words to the effect of 'Warning–X-rays' • for premises in which radioactive substances are used, words to the effect of 'Warning–radiation' • for premises in which radioactive substances are stored, words to the effect of 'Warning–store for radioactive substances'

Test	Compliance Test	Criteria for Passing the Test
		The symbol and lettering must be black on a yellow background. Note 1: This requirement does not apply to: (a) rooms that can only be accessed from the radiation source room; or (b) entrances to the radiation source room where a person must, prior to entering the room, pass through a control area, provided that a radiation warning sign is placed at the outside entrance to the control area; or (c) rooms only used to carry out intra-oral dental diagnostic radiography, provided that a radiation warning sign is placed at each access point to a Type 2 area. Note 2: For premises where radioactive substances are stored, the sign may be placed either at the entry to the radiation source room, or placed inside the radiation source room where it is visible immediately upon entry to the room. Note 3: The word 'caution' or, for premises in which X-ray or electron beam irradiators or gamma irradiators are used, the word 'danger', is acceptable.
2.1.3	Contact information displayed	The contact telephone number of the radiation safety officer must be displayed: (a) at each entrance to the radiation source room; or (b) in the radiation source room.

Section 3 – Specific Requirements for Each Practice Type

3.1 Requirements, in addition to the principal requirements, for premises used to store radioactive substances

The following table sets out the minimum test requirements, in addition to the principal requirements in Section 2, for premises used to store radioactive substances.

Test	Compliance Test	Criteria for Passing the Test
3.1.1	Radiation dose rate limit	The dose rate measured at 30 centimetres from any accessible area or place external to the radiation source room must not exceed 10 $\mu Gy.h^{-1}$ due to the storage of radioactive substances in the room.
3.1.2	Radioactive gases	Where radioactive material is likely to emit a radioactive gas, there must be a means of managing the gas so that its concentration within or external to the radiation source room does not contribute to an individual receiving an effective dose greater than the relevant total effective dose in Test 2.1.1.
3.1.3	Storage with other items	If radioactive material is stored with, or in proximity to, other dangerous goods: (a) there must be a means to ensure the integrity of the radioactive material is not compromised; and (b) there must be signage to indicate where the different hazards are located.
3.1.4	Storage of unsealed radioactive substances	If unsealed radioactive substances are stored in the radiation source room: (a) the surfaces of the room must be readily cleanable; and (b) there must be a means of containing unsealed radioactive substances if spilt.
3.1.5	Security	The physical access controls required to prevent access by unauthorised persons must be installed and operational.

3.2 Requirements, in addition to the principal requirements, for premises in which an ionising radiation apparatus is used to carry out medical imaging

The following table sets out the minimum test requirements, in addition to the principal requirements in Section 2, for premises in which an ionising radiation apparatus is used to carry out medical imaging, including veterinary medical imaging.

Test	Compliance Test	Criteria for Passing the Test
3.2.1	Illuminated radiation warning signs	At each entrance through which entry to the radiation source room is possible, an illuminated radiation warning sign must be provided. This radiation warning sign light must be connected in such a way that it illuminates during both the preparation time and the full period of the X-ray exposure. The radiation warning sign must contain words to the effect of 'X-ray in use'. Note: This requirement does not apply to– (a) radiation source rooms in which the radiation apparatus is plain diagnostic imaging X-ray equipment, mammography X-ray equipment, dental X-ray equipment or bone mineral densitometry X-ray equipment; or (b) radiation source rooms in which only a mobile radiation apparatus is used, where an alternative warning is available (e.g. radiation warning sign, portable light); or (c) rooms that can only be accessed from the radiation source room; or (d) radiation source rooms in which the radiation dose rate from the radiation apparatus when operating at its maximum output is no greater than 1 µGy in one hour at 1 m from the source.
3.2.2	Communication	Means must be available to enable the operator to observe and communicate with a patient or a person in the radiation source room during a radiation procedure. Note: For the purposes of this test, 'observe' may be direct, or indirect.

