



**Queensland  
Government**

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*Radiation Safety Act 1999*

## **RADIATION SAFETY STANDARD**

**Standard for radiation sources—industrial, mining,  
manufacturing, and other practices (2021)**

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# Standard for radiation sources – industrial, mining, manufacturing, and other practices (2021)

## Preface

This radiation safety standard sets out:

- (a) the minimum performance expectations for certain radiation sources in relation to the carrying out of radiation practices, specifically those used for industrial, mining, manufacturing, and other practices; and
- (b) the minimum requirements for the sealing of sealed radioactive substances used to carry out certain radiation practices.

These requirements are made to ensure that radiation sources used for industrial, mining, manufacturing, and other practices continue to meet a minimum standard of radiation safety. They also confirm that the encapsulation of a sealed radioactive substance will provide sufficient protection against the release of radioactive material to ensure no related adverse effects to the health and safety of persons, or the environment.

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 a radiation source complies, or does not comply, with this radiation safety standard. Compliance with all of the tests in the standard means that the source may continue to be used. Failure of any test in the standard means that the source must not be used.

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

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 radiation sources–industrial, mining, manufacturing, and other practices (2021)*, for the purposes of the Act.

## SIGNED BY

**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 performance expectations for certain ionising radiation apparatus and sealed source apparatus in relation to carrying out of radiation practices, specifically those used for industrial, mining, manufacturing and other practices.

This standard also sets out the minimum requirements that must be certified for ongoing use of a sealed radioactive substance, used for a particular radiation practice.

This standard specifically targets:

- (a) cabinet radiation apparatus and enclosed radiation apparatus used to carry out a radiation practice
- (b) radiation apparatus and sealed source apparatus used to carry out industrial radiography
- (c) radiation apparatus and sealed source apparatus used to carry out chemical and physical analysis
- (d) radiation apparatus and sealed source apparatus used to carry out industrial gauging
- (e) sealed source apparatus used to carry out borehole logging
- (f) radiation apparatus and sealed source apparatus used to carry out sterilisation
- (g) sealed source apparatus used to carry out moisture/density measurements

### 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:

*'access panel'* means any parts of the protective housing that are intended to be removed or displaced for operational maintenance or use (excluding during servicing), which would allow access to the primary beam.

*'borehole logging'* is an activity where a sealed radioactive substance is used to investigate the physical properties of a geological sequence, or any fluids contained in a geological sequence, or the properties of a borehole itself. The sealed source apparatus used for borehole logging is typically either:

- (i) a device in which the radioactive substance is a non-removable element – a Type A borehole logging tool; or
- (ii) a device for which the radioactive substance is installed immediately before each use and removed immediately after each use – a Type B borehole logging tool.

*'control cable'* means a component of a mechanical source control mechanism which, for shutter type source containers, controls the shutter from a location remote from the radioactive substance or, for a projection type source container, is a windout cable.

*'durable'*, *'durably'*, when describing the acceptability of a label or a marking, means made of a material and marked in a way that can withstand the long-term effects of corrosion and general exposure to the environment in which the radiation apparatus, or a sealed source apparatus, is used.

*'energised'* means the radiation source is producing radiation.

*'fixed industrial gauge'* means a device used as part of a manufacturing process for the non-invasive measurement and control of the thickness, level, density, weight, composition or moisture content in a continuous chemical, material handling, or industrial control process.

*'gamma irradiator'* means an irradiator in which the 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. In ISO 2919 this is a Category IV irradiator - Panoramic irradiator with wet storage.

*'guide tube'* means a tube, typically of flexible construction, designed to provide an enclosed path along which a radioactive substance may be moved from its sealed source apparatus to its exposure position and back again.

*'hand-held radiation apparatus'* means a portable apparatus that is designed to be held and operated by hand.

*'industrial radiography'* means the use of the penetrating power of ionising radiation to obtain information non-destructively on the internal state or structure of objects and materials.

*'irradiation room'* means the room, facility or premises in which irradiation is performed that is potentially accessible to personnel, but that is kept inaccessible during the irradiation process.

*'ISO'* means the International Organization for Standardization

*'ISO 2919'* means ISO 2919:2012 *Radiological protection — Sealed radioactive sources — General requirements and classification*. The requirements of ISO 2919 include:

- (i) designation and classification requirements;
- (ii) performance requirements; and
- (iii) requirements for source marking and the provision of a sealed source certificate.

*'open site'* means a site at which, due to operational requirements, the shielding afforded by a fully enclosed site or a partially enclosed site cannot be provided, and for which a clearly marked boundary is set up and strict control of access and occupancy is observed.

*'operational maintenance'* means maintenance which is expected to be undertaken by the owner of the apparatus, as detailed in operator manuals supplied with the apparatus, and excludes service.

*'projection type container'* means a source container which retains the sealed radioactive substance in a shielded position except during exposure, when it allows or facilitates the substance to be propelled from the container along a guide tube to its exposure position.

*'sealed source performance classification'* means the classification determined following assessment of the sealed source type against the tests in Table 1 of ISO 2919.

*'self-contained irradiator'* means an irradiator in which the sealed radioactive substance is contained in a sealed source apparatus and is shielded from access by persons both when in use and when not in use. In ISO 2919 this is a Category I irradiator - Self-contained irradiator with dry storage.

*'source container'* means the shielded device which houses the radioactive substance when it is not in use.

*'X-ray crawler'* means radiation apparatus designed to travel automatically or by remote control within pipes to radiograph pipeline welds etc. through the pipe wall.

## Section 2 – Specific Requirements – Radiation Apparatus and Sealed Source Apparatus

The following sections set out the minimum test requirements for all radiation apparatus and sealed source apparatus the subject of this standard. The sealed radioactive substances incorporated in sealed source apparatus must also meet the requirements of Section 3 in this standard.

Sealed source apparatus incorporating a sealed radioactive substance that does not meet the criteria specified in the relevant part of Section 3 is not approved unless specific written and time-limited approval for the use of the particular sealed radioactive substance has been obtained from the chief executive. An accredited person assessing a sealed source apparatus incorporating a sealed radioactive substance that is the subject of such an approval must sight the approval.

### A. Requirements for cabinet radiation apparatus and enclosed radiation apparatus used to carry out a radiation practice

The following table sets out the minimum test requirements for cabinet radiation apparatus and enclosed radiation apparatus used to carry out a radiation practice.

Test	Compliance Test	Criteria for Passing Test
A.1	Radiation dose rate	<p>The radiation dose rate at any accessible point 5 centimetres from the external surface of the apparatus must not exceed <math>5 \mu\text{Gy}\cdot\text{h}^{-1}</math>.</p> <p>Compliance with this requirement must be made with an object, typical of those examined, in the beam and any flexible or moveable screen displaced as would reasonably occur during the operation of the equipment.</p>
A.2	Access limited	<p>When a conveyor system is used, means must be provided to ensure that a person is not able to insert any part of their body into the irradiation area during normal operations.</p>
A.3	Indicator lights – energised source	<p>An indicator light must:</p> <ol style="list-style-type: none"> <li>be provided which automatically illuminates when the radiation source is energised; and</li> <li>include words to clearly indicate that the source is activated (e.g. 'radiation on').</li> </ol> <p>This indicator light must be clearly visible and interlocked so that the apparatus is not able to energise if the light is not operational. Re-engaging the interlock must not cause the radiation source to automatically resume irradiation.</p>
A.4	Radiation warning label	<p>A clearly visible and durable radiation warning label containing the following information must be legible and be conspicuous at the control panel:</p> <ul style="list-style-type: none"> <li>radiation warning sign (trefoil)</li> <li>words to the effect of 'Caution – X-rays' or 'Caution – radiation'</li> </ul> <p>The lettering and symbol must be in black on a yellow background.</p> <p>The sign must not be able to be obscured during normal operation of the apparatus.</p>
A.5	Doors and access panels	<p>Access panels, or doors provided for insertion of items to be examined or tested, must be:</p> <ol style="list-style-type: none"> <li>secured so that tools or keys are required to open them; and</li> <li>interlocked so that the power supply to the primary beam is disconnected when the door is opened; and</li> <li>labelled to warn of the presence of a radiation source within.</li> </ol>

Test	Compliance Test	Criteria for Passing Test
A.6	Key switch on control panel	<p>A key operated control must be connected so that radiation is not produced, or able to be produced, when the key is removed.</p> <p>For the purpose of this test, a key could be a magnetic card, numeric panel, USB key, password, or similar.</p>
A.7	X-ray control function	<p>A radiation exposure on/off control function must:</p> <ul style="list-style-type: none"> <li>(a) be physically separate from the key switch/function; and</li> <li>(b) be fail-safe if manually operated.</li> </ul> <p>Apparatus in which samples can be loaded by hand must only be able to produce radiation if manually operated (i.e. must not energise automatically).</p>
A.8	Visibility of ports and doors	<p>For radiation apparatus designed primarily for the inspection of carry-on baggage, the operator who initiates the radiation exposure must be able to readily observe, from the operating position, all ports and doors during the generation of radiation.</p> <p>In the case of radiation apparatus in which the beam is activated by an automatic device, this requirement will be met if, at the primary viewing position for the image, all ports and doors are readily observable during the generation of radiation.</p>
A.9	Construction of equipment with entry ports	<p>Where entry ports are provided for insertion of items or materials to be examined or tested, the equipment must be so constructed so that insertion of any part of a person into the primary beam cannot be readily achieved.</p>
A.10	Radiation control override switch	<p>For radiation apparatus that allows a person to be admitted to the interior for purposes associated with the operation of the equipment, there must be a control within the apparatus which may be used to terminate or prevent the production of radiation.</p> <p>This control must:</p> <ul style="list-style-type: none"> <li>(a) not be able to be overridden from the outside of the apparatus; and</li> <li>(b) be conspicuous, clearly labelled and readily accessible to personnel within the apparatus.</li> </ul>
A.11	Audible/visible signals – within apparatus	<p>For radiation apparatus that allows a person to be admitted into the interior for purposes associated with the operation of the equipment:</p> <ul style="list-style-type: none"> <li>(a) there must be audible and visible signals within the apparatus which activate for at least 10 seconds prior to the production of radiation; and</li> <li>(b) a separate and clearly distinguishable visible warning signal must remain active within the apparatus when radiation is produced.</li> </ul>
A.12	Signs illuminate when control 'on'	<p>For radiation apparatus that allows a person to be admitted into the interior for purposes associated with the operation of the equipment, there must be clearly visible, legible signs describing the meaning of the warning signals.</p> <p>These signs must illuminate when the main power control is in the 'on' position.</p>

## B. Requirements for radiation apparatus and sealed source apparatus used to carry out industrial radiography

### B.1 Requirements for industrial radiography radiation apparatus

The following table sets out the minimum test requirements for radiation apparatus used to carry out industrial radiography, and is applicable to both pulsed and non-pulsed apparatus used for industrial radiography.

Test	Compliance Test	Criteria for Passing the Test
B.1.1	Radiation dose rate	The maximum radiation dose rate values for leakage radiation at 1 metre from the housing must not exceed 5000 $\mu\text{Gy}\cdot\text{h}^{-1}$ under conditions of continuous operation at maximum energy and output.
B.1.2	Radiation dose rate – direct transmission imaging (hand-held)	Radiation apparatus designed or configured for hand-held, direct transmission imaging must: <ol style="list-style-type: none"> <li>be shielded such that, at no time during an exposure, can the equivalent radiation dose rate at any accessible position exceed 25 <math>\mu\text{Gy}\cdot\text{h}^{-1}</math>; and</li> <li>be designed or configured such that, when in use, the primary beam is totally intercepted.</li> </ol>
B.1.3	Control panel – kV and mA indication	When the apparatus is energised, the control panel must indicate the X-ray beam energy and output in terms of the X-ray tube potential difference (kVp) and current (mA) or electron energy and radiation dose rate, as appropriate.  For radiation apparatus that is used at an open site, the values indicated must be clearly legible in bright sunlight.  Note: For apparatus operating at fixed kV or fixed mA, a durable label specifying the kV or mA must be affixed to the control panel.
B.1.4	Control panel – indicator lights	Indication must be provided on the control panel which: <ol style="list-style-type: none"> <li>clearly indicates when the apparatus is enabled; and</li> <li>clearly indicates when the X-ray tube is energised.</li> </ol> <p>The indications must be clearly distinguishable from each other and be clearly and durably labelled to indicate their function.</p>
B.1.5	X-ray tube housing – labels and indicators	The X-ray tube housing must: <ol style="list-style-type: none"> <li>be durably labelled to indicate where the primary radiation beam exits the housing; and</li> <li>incorporate an indicator light which:               <ol style="list-style-type: none"> <li>automatically illuminates when the X-ray tube is energised; and</li> <li>is visible from a distance of at least 10 metres.</li> </ol> </li> </ol>
B.1.6	Radiation warning label	The control panel of the radiation apparatus must be durably and legibly marked with a label incorporating the following information in a conspicuous location: <ul style="list-style-type: none"> <li>radiation warning sign (trefoil)</li> <li>the word 'caution' or 'warning'</li> </ul> <p>The lettering and symbol must be in black on a yellow background.</p>
B.1.7	Key switch on control panel	A key operated control must be connected so that X-rays are not produced, or able to be produced, when the key is removed.  For the purpose of this test, a key could be a magnetic card, numeric panel, USB key, password, or similar.