3.3 Requirements, in addition to the principal requirements, for premises in which an ionising radiation apparatus is used to carry out radiation therapy

The following table sets out the minimum test requirements, in addition to the principal requirements in Section 2, for premises in which an ionising radiation apparatus is used to carry out radiation therapy, including veterinary radiation therapy, but excluding brachytherapy.

Test	Compliance Test	Criteria for Passing the Test
3.3.1	Illuminated radiation warning signs and audible warning devices	The entrance to the radiation source room must have: (a) a radiation warning sign which illuminates while the apparatus is in the preparatory state. This must contain words that indicate imminent radiation exposure (e.g. 'ready'); and (b) a radiation warning sign which illuminates while the apparatus is in the loaded state. This must contain words that indicate radiation exposure (e.g. 'beam on'). Within the radiation source room, radiation warning devices, both visible and audible, must be activated when the apparatus is in the preparatory state and the loaded state. Note: For this test– (a) The warnings of the preparatory and the loaded states must be clearly distinguishable from each other. (b) The visible devices must contain words to indicate the state of the apparatus. (c) The audible alarm must be a mechanism which allows the person to detect a change of state audibly. (d) If a radiation warning device fails, it must either: (i) cause the beam to turn off; or (ii) indicate at the control panel that a device has failed in a clear and unambiguous manner.
3.3.2	Communication	Means must be available to enable the operator to observe and communicate with a patient during a radiation procedure. Note 1: This requirement does not apply to a radiation source room where only veterinary radiation therapy is carried out. Note 2: For the purposes of this test, 'observe' means to see a patient, either directly, or indirectly.
3.3.3	Interlocks	Each door required for radiation shielding must be interlocked to ensure that an exposure cannot be made if the door is open. The entrance to the radiation source room must have an interlock that prevents exposure unless the interlock has been set. The breaking of an interlock during an exposure must automatically cause the beam to turn off and subsequent reinstatement of this interlock must not automatically turn the beam on.
3.3.4	Last person out button	There must be a 'last person out' interlocking arrangement composed of a button within the radiation source room and either: (a) an entrance door interlock; or (b) a second button immediately outside the room.

Test	Compliance Test	Criteria for Passing the Test
		The radiation apparatus must not be able to be activated unless the button within the room is pressed within a pre-defined period (of approximately 10 seconds) before the entrance door interlock is made or the button outside the room is pressed. The activation of the button within the radiation source room must be indicated by an audible signal.
3.3.5	Rooms within radiation source rooms	The doors to rooms within the radiation source room must be lockable in such a way that they prevent entry into the room from the radiation source room, but allow a person to exit the room.
3.3.6	Emergency switch	An emergency 'off' switch, which terminates an exposure, must be provided within the radiation source room. This switch must be conspicuous, clearly labelled and readily accessible to personnel within the radiation source room.

3.4 Requirements, in addition to the principal requirements, for premises in which a radioactive substance is used to carry out high or pulsed dose rate brachytherapy using a remote afterloading brachytherapy machine

The following table sets out the minimum test requirements, in addition to the principal requirements in Section 2, for premises in which a radioactive substance is used to carry out high or pulsed dose rate brachytherapy using a remote afterloading brachytherapy machine.