Test	Compliance Test	Criteria for Passing the Test
B.1.8	Function of key switch clearly marked	The function of the key switch and its on/off indication must be clearly and durably indicated on the control panel.
B.1.9	Operation of X-ray control function	The means of initiating an exposure using the control function: (a) must be physically separate from the key switch; and (b) must be clearly and durably marked on the control panel.
B.1.10	Termination of X-rays	The radiation apparatus must either: (a) control the exposure duration and automatically terminate the exposure after a pre-set interval; or (b) be provided with a control device that requires continuous activation by the operator to maintain the generation of radiation.  Additionally, the control panel must have a clear and durably labelled means of immediately terminating the generation of radiation.
B.1.11	Control panel fitted with remote flashing light	The control panel must be fitted with a means of connecting a remote flashing light, or a series of remote flashing lights or annunciators, to define a boundary or provide a visible warning.  The means of connecting a light, annunciator, or series of lights, must be functional.
B.1.12	Length of cable	If the radiation apparatus is used at an open site, a cable connecting the control panel to the X-ray tube must: (a) be available; (b) be in good working order; and (c) not be less than— <ul style="list-style-type: none"> <li>• 7 metres for a generator <math>\leq 100</math> kV</li> <li>• 10 metres for a generator of <math>\leq 200</math> kV but <math>&gt; 100</math> kV</li> <li>• 15 metres for a generator of <math>\leq 250</math> kV but <math>&gt; 200</math> kV</li> <li>• 20 metres for generators of 250kV or greater</li> </ul>
<b>Additional requirements for X-ray crawler equipment</b>		
B.1.13	Device malfunction and accidental exposures	An X-ray crawler must be fitted with safety devices which: (a) prevent unintentional exposure; and (b) provide for the power to the radiation apparatus to be disconnected in the event of a malfunction during operation.
B.1.14	Audible signal	If an audible alarm is fitted to the X-ray crawler, it must automatically operate: (a) when the crawler has reached its exposure position; and (b) for a warning period of approximately 10 seconds immediately prior to the exposure; and (c) continually, in a manner distinguishable from the 10 second warning, while the exposure takes place.

## B.2 Requirements for industrial radiography sealed source apparatus

The following table sets out the minimum test requirements for sealed radioactive substances incorporated in sealed source apparatus used to carry out industrial radiography.

Test	Compliance Test	Criteria for Passing the Test
B.2.1	Radiation dose rate	<p>When the radioactive substance in the source container is in the fully shielded position, and the appropriate port plugs fitted, the radiation dose rates must not exceed:</p> <p>(a) At any point 5 centimetres from the external surface:</p> <ul style="list-style-type: none"> <li>• 500 <math>\mu\text{Gy}\cdot\text{h}^{-1}</math> for source containers weighing no more than 50 kg; or</li> <li>• 1000 <math>\mu\text{Gy}\cdot\text{h}^{-1}</math> for source containers weighing more than 50 kg.</li> </ul> <p>(b) At any point 1 metre from the external surface:</p> <ul style="list-style-type: none"> <li>• 20 <math>\mu\text{Gy}\cdot\text{h}^{-1}</math> for source containers weighing no more than 50 kg; or</li> <li>• 100 <math>\mu\text{Gy}\cdot\text{h}^{-1}</math> for source containers weighing more than 50 kg.</li> </ul>
B.2.2	Informative label	<p>The external surface of the source container must be durably and legibly marked with a label or labels incorporating the following information in a conspicuous location:</p> <ul style="list-style-type: none"> <li>• the radiation warning sign (trefoil)</li> <li>• the word 'caution' or 'warning'</li> <li>• words to the general form of 'radioactive material'</li> <li>• name and address of the supplier or manufacturer of the apparatus</li> <li>• identification number of the apparatus</li> <li>• maximum radiation dose rate at 1 metre from the surface of the sealed source apparatus (with shutters closed) and the date the measurement was made</li> <li>• if applicable, an indication of whether the container contains depleted uranium</li> <li>• the name of the radioisotope</li> <li>• serial number of the radioactive substance</li> <li>• the activity of the radioactive substance and the date the activity was measured</li> <li>• name, address and telephone number of the owner</li> </ul> <p>Note 1: The warning information must be black on a yellow background. The label must not be able to be obscured during normal handling and use.</p> <p>Note 2: The information about the sealed source apparatus and sealed radioactive substance must be in black, or dark, lettering.</p> <p>Note 3: The information about the sealed radioactive substance may be on a label firmly fixed to the apparatus by a metal ring or chain or other robust attachment.</p>
B.2.3	Shutter or source control mechanism	<p>The source container must be provided with a radiation source control mechanism or shutter.</p> <p>If power operated, the shutter or source control mechanism must be fail-safe, i.e. if a power failure occurs, the source must automatically return to its fully shielded position.</p>

Test	Compliance Test	Criteria for Passing the Test
		<p>When a source control mechanism is not connected to a source container, the connection port, and for a projection type container, the projection port, must be able to be:</p> <ul style="list-style-type: none"> <li>(a) closed with an end cap that can be screwed or otherwise firmly fixed into position; and</li> <li>(b) secured with a locking pin or similar device.</li> </ul> <p>The associated hardware (i.e. end cap, locking pin or similar device) must be available and in good working order.</p>
B.2.4	Shutter lock	<p>The shutter or source control mechanism must be provided with an effective key-operated lock which:</p> <ul style="list-style-type: none"> <li>(a) can be locked only when the radioactive substance is in the fully shielded position; and</li> <li>(b) will secure the radioactive substance in that position.</li> </ul> <p>The flexible source holder (i.e. pigtail) must be able to be secured within the apparatus in its fully shielded position. The source holder's cable-coupling end must be able to be secured at the control cable port.</p>
B.2.5	Source retraction test	<p>The source container must be fitted with a mechanical indicator, which may be audible or visible, to confirm that the source has been fully retracted into the shielded position.</p>
B.2.6	Handling features	<p>The source container must be provided with a handle or handles, lifting lugs or brackets, or other means as appropriate, to facilitate safe handling.</p>
B.2.7	Guide tube	<p>A guide tube must be provided through which the radioactive substance can move freely. The guide tube must be:</p> <ul style="list-style-type: none"> <li>(a) sealed to prevent ingress of material (e.g. dirt, grit, moisture); and</li> <li>(b) in good working order.</li> </ul> <p>The exposure end of the guide tube must:</p> <ul style="list-style-type: none"> <li>(a) have an end cap to prevent inadvertent release of the sealed radioactive substance or pigtail when fully projected; and</li> <li>(b) be capable of being clamped in position during exposure without affecting the free movement of the cable and radioactive substance.</li> </ul>
B.2.8	Control cable	<p>The control cable must be 10 metres or more in length.</p>

## C. Requirements for radiation apparatus and sealed source apparatus used to carry out chemical or physical analysis

The following sections set out the minimum test requirements for radiation apparatus, and sealed source apparatus, used to carry out chemical and physical analysis.

These requirements exclude radiation apparatus, or sealed source apparatus, used as part of a manufacturing process or for the non-invasive measurement or control of composition of material in an industrial production process.

### C.1 Requirements for analytical radiation apparatus

The following table sets out the minimum test requirements for ionising radiation apparatus used to carry out chemical or physical analysis, excluding portable analytical radiation apparatus designed to be held and operated by hand.

Test	Compliance Test	Criteria for Passing the Test
C.1.1	Radiation dose rate	The maximum radiation dose rate at any accessible point from the external surface of the apparatus must not exceed $25 \mu\text{Gy}\cdot\text{h}^{-1}$ during any mode of operation when the X-ray tube is operated at any of the permissible ratings specified by the manufacturer of the radiation apparatus.
C.1.2	Warning light	<p>The radiation apparatus must be fitted with an illuminated sign, or combination of a sign and a light, which is activated only if the X-ray tube is energised.</p> <p>The sign must contain a radiation warning sign (trefoil) or words to the effect of 'X-rays on'.</p> <p>The colour of the light must either be red or orange.</p> <p>The illuminated sign must be legible and readily discernible at least 2 metres from all accessible sides of the equipment.</p>
C.1.3	Shutter indication	<p>There must be clear indication to all persons involved in carrying out the practice when a shutter is open.</p> <p>This indication must only be activated when that shutter is open and indicate without ambiguity which shutter is open.</p>
C.1.4	Lights fail-safe	<p>In the event of a warning light or shutter indication failure:</p> <p>(a) it must not be possible for a radiation exposure to occur (e.g. X-ray tube is de-energised); or</p> <p>(b) adequate warning that a failure has occurred must be indicated in a clear and unambiguous manner.</p>
C.1.5	Barriers or shields complete	<p>The radiation apparatus must incorporate a shielded enclosure, to prevent access to the X-ray tube, that is either:</p> <p>(a) secured so that tools or keys are required to open the enclosure; or</p> <p>(b) interlocked so that the power supply to the primary beam is disconnected when the enclosure is opened.</p>
C.1.6	Tube shutter	If a tube shutter is provided on the radiation apparatus, the shutter must be fitted with a device which, in the absence of an external applied force, keeps the shutter closed.
C.1.7	Removal of shutter and operating mechanism	If a tube shutter is provided it must not be possible to remove the shutter or its operating mechanism without the use of tools.

Test	Compliance Test	Criteria for Passing the Test
C.1.8	Beam-stop	Each beam-stop must: <ul style="list-style-type: none"> <li>(a) form a fixed part of the unit, and not be easily removed; and</li> <li>(b) be interlocked so that removal of the beam-stop: <ul style="list-style-type: none"> <li>(i) de-energises the X-ray tube; or</li> <li>(ii) immediately closes the shutter related to that beam-stop.</li> </ul> </li> </ul>
C.1.9	Radiation warning label	A radiation warning sign containing the following information must be legible and be conspicuous at the control panel: <ul style="list-style-type: none"> <li>• radiation warning sign (trefoil)</li> <li>• words to the effect of 'Caution - X-rays'</li> </ul> <p>The lettering and symbol must be black on a yellow background.</p>

## C.2 Requirements for hand-held analytical radiation apparatus

The following table sets out the minimum test requirements for hand-held radiation apparatus used to carry out chemical or physical analysis.

Test	Compliance test	Proposed criteria for passing the test
C.2.1	Radiation dose rate	When the X-ray tube is energised, and operating at its maximum output, the radiation dose rate must not exceed $10 \mu\text{Gy}\cdot\text{h}^{-1}$ at any accessible point 5 centimetres from any external surface.
C.2.2	Radiation warning label	The external surface of the radiation apparatus must be durably and legibly marked with a label incorporating the following information in a conspicuous location: <ul style="list-style-type: none"> <li>• radiation warning sign (trefoil)</li> <li>• the word 'caution' or 'warning'</li> </ul> <p>The lettering and symbol must be in black on a yellow background.</p>
C.2.3	Unauthorised operation	The radiation apparatus must be key operated so that X-rays are not produced, or able to be produced, when the key is removed. <p>For the purpose of this test, a key could be a magnetic card, numeric panel, USB key, password, or similar.</p>
C.2.4	Exposure control	An exposure control must be provided which requires: <ul style="list-style-type: none"> <li>(a) continuous actuation (e.g. a trigger); or</li> <li>(b) a pre-set time interval.</li> </ul> <p>Emission of X-rays must not be possible after the timer has expired or the trigger is released.</p>
C.2.5	Warning lights	The radiation apparatus must be fitted with an indicator which illuminates only if the X-ray tube is energised.
C.2.6	Proximity sensor	As a default setting, the radiation apparatus must not emit X-rays if the apparatus is not in the 'measurement' position (e.g. pushed against the sample being analysed). <p>If the proximity sensor can be changed by the operator, it must not be able to remain in that condition when the device is de-energised, then re-energised; i.e. it must be a conscious act by the user to de-activate the proximity sensor for each measurement session.</p>

Test	Compliance test	Proposed criteria for passing the test
C.2.7	Local enclosure	<p>If a local enclosure is provided for use with the radiation apparatus, the following must be complied with:</p> <p>(a) the radiation dose rate outside this enclosure must not exceed <math>2.5 \mu\text{Gy}\cdot\text{h}^{-1}</math> when the X-ray tube is operated at its maximum output; and</p> <p>(b) a durable and legible radiation warning label is visible in a conspicuous location, containing the information:</p> <ul style="list-style-type: none"> <li>• radiation warning sign (trefoil)</li> <li>• the word 'caution' or 'warning'</li> </ul> <p>The lettering and symbol must be in black on a yellow background; and</p> <p>(c) there is a visible indication which illuminates only if the X-ray tube is energised.</p>

### C.3 Requirements for analytical sealed source apparatus

The following table sets out the minimum test requirements for sealed radioactive substances incorporated in portable, or benchtop sealed source apparatus used to carry out chemical analysis.