Test	Compliance Test	Criteria for Passing the Test
3.4.1	Radiation dose rate limit	In addition to the principal requirement for all premises, the absorbed dose of radiation as a result of the radiation practice being carried out in the radiation source room, measured over the period of an hour at a distance of 30 centimetres from any accessible area or place external to the radiation source room, must not exceed 25 μGy. Note: This test does not apply during the transit of the source between the brachytherapy machine and the patient.
3.4.2	Radiation monitor and illuminated warning signs	A fixed radiation monitor must be provided to detect the radiation levels in the radiation source room. Each entrance to the radiation source room must have: (a) a light, which is connected to the radiation monitor, which illuminates when the radioactive substance is in its shielded position; and (b) a radiation warning sign, which is connected to the radiation monitor, which illuminates when the radioactive substance is not in its shielded position. This must contain a radiation warning symbol (trefoil). The illuminated signs or lights at the entrance to the radiation source room must contain words to indicate the position of the radioactive substance. All illuminated warning signs or lights must be fail-safe (i.e. returns the radioactive substance to its shielded position if the sign or light fails). Alternatively, adequate warning that the light has failed must be indicated in a clear and unambiguous manner.
3.4.3	Communication	Means must be available to enable the operator to observe and communicate with a patient during a radiation procedure. Note: For the purposes of this test, 'observe' means to see a patient, either directly, or indirectly.
3.4.4	Interlocks	Each door required for radiation shielding must be interlocked to ensure that the radioactive substance remains in its shielded position if the door is open. The entrance to the radiation source room must have an interlock to ensure that the radioactive substance remains in its shielded position if the door is open. The breaking of an interlock during treatment must automatically cause the radioactive substance to return to its shielded position.
3.4.5	Last person out button	There must be a 'last person out' button which is interlocked to ensure that the radioactive substance cannot be moved out of its shielded position unless the button has been pressed since the entrance interlock was last broken. The button must be located within the radiation source room. The activation of the button must be indicated by an audible signal.

Test	Compliance Test	Criteria for Passing the Test
3.4.6	Rooms within radiation source rooms	The doors to rooms within radiation source rooms must be lockable in such a way that they prevent entry into the room from the radiation source room, but allow a person to exit the room.
3.4.7	Emergency switch	An emergency 'off' switch, which terminates an exposure, must be provided within the radiation source room. This switch must be conspicuous, clearly labelled and readily accessible to personnel within the radiation source room.

3.5 Requirements, in addition to the principal requirements, for premises in which a radiation source is used to carry out industrial radiography

The following table sets out the minimum test requirements, in addition to the principal requirements in Section 2, for premises in which a radiation source is used to carry out industrial radiography.

Test	Compliance Test	Criteria for Passing the Test
3.5.1	Radiation dose rate limit	In addition to the principal requirement for all premises, the dose rate measured at 30 centimetres from any accessible area or place external to the radiation source room must not exceed 25 $\mu Gy.h^{-1}$ as a result of the radiation practice being carried out in the radiation source room being assessed.
3.5.2	Warning signs	The radiation source room must be clearly identified as either a fully enclosed site or a partially enclosed site through the use of warning signs at access points.
3.5.3	Warning lights and audible warning devices	A warning light, which illuminates during exposure and is clearly visible from outside the radiation source room, must be provided at access points to the radiation source room. If the radiation source room is a fully enclosed site, it must be provided with visible and audible warning devices inside the radiation source room which activate during exposure. If the radiation source room is a partially enclosed site, it must be provided with visible and audible warning devices which activate during exposure and which can be seen and heard from both inside and outside the radiation source room.
3.5.4	Operation via remote control	Radiation apparatus must be operable from outside the radiation source room by remote control.
3.5.5	Exit from enclosure	An exit, which may be the main or only exit, must be provided to enable any person who is accidentally shut in to leave the radiation source room without delay.
3.5.6	Interlocks at access points	Where a maze is used for access of persons into the radiation source room, a lockable door or barrier must be provided and be interlocked. For fully enclosed sites, all access points to the radiation source room must be interlocked. For partially enclosed sites, all entrances or exits used to permit the access of persons to or from the radiation source room must incorporate a lockable door or barrier which is interlocked. Breaking an interlock during an exposure must: (a) activate visible and audible alarms. Reinstatement of the interlock must not automatically reset the alarm; and (b) in the case of radiation apparatus, automatically cause the interruption of the power supply to the radiation apparatus. Subsequent closing of this interlocked door must not automatically re-energise the radiation apparatus.
3.5.7	Enclosure requirements	If the radiation source room is a fully enclosed site, when access doors or ports are closed, the walls, floor and ceiling of the site must form a completely shielded enclosure. If the radiation source room is a partially enclosed site, the shielded walls must be at least 2.1 metres high.