Test	Compliance Test	Criteria for Passing the Test
C.3.1	Radiation dose rate – shielded position	<p>When the sealed source apparatus is locked in the shielded position, the radiation dose rates must not exceed:</p> <p>(a) <math>10 \mu\text{Gy}\cdot\text{h}^{-1}</math> at any point 5 centimetres from the external surface of the sealed source apparatus; and</p> <p>(b) <math>1 \mu\text{Gy}\cdot\text{h}^{-1}</math> at any point 1 metre from the external surface of the sealed source apparatus.</p>
C.3.2	Radiation dose rate – unshielded position	<p>When the sealed source apparatus is in the unshielded position, the radiation dose rate must not exceed <math>10 \mu\text{Gy}\cdot\text{h}^{-1}</math> at any accessible location around the sealed source apparatus.</p>
C.3.3	Interception of primary radiation beam	<p>Primary radiation emitted by the radioactive substance must be stopped by a shutter assembly (or equivalent) at all times except during a measurement.</p>
C.3.4	Shutter operation indicators	<p>The sealed source apparatus must indicate when the shutter is open. This indication may be visible or audible.</p>
C.3.5	Informative label	<p>The external surface of the radiation apparatus must be durably and legibly marked with a label or labels incorporating the following information in a conspicuous location:</p> <ul style="list-style-type: none"> <li>• the radiation warning sign (trefoil)</li> <li>• the word 'caution' or 'warning'</li> <li>• words to the general form of 'radioactive material'</li> <li>• manufacturer, model and serial number of the apparatus</li> <li>• the name of the radioisotope</li> <li>• the manufacturer and model of the radioactive substance</li> <li>• serial number of the radioactive substance</li> <li>• the activity of the radioactive substance and the date the activity was measured</li> </ul> <p>Note 1: The warning information must be black on a yellow background. The label must not be able to be obscured during normal handling and use.</p>

Test	Compliance Test	Criteria for Passing the Test
		<p>Note 2: The information about the sealed source apparatus and radioactive substance must be in black, or dark, lettering.</p> <p>Note 3: The sealed radioactive substance label(s) must be affixed as close as possible to the location of the radioactive substance.</p>
C.3.6	Source holder securely enclosed	The radiation source holder must be able to be securely enclosed within the sealed source apparatus.
C.3.7	Shutter assembly interlock	The shutter assembly must be such that the aperture cannot open if the sample or sample holder is not placed in the correct or appropriate position.

## D. Requirements for radiation apparatus and sealed source apparatus used to carry out industrial gauging

### D.1 Requirements for a fixed industrial gauge incorporating an X-ray tube or neutron generator

The following table sets out the minimum test requirements for a radiation apparatus used to carry out industrial gauging.

Test	Compliance Test	Criteria for Passing the Test
D.1.1	Radiation dose rate	<p>When the fixed industrial gauge is energised, and operating at its maximum output, the equivalent radiation dose rate must not exceed:</p> <ul style="list-style-type: none"> <li>(a) 300 <math>\mu\text{Gy}\cdot\text{h}^{-1}</math> at any accessible point 5 centimetres from the external surface of the tube housing or shielded enclosure; and</li> <li>(b) 10 <math>\mu\text{Gy}\cdot\text{h}^{-1}</math> at any point one metre from the surface of the tube housing or shielded enclosure.</li> </ul> <p>Note: The shutter or source control mechanism must be in the closed position during the measurement.</p>
D.1.2	Indicators	<p>Whenever the fixed industrial gauge is energised, that condition must be clearly and unambiguously indicated.</p> <p>The indicator must be protected against mechanical damage.</p> <p>If a mechanical indicator is used, the indicator markings must be readily discernable and not obscured by dust, precipitation, corrosion or paint.</p> <p>If an electrical indicator is used, it must be fail-safe.</p>
D.1.3	Informative label	<p>The external surface of the radiation apparatus must be durably and legibly marked with a label or labels incorporating the following information in a conspicuous location:</p> <ul style="list-style-type: none"> <li>• radiation warning sign (trefoil)</li> <li>• the word 'caution' or 'warning'</li> <li>• words to the general form of 'X-rays'</li> </ul> <ul style="list-style-type: none"> <li>• manufacturer name, model and serial number of the fixed industrial gauge</li> </ul> <p><i>If an X-ray tube is incorporated in the apparatus</i></p> <ul style="list-style-type: none"> <li>• manufacturer name and model of the tube</li> <li>• maximum rated tube potential (kVp) and current (mA)</li> <li>• maximum radiation dose rate at 1 metre from the surface of the tube housing or shielded enclosure (with all shutters closed)</li> </ul> <p><i>If a neutron generator tube is incorporated in the apparatus</i></p> <ul style="list-style-type: none"> <li>• the name of the radioactive substance</li> <li>• the model and serial number of the radioactive substance</li> <li>• the ISO classification of the radioactive substance</li> <li>• the activity of the radioactive substance and the date the activity was measured</li> <li>• the maximum radiation dose rate at 1 metre from the surface of the fixed industrial gauge (with all shutters closed).</li> </ul> <p>Note 1: The warning information must be black on a yellow background. The label must not be able to be obscured during normal handling and use.</p>



Test	Compliance Test	Criteria for Passing the Test
		Note 2: The information about the apparatus and tube must be in black, or dark, lettering.
D.1.4	Shutter or source control mechanism	<p>Unless otherwise approved by the chief executive for the particular device, the fixed industrial gauge must be provided with a radiation source control mechanism or shutter.</p> <p>If a shutter or source control mechanism is fitted, it must:</p> <ul style="list-style-type: none"> <li>(a) be in working order;</li> <li>(b) not be able to be locked in the unshielded, or operating position; and</li> <li>(c) be fail-safe.</li> </ul> <p>If the apparatus is shutterless, it must be durably marked to indicate that it is shutterless.</p>
D.1.5	Isolation of apparatus	The radiation apparatus must be provided with a lockable isolator which will prevent unintended radiation exposure.
D.1.6	Interlocks	The primary shielding must incorporate shutters or interlocks which will prevent access to the primary beam.
D.1.7	Access panels	<p>Access panels must be:</p> <ul style="list-style-type: none"> <li>(a) secured so that tools or keys are required to open them; and</li> <li>(b) interlocked so that the power supply to the primary beam is disconnected when the door is opened; and</li> <li>(c) labelled to warn of the presence of a radiation source within.</li> </ul>

## D.2 Requirements for a fixed industrial gauge incorporating a radioactive substance

The following table sets out the minimum test requirements for a sealed source apparatus used to carry out industrial gauging.