3.6 Requirements, in addition to the principal requirements, for premises in which an electron beam irradiator, X-ray irradiator or a gamma irradiator is used

The following table sets out the minimum test requirements, in addition to the principal requirements in Section 2, for premises in which an electron beam irradiator, X-ray irradiator or a gamma irradiator is used.

Test	Compliance Test	Criteria for Passing the Test
3.6.1	Radiation dose rate limit	In addition to principal requirement for all premises, the radiation dose rate must not exceed: (a) 4 $\mu Gy.h^{-1}$ in a Type 1 area; and (b) 25 $\mu Gy.h^{-1}$ in a Type 2 area; and (c) 0.5 $\mu Gy.h^{-1}$ in the vicinity of the irradiator control console. Where: '**Type 1 area**' is– (i) any area or place external to the radiation source room being assessed, and (ii) able to be accessed by members of the public or persons who are occupationally exposed but who are not involved in carrying out a radiation practice for the possession licensee at the premises. '**Type 2 area**' is– (i) any area or place within the premises but outside of the radiation source room being assessed, and (ii) normally only occupied by occupationally exposed persons involved in carrying out a radiation practice for the possession licensee at the premises. Note: For (a) and (b), the dose rate is to be measured at 30 centimetres from any accessible surface external to the radiation source room.
3.6.2	Warning sign – entry and exit ports	Each product entry and exit port must be posted with appropriate hazard warning signs.
3.6.3	Radiation monitor	A fixed radiation survey meter must be provided to detect the radiation levels in the radiation source room. The fixed radiation survey meter must be integrated with the personnel access door interlocks to prevent room access when the monitor: (a) detects a radiation level in excess of 25 $\mu Gy.h^{-1}$; or (b) is turned off. The fixed radiation survey meter must generate visible and audible alarm signals if the radiation level exceeds 25 $\mu Gy.h^{-1}$ when the irradiator is indicated to be in the de-energised or fully shielded condition.
3.6.4	Personnel access door interlocks	The personnel access door into the radiation source room must be controlled using interlocks to prevent access into the room when the radiation source is energised or not in the fully shielded position. The door interlocks must be integrated with the master control system such that dis-engagement of the interlock system or opening of the door automatically returns the source to the de-energised or fully shielded condition. Opening of the door with the radiation source not in its de-energised or fully shielded condition, through dis-engagement of any interlock, must generate visible and audible alarm signals.

Test	Compliance Test	Criteria for Passing the Test
3.6.5	Safety delay timer	The radiation source room must be equipped with a key operated safety timer that will automatically activate visible and audible warning signals to alert personnel in the area that the radiation source exposure sequence has commenced. The safety timer must be integrated with the master control system such that the radiation source cannot be energised or exposed unless the source exposure sequence is complete and the control console indicates that it is safe to energise or expose the radiation source. The visible warning signal in the radiation source room must remain activated during irradiation. If the source exposure sequence is not completed within a pre-determined time, the sequence must be aborted.
3.6.6	Emergency egress	It must be possible for personnel to leave the radiation source room at any time.
3.6.7	Emergency stop device	An emergency stop device must be provided within the radiation source room to terminate irradiator operations and return the radiation source to the de-energised or fully shielded condition. The device must be conspicuous, clearly labelled and readily accessible to personnel in the radiation source room.
3.6.8	Radiation source room shield plugs	Removable radiation source room shield plugs must be interlocked with the master control system to prevent or abort irradiator operations, causing the radiation source to return automatically to the de-energised condition if a plug is removed.
3.6.9	Power failure	If an electrical power failure occurs, the irradiator must: (a) de-energise or return the source to the fully shielded position; and (b) only be able to recommence operations by re-initiating the operating procedures.
3.6.10	Gas control	The ventilation of the chamber must be such that at no time is a person exposed to the concentration of ozone mentioned in the *Workplace Exposure Standards for Airborne Contaminants*, dated 27 April 2018, published by Safe Work Australia.
Additional requirements for premises in which a gamma irradiator is used		
3.6.11	Fire protection	Heat and smoke sensing devices with visible and audible alarms must be provided to detect combustion in the radiation source room. An interlock must be provided which will ensure the radiation source will return automatically to the fully shielded position, and the product positioning and any ventilation systems must shut down if either device is actuated. A fire extinguishing system must be provided in the radiation source room, and adjoining spaces.
3.6.12	Pool guard	A physical barrier must be placed around any open pool to prevent personnel from inadvertently falling into the pool.
3.6.13	Pool water controls	A metering device must be installed in the replenishment water supply line. Means must be provided to automatically replenish water losses from the pool.
3.6.14	Pool water level alarm	Means must be provided to activate audible and visible signals in the control area if the pool water falls to a level more than 30 centimetres below the normal water level. It must not be possible to enter the radiation source room using normal entry procedures while the abnormal, low water level condition exists.