Test	Compliance Test	Criteria for Passing the Test
D.2.1	Radiation dose rate	<p>When the sealed source apparatus is locked in the shielded position, the radiation dose rates must not exceed:</p> <ul style="list-style-type: none"> <li>(a) 300 <math>\mu\text{Gy}\cdot\text{h}^{-1}</math> at any accessible point 5 centimetres from the external surface of the sealed source apparatus; and</li> <li>(b) 10 <math>\mu\text{Gy}\cdot\text{h}^{-1}</math> at any accessible point 1 metre from the external surface of the sealed source apparatus.</li> </ul>
D.2.2	Indicators	<p>The shielded and unshielded positions must be clearly and unambiguously indicated.</p> <p>The indicator must be protected against mechanical damage.</p> <p>If a mechanical indicator is used, the shielded and unshielded position markings must be readily discernable and not obscured by dust, precipitation, corrosion or paint.</p> <p>If an electrical indicator is used, it must:</p> <ul style="list-style-type: none"> <li>(a) include separate lamps or signals to indicate the shielded and unshielded conditions; and</li> <li>(b) be fail-safe.</li> </ul>

Test	Compliance Test	Criteria for Passing the Test
D.2.3	Informative label	<p>The external surface of the sealed source apparatus must be durably and legibly marked with a label or labels incorporating the following information in a conspicuous location:</p> <ul style="list-style-type: none"> <li>• the radiation warning sign (trefoil)</li> <li>• the word 'caution' or 'warning'</li> <li>• words to the general form of 'radioactive material'</li> </ul> <ul style="list-style-type: none"> <li>• name and address of the supplier or manufacturer of the apparatus</li> <li>• make, model and serial number of the apparatus</li> <li>• maximum radiation dose rate at the surface, and at 1 metre from the surface, of the sealed source apparatus (with shutters closed) and the date the measurement was made</li> </ul> <ul style="list-style-type: none"> <li>• the name of the radioisotope</li> <li>• the model of the sealed radioactive substance</li> <li>• the activity of the radioactive substance and the date the activity was measured</li> <li>• serial number of the sealed radioactive substance</li> </ul> <p>Note 1: The warning information must be black on a yellow background. The label must not be able to be obscured during normal handling and use.</p> <p>Note 2: The information about the sealed source apparatus and radioactive substance must be in black, or dark, lettering.</p>
D.2.4	Shutter or source control mechanism	<p>Unless otherwise approved by the chief executive for the particular device, the sealed source apparatus must be provided with a radiation source control mechanism or shutter.</p> <p>This shutter or source control mechanism must be:</p> <p>(a) in working order; and</p> <p>(b) fail-safe.</p> <p>If the apparatus is shutterless, it must be durably marked to indicate that it is shutterless.</p>
D.2.5	Shutter function	<p>The radiation source control mechanism or shutter must be provided with a means of being secured in the shielded position.</p> <p>The sealed source apparatus must not be able to be locked in the unshielded, or operating position.</p>
D.2.6	Handling features	<p>The sealed source apparatus must be provided with the means to enable safe handling of the apparatus during installation and maintenance to minimise risk of radiation exposure and accidental damage which may affect the integrity of the housing or operation.</p>

## E. Requirements for sealed source apparatus used to carry out borehole logging

The following table sets out the minimum test requirements for sealed radioactive substances in sealed source apparatus used to carry out borehole logging. It excludes borehole logging apparatus which uses a neutron generator as its radiation source.

Test	Compliance Test	Criteria for Passing the Test
E.1	Radiation source fixed in sealed source apparatus	The sealed source apparatus must have the means to ensure that the radioactive substance is able to be fixed and locked to prevent loss, dislodgment or removal of the substance by an unauthorised person.
E.2	Radiation dose rate	If the sealed source apparatus also serves as the transport/storage container, the radiation dose rates must not exceed: <ul style="list-style-type: none"> <li>(a) 1000 <math>\mu\text{Gy}\cdot\text{h}^{-1}</math> at any point 5 centimetres from the external surface of the apparatus; and</li> <li>(b) 50 <math>\mu\text{Gy}\cdot\text{h}^{-1}</math> at any point 1 metre from the external surface of the apparatus.</li> </ul>
E.3	Informative label	For a Type A borehole logging tool, the external surface of the apparatus must be durably and legibly marked with a label or labels incorporating the following information in a conspicuous location: <ul style="list-style-type: none"> <li>• the radiation warning sign (trefoil)</li> <li>• the word 'caution' or 'warning'</li> <li>• words to the general form of 'radioactive material'</li> <li>• name and address of the supplier or manufacturer</li> <li>• name, address and telephone number of the owner</li> <li>• identification number of the container</li> <li>• maximum radiation dose rate at 1 metre from the surface of the probe</li> <li>• the name of the radioisotope</li> <li>• the model of the sealed radioactive substance</li> <li>• the activity of the radioactive substance and the date the activity was measured</li> <li>• serial number of the sealed radioactive substance</li> </ul> <p>Note 1. The warning information must be black on a yellow background. The label must not be able to be obscured during normal handling and use.</p> <p>Note 2. The information about the sealed source apparatus and sealed radioactive substance must be in black, or dark, lettering.</p>
E.4	Mechanism for attachment of apparatus	The mechanism for attaching the sealed source apparatus to a wireline or drill string must: <ul style="list-style-type: none"> <li>(a) be able to be determined easily;</li> <li>(b) be protected against unintentional release of the tool;</li> <li>(c) be made of wear resistant material;</li> <li>(d) not be worn; and</li> <li>(e) be in good working order.</li> </ul> <p>Note: The mechanism includes all cables and connectors.</p>

## F. Requirements for sealed source apparatus used to carry out moisture/density measurements

The following table sets out the minimum test requirements for sealed radioactive substances incorporated in sealed source apparatus used to carry out moisture/density measurements.

Test	Compliance Test	Criteria for Passing the Test
F.1	Radiation source fixed in sealed source apparatus	The radioactive substance must not be capable of being physically separated from the sealed source apparatus under normal operational, transport and storage conditions.
F.2	Radioactive substance assembly	<p>The radioactive substance assembly must be capable of being definitively located in:</p> <p>(a) the correct operating positions; and</p> <p>(b) the shielded position.</p> <p>The radioactive substance assembly in the sealed source apparatus must be able to fully retract into the shielded position without jamming or sticking.</p>
F.3	Radiation dose rate	<p>When the radioactive substances are in the shielded position, the radiation dose (equivalent) rates must not exceed:</p> <p>(a) 250 <math>\mu\text{Gy}\cdot\text{h}^{-1}</math> at any point 5 centimetres from the external surface of the sealed source apparatus; and</p> <p>(b) 10 <math>\mu\text{Gy}\cdot\text{h}^{-1}</math> at any point 1 metre from the external surface of the sealed source apparatus.</p>
F.4	Informative label	<p>The external surface of the sealed source apparatus must be durably and legibly marked with a label or labels incorporating the following information in a conspicuous location:</p> <ul style="list-style-type: none"> <li>• the radiation warning sign (trefoil)</li> <li>• the word 'caution' or 'warning'</li> <li>• words to the general form of 'radioactive material'</li>   <li>• name and address of the supplier or manufacturer of the apparatus</li> <li>• serial number of the apparatus</li> <li>• maximum radiation dose rate at the surface, and at 1 metre from the surface, of the sealed source apparatus (with radioactive substances in the shielded position) and the date the measurement was made</li>   <li>• the name of the radioisotope</li> <li>• the activity of the radioactive substance and the date the activity was measured</li>   <li>• name, address and telephone number of the owner</li> </ul> <p>Note 1: The warning information must be black on a yellow background. The label must not be able to be obscured during normal handling and use.</p> <p>Note 2: The information about the sealed source apparatus and radioactive substance must be in black, or dark, lettering.</p>
F.5	Shutter lock	The radioactive substances in the sealed source apparatus must be able to be locked in the shielded, or 'beam off' position. It must not be possible to lock the radioactive substances in the 'beam on' position.

## G. Requirements for radiation apparatus and sealed source apparatus used to carry out sterilisation

The following table sets out the minimum test requirements for a gamma irradiator, an electron beam irradiator or an X-ray irradiator used to carry out sterilisation, disinfestation, decontamination and other related purposes.

These tests do **not** apply to self-contained irradiators, that is, devices used for irradiating things for purposes such as specialist radiation-related research studies or blood sterilisation in which the source of radiation is securely enclosed within a device, and in which the shielding required for the safe operation of the device, and the safe and secure storage of the radioactive substance when the device is not in use, is an integral part of the device.

Note: 'sterilisation' includes disinfestation and decontamination.

Test	Compliance Test	Criteria for Passing the Test
G.1	Control label	<p>The control panel or console must be easily identifiable as being part of the irradiator.</p> <p>Each control must be clearly and unambiguously labelled according to its function.</p>
G.2	Sequentially interlocked controls	<p>Sequentially interlocked controls must be provided for personnel access, irradiation room lockup sequence, and source energising or exposing operations.</p> <p>The controls must be designed such that any attempt to pre-empt or apply the controls out of sequence will automatically stop the intended operation.</p>
G.3	Single multipurpose key	<p>A single multipurpose key must be provided to operate the irradiator during normal use. This key is to be required to operate the control console, to gain access to the radiation room, and to actuate the safety delay timer.</p> <p>The key must be attached to a portable radiation survey meter or audible warning device by a chain or cable long enough to allow easy operation of all key switches.</p> <p>The portable radiation survey meter must be functional.</p> <p>When the irradiator is fully operational, it must not be possible to remove the single multipurpose key without aborting, or shutting down, irradiator operation.</p>
G.4	Emergency stop device on control console	<p>An emergency stop device must be provided at the control console that prevents, quickly interrupts, or shuts down irradiator operations and returns the radiation source to the de-energised condition, or radioactive substance to the fully shielded position, at any time.</p> <p>This function must be verified.</p> <p>This emergency stop device must be conspicuous, clearly labelled and provided in addition to any other means typically provided at a control console to shut down an irradiator.</p>
G.5	Product entry and exit port interlocks	<p>Physical means must be provided on product entry and exit ports to prevent entry of personnel into the irradiation room when the radiation source is energised or not in the fully shielded position.</p>
G.6	Termination of exposure	<p>If the entry or exit port control mechanism malfunctions, the irradiator must immediately return automatically to the de-energised condition, or radioactive substance to the fully shielded condition.</p>
G.7	Audible/visible alarm – entry and exit port control mechanism	<p>An audible and visible alarm must be provided to indicate when an entry or exit port control mechanism has failed or malfunctioned.</p>

Test	Compliance Test	Criteria for Passing the Test
G.8	Source status indicators – control console	Source status indicators must be provided at the control console to indicate when the irradiator: (a) is fully energised or in source-in-use status; and (b) is in the de-energised condition or when radioactive substances are not fully shielded (e.g. during movement of source); and (c) is fully shut down or radioactive substances are fully shielded
G.9	Irradiator guard	The radiation source must be provided with adequate mechanical protection to prevent interference from items such as product boxes or carriers. For example, this may take the form of a protective shroud, guide bars, or floor guides on the product positioning system.  Product positioning systems must not be able to apply force directly or indirectly to the radiation source.
G.10	Product positioning system	The product positioning system must be provided with controls that detect a malfunction of that system and, in the event of a malfunction: (a) cause the radiation source to return automatically to the de-energised condition, or the radioactive substance to the fully shielded position; and (b) the irradiator to shut down.
G.11	Visible and audible warning – source status indicator	The following warning signals must be provided: (a) a source status indicator (e.g. warning light) must be visible at each personnel or product entry and exit port in the radiation shield to indicate when the radiation source is energised or radioactive substance is not fully shielded; and (b) a warning signal, which is audible both inside the irradiation room and at all access ports, to indicate when the radiation source is changing status.
G.12	Radiation warning label	A clearly visible sign bearing a radiation warning sign (trefoil) and the word “warning” or “caution”, must be fixed to the irradiator in clearly visible locations.  The lettering and symbol must be in black on a yellow background.
G.13	Radiofrequency fields	Radiofrequency radiation levels produced as a result of the carrying out of the practice must, in accessible areas, comply with the requirements of <i>Standard for Limiting Exposure to Radiofrequency Fields – 100 kHz to 300 GHz (2021)</i> , published by ARPANSA.
<b>Additional requirements for gamma irradiators</b>		
G.14	Radiation monitor	Fixed radiation monitors with audible alarms must be located to detect any radiation at the product exit port.  This monitoring system must be interlocked with the irradiator controls so that, if radiation at the exit port exceeds a predetermined level,: (a) the conveyor which carries product from the radiation room to the exit port stops; and (b) the radioactive substance returns automatically to the fully shielded position.
G.15	Source operation – malfunction	If a malfunction occurs in the source operation: (a) the radiation substance must immediately return automatically to the fully shielded condition; and (b) the irradiator must shut down.
G.16	Disconnection of the motive power	A mechanism must be provided to disconnect the motive power used to expose the source, so that servicing can be carried out without the danger of the source being inadvertently exposed.