Test	Compliance Test	Criteria for Passing the Test
3.6.15	Cleaning storage pool	Any vacuum system used for pool cleaning must be fitted with an in-line filter.

3.7 Requirements, in addition to the principal requirements, for premises in which a radiation source is used as part of a nuclear medicine practice, and premises used for the production of radioisotopes and radiopharmaceuticals

The following table sets out the minimum test requirements, in addition to the principal requirements in Section 2, for premises in which a radiation source is used as part of a nuclear medicine practice, including veterinary nuclear medicine, and premises used for the production of radioisotopes and radiopharmaceuticals.

Note: For clarity, this section includes premises where a cyclotron is used to produce radioisotopes.

Test	Compliance Test	Criteria for Passing the Test
3.7.1	Illuminated radiation warning signs	At each entrance through which entry to a radiation apparatus is possible, an illuminated radiation warning sign must be provided. If the radiation apparatus is X-ray equipment, this radiation warning sign must: (a) be connected in such a way that it illuminates during both the preparation time and the full period of the X-ray exposure; and (b) include a radiation warning symbol (trefoil); and (c) contain words to the effect of 'X-ray in use'. If the radiation apparatus is a cyclotron, this radiation warning sign must: (a) be connected in such a way that it illuminates when the beam is on; and (b) include a radiation warning symbol (trefoil); and (c) contain words to the effect of 'beam on'. Note: This requirement does not apply to– (a) radiation source rooms in which the radiation apparatus is plain diagnostic imaging X-ray equipment, mammography X-ray equipment, dental X-ray equipment or bone mineral densitometry X-ray equipment; or (b) radiation source rooms in which only a mobile radiation apparatus is used, and alternative warning is available (e.g. radiation warning sign, portable light); or (c) rooms that can only be accessed from the radiation source room; or (d) radiation source rooms in which the radiation dose rate from the radiation apparatus when operating at its maximum output is no greater than 1 µGy in one hour at 1 m.
3.7.2	Communication	Means must be available to enable the operator to observe and communicate with a patient or a person in the radiation source room during a radiation procedure. Note: For the purposes of this test, 'observe' may be direct, or indirect.
3.7.3	Surface finishes	If unsealed radioactive substances are produced or used in the radiation source room: (a) all surfaces must be smooth, impermeable and cleanable (b) all joints must be sealed and impermeable and must be located away from potential sources of contamination (c) the floor must be a sealed surface that is cleanable, coved up to or sealed to the walls and fixed vertical surfaces (d) bench surfaces must not leak or trap contamination.
3.7.4	Hand basins	If unsealed radioactive substances are produced or used, a hand basin must be readily available and the taps must be able to be operated automatically, or hands free.