Test	Compliance Test	Criteria for Passing the Test
		It must be possible to definitively secure this mechanism in the disconnected position.
G.17	Source holder	The source holder mechanism must be actively secured in the irradiation position (i.e. some force must be applied to keep the sources in that position).
<b><i>Additional requirements for electron beam or X-ray irradiators</i></b>		
G.18	Control console	Operating parameters must be able to be adjusted and displayed at the control console.  The operating parameters that must be displayed are those that determine the energy of the primary beam and which influence the radiation dose received by the product being irradiated.
G.19	Coupling of safety interlock circuits	The control system must couple in series the facility interlock circuits with the radiation producing circuits so that radiation cannot be produced until the interlock system has been completely engaged.
G.20	Panels and shields	All inspection panels and all removable shields must be interlocked.  When one of these interlocks is disengaged, operation must be able to resume only after manually re-engaging the interlock at the location where the interlock was disengaged.
G.21	Warning labels – panels, shields and interlocks	All inspection panels, removable shields, and interlocks must be posted with appropriate warning labels advising of their intended function, where this is pertinent, and of the hazards which might occur if they are removed.

## Section 3 – Specific Requirements – Sealed Radioactive Substances

### A. Performance and classification

The radioactive substance used in carrying out a radiation practice described in Column 1 of Table 1 must satisfy the requirements described in Column 2 of Table 1.

Table 1 Requirements for the sealing of radioactive substances

Column 1	Column 2
Radiation practice	Requirement <sup>Note 1</sup>
Borehole logging	<p>The sealing of the radioactive substance must:</p> <ul style="list-style-type: none"> <li>(a) satisfy the requirements of ISO 2919 or equivalent; and</li> <li>(b) satisfy the 'special form' design and test requirements of the Transport Code.</li> </ul> <p>For a sealed source that emits gamma or neutron radiation, the minimum sealed source performance classification is:</p> <ul style="list-style-type: none"> <li>(a) 56522 for a sealed source used for oil or gas well logging; or</li> <li>(b) 54422 for a sealed source used for other than oil or gas well logging.</li> </ul>
Calibration	<p>For a radioactive substance with an activity greater than 1 MBq, the sealing of the radioactive substance must satisfy the requirements of ISO 2919 or equivalent.</p> <p>The minimum sealed source performance classification is 22212.</p> <p>Note 1: This requirement does not apply to a calibration source with an activity of 1 MBq or less.</p> <p>Note 2: For the purpose of this requirement 'calibration' includes consistency checks, operational or other checks for the correct response of devices.</p>
Chemical or physical analysis	<p>The sealing of the radioactive substance must satisfy the requirements of ISO 2919 or equivalent.</p> <p>The minimum sealed source performance classification is 33222.</p>
Industrial gauging	<p>The sealing of the radioactive substance must:</p> <ul style="list-style-type: none"> <li>(a) satisfy the requirements of ISO 2919 or equivalent; and</li> <li>(b) satisfy the 'special form' design and test requirements of the Transport Code.</li> </ul> <p>For a sealed source that emits medium or high energy gamma radiation, the minimum sealed source performance classification is:</p> <ul style="list-style-type: none"> <li>(a) 43232 for a source that is contained in a sealed source apparatus when in use; or</li> <li>(b) 43333 for a source that is not protected when in use.</li> </ul> <p>For a sealed source that emits low energy gamma radiation or beta radiation, the minimum sealed source performance classification is 33222.</p> <p>For a sealed source that emits neutron radiation the minimum sealed source performance classification is 43323.</p>
Industrial radiography	<p>The sealing of the radioactive substance must:</p> <ul style="list-style-type: none"> <li>(a) satisfy the requirements of ISO 2919 or equivalent; and</li> <li>(b) satisfy the 'special form' design and test requirements of the Transport Code.</li> </ul> <p>The minimum sealed source performance classification is:</p> <ul style="list-style-type: none"> <li>(a) 43515 for a sealed source that is outside of a sealed source apparatus when in use;</li> </ul>



Column 1	Column 2
Radiation practice	Requirement <sup>Note 1</sup>
	<p>or</p> <p>(b) 43313 for a sealed source that is contained in a sealed source apparatus when in use.</p>
Medical applications	<p>The sealing of a radioactive substance used for gamma teletherapy, brachytherapy, or in a surface applicator must satisfy the requirements of ISO 2919 or equivalent.</p> <p>The minimum sealed source performance classification is:</p> <p>(a) 53524 for a sealed source used for gamma teletherapy;</p> <p>(b) 53211 for a sealed source used for brachytherapy; or</p> <p>(c) 43312 for a sealed source used in a surface applicator.</p>
Moisture/density measurements	<p>The sealing of the radioactive substance must:</p> <p>(a) satisfy the requirements of ISO 2919 or equivalent; and</p> <p>(b) satisfy the 'special form' design and test requirements of the Transport Code.</p> <p>The minimum sealed source performance classification is 43333.</p>
Sterilisation or product irradiation	<p>The sealing of the radioactive substance must satisfy the requirements of ISO 2919 or equivalent.</p> <p>A sealed source used in a self-contained irradiator (Category I irradiator) must have:</p> <p>(a) a minimum sealed source performance classification of 43323; and</p> <p>(b) a minimum bend test classification of 4, as specified in ISO 2919.</p> <p>A sealed source used in a gamma irradiator (Category IV irradiator) must have:</p> <p>(a) a minimum sealed source performance classification of 53424; and</p> <p>(b) a minimum bend test classification of 5, as specified in ISO 2919.</p>

Note 1: The 5 digits of the ISO 2919 sealed source performance classification are class numbers which describe the required performance for temperature, external pressure, impact, vibration and puncture respectively.

## B. Recommended working life

A radioactive substance used in carrying out a radiation practice described in Column 1 of Table 1 that has reached the end of its recommended working life as stated on the sealed source certificate required by ISO 2919 or equivalent, must have an assessment undertaken as approved by the chief executive to verify that the radioactive substance is fit for continued use.

The assessment must include:

- (a) an inspection and a technical assessment of the radioactive substance;
- (b) leakage and/or contamination testing of the radioactive substance;
- (c) a review of the design safety for the radioactive substance in the context of the particular radiation practice for which it is used; and
- (d) a determination of when any reassessment of the sealed radioactive substance will be required, stating the date by which the reassessment must be commenced.