Test	Compliance Test	Criteria for Passing the Test
3.7.5	Disposal and decontamination	If unsealed radioactive substances are disposed of within the licensee's premises, a sink with hands free operated taps, for the disposal of radioactive material and for cleaning contaminated items, must be provided. The relevant drainage and sewerage systems must be labelled at accessible locations within the premises with the following information: • radiation warning symbol (trefoil) • words to the effect of 'Caution – possible radiation: contact the radiation safety officer'.
3.7.6	Gas management system	Where radioactive material may emit a radioactive gas, the radiation source room must have a gas management system in place so that the concentration of the gas does not contribute to an individual receiving an effective dose greater than the relevant total effective dose in Test 2.1.1. For clarity, some examples of a gas and aerosol management system are: • a device to capture patient aerosol exhalation • fume cupboard with non-recirculated exhaust air and appropriate filtration • room ventilation • a gas capture device • a delay line system • room pressure cascades The system must be labelled at accessible locations with the following information: • radiation warning symbol (trefoil) • words to the effect of 'Caution – possible radiation: contact the radiation safety officer'
3.7.7	Production areas	A radioisotope or radiopharmaceutical production area must have: (a) a hot cell, or shielded area; and (b) a shielded storage area for radioactive waste. This test includes the area where isotopes are eluted from a generator. Note: 'production' includes 'manufacture'
3.7.8	Dispensing and preparation areas	A dispensing and radiopharmaceutical preparation area must have: (a) a shield with a protective viewing window; (b) for PET and therapy dispensing applications, a dose calibrator chamber; and (c) shielded storage for radioactive waste. Note: The protective viewing window requirement does not apply to an automated dispensing unit.
3.7.9	Cyclotron vault or self-shielded cyclotron	For premises in which a cyclotron is used: (a) Access to a cyclotron vault or self-shielded cyclotron must be controlled using interlocks to prevent access when the beam is on. The interlocks must be integrated with the master control system such that violation of the interlock system or personnel entry must cause the cyclotron to return to a beam-off condition. (b) Shielded storage for radioactive waste from cyclotron activation must be available. This includes cyclotron activated target bodies, parts within the beam line, and items within the source room.

Test	Compliance Test	Criteria for Passing the Test
3.7.10	Dedicated toilet facilities	For premises where radiopharmaceuticals are administered to patients, designated toilets, that are not accessible to the general public, must be available for use by the patients.
3.7.11	Security	The physical access controls required to prevent access by unauthorised persons must be installed and operational.

3.8 Requirements, in addition to the principal requirements, for all premises not otherwise specified in 3.1 to 3.7 in which unsealed radioactive substances are used

The following table sets out the minimum test requirements, in addition to the principal requirements in Section 2, for all other premises not otherwise specified, in which unsealed radioactive substances are used.

Test	Compliance Test	Criteria for Passing the Test
3.8.1	Surface finishes	In the radiation source room: (a) all surfaces must be smooth, impermeable and cleanable; and (b) the floor must be a sealed surface that is cleanable; and (c) bench surfaces must not leak or trap contamination.
3.8.2	Hand basins	A hand basin must be readily accessible and the taps must be able to be operated automatically, or hands free.
3.8.3	Disposal and decontamination	A sink, with hands free operated taps, for the disposal of radioactive material and for cleaning contaminated items must be provided in the radiation source room. The relevant drainage system must be labelled at accessible locations within the premises with the following information: • radiation warning symbol (trefoil) • words to the effect of 'Caution – possible radiation: contact the Radiation Safety Officer'
3.8.4	Gas management system	Where radioactive material may emit a radioactive gas, the radiation source room must have a gas management system in place so that the concentration of the gas does not contribute to an individual receiving an effective dose greater than the relevant total effective dose in Test 2.1.1. For clarity, some examples of a gas and aerosol management system are: • fume cupboard with non-recirculated exhaust air and appropriate filtration • room ventilation • a gas capture device • a delay line system • room pressure cascades The system must be labelled at accessible locations with the following information: • radiation warning symbol (trefoil) • words to the effect of 'Caution – possible radiation: contact the Radiation Safety Officer'
3.8.5	Security	The physical access controls required to prevent access by unauthorised persons must be installed and operational.