Department of Health and Human Services
Population Health

Radiation Protection Act 2005 – Section 17

CERTIFICATE OF COMPLIANCE:

STANDARD FOR SEALED RADIATION SOURCE -

IN STREAM ANALYSIS

SECTION 1: REQUIREMENTS FOR CERTIFICATES OF COMPLIANCE FOR CLASSES OF RADIATION SOURCES

SECTION 2: PARTS OF STANDARDS AND CODES OF PRACTICE ADOPTED BY THIS STANDARD

This information can also be accessed at
http://www.dhhs.tas.gov.au/peh/radiation_protection

Radiation Protection Unit
90 Davey Street
HOBART TAS 7000

Phone 03 6222 7256
Fax 03 6222 7257
Email
radiation.protection@dhhs.tas.gov.au

Section 1 – REQUIREMENTS FOR CERTIFICATES OF COMPLIANCE FOR CLASSES OF RADIATION SOURCES

This Standard is to be used when assessing Radiation Sources, classified by Radiation Protection Act 2005 licences as "Sealed in stream analysis", for the purpose of issuing a certificate of compliance.

In order for a certificate of compliance to be issued the Radiation Source must be shown to fully comply with the requirements in Section 2.

Some items only need to be shown to comply every two years from the date of the first certificate of compliance issued for a particular radiation source.

† **Where an item was demonstrated to comply at the time of manufacture or supply, ongoing compliance for that item may be stated only if it is reasonable to assume there has been no change, modification, damage or unacceptable wear and tear to that item since the time of manufacture.**

The requirements in Section 2 are taken from the following:

RPS 13 *Code of Practice for Safe Use of Fixed Radiation Gauges (2007).*
ISO *ISO 9978: 1992 (E) International Standard.* Radiation protection – Sealed radioactive sources – Leakage test methods

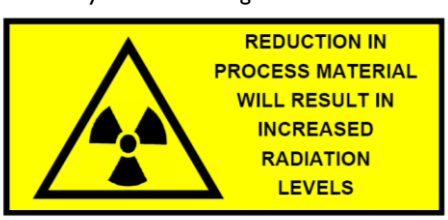
Section 2 – PARTS OF STANDARDS AND CODES OF PRACTICE ADOPTED BY THIS STANDARD

ITEM	**Requirements**
Radioactive Sources	
Only appropriate sources †	Radioactive material used in an in stream analysis probe must be appropriate for the particular application, with regard to its activity, half-life, energy and type of radiations emitted. ***RPS 13* B1.1 (a)**
Toxicity †	The radioactive source must not be a radioactive material of high committed effective dose per unit of intake activity (Sv Bq^{-1}), such as those listed below, unless: (i) it is necessary for the production of neutron radiation for the particular gauging use; or (ii) a radioactive material of low committed effective dose per unit of intake activity, that produces radiation of the required type and energy for the particular gauging application, is unavailable or is otherwise impracticable for use as the source. **Radioactive materials of high committed effective dose per unit of intake:** ^{210}Pb, ^{210}Po, ^{226}Ra, ^{228}Ra, ^{227}Ac, ^{228}Th, ^{230}Th, ^{231}Pa, ^{232}U, ^{233}U, ^{234}U, ^{237}Np, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, ^{241}Am, ^{243}Am, ^{242}Cm, ^{243}Cm, ^{244}Cm, ^{245}Cm, ^{246}Cm, ^{249}Cf, ^{250}Cf, ^{252}Cf ***RPS 13 B1.1 (b)***
Chemical and physical form †	The radioactive material must be in a chemical and physical form that, throughout the projected useful life of the in stream analysis probe in which it is used, will minimise: (i) corrosion and build up of internal pressure; and (ii) dispersal and solubility of the radioactive material if the source capsule is ruptured. ***RPS 13* B 1.1 (c)**
Minimum activity †	The radioactive material must not have an activity that is greater than necessary to ensure that the in stream analysis probe operates effectively during its projected useful life and the activity will depend on the: (i) effective radiation path length between the source and detector; and (ii) detector sensitivity and the proposed conditions of its use, where an allowance may be made for a 25% loss of detection sensitivity during the lifetime of the in stream analysis probe; and (iii) shielding effects of intra-beam material; and (iv) half-life of the radioactive material used. ***RPS 13* B 1.1 (d)**

Radioactive source encapsulation †	Each radioactive source used in an in stream analysis probe must be: (a) a sealed source of durable design and construction; and (b) readily identifiable by use of appropriate markings and documentation. ***RPS 13* B 2.1** The form and working life of each source used in an in stream analysis probe must be suitable for: (a) the particular application; and (b) the useful life of the in stream analysis probe; and (c) environmental conditions of its use. ***RPS 13* B2.2** The outermost capsule of a radioactive source that is used in an in stream analysis probe (located inside a source container) must satisfy the American National Standard N 452.1977 (NBS Handbook 126) if the source pre dates 2000. ***RPS 13* B 2.4** For radioactive sources post 2000 they must satisfy ISO (International Standard) 2919-1999(E); Note: A radioactive source that complies with the 'special form' design and test requirements of the IAEA (International Atomic Energy Agency) would satisfy the ISO test requirements. ***RAR***
Source Containers	
Construction requirements for a source container	
Shielding with depleted uranium †	Radiation source containment that incorporates depleted uranium in its construction must be durably marked to: (a) warn of the presence of depleted uranium; and (b) indicate the quantity incorporated; and (c) provide information on the relevant physical (i.e. may spontaneously catch fire when finely divided) and radiological safety requirements. ***RPS 13* C1.1**
Useful beam aperture †	The useful beam aperture in the shielded container for a radioactive source or the tube housing for a tube insert must be limited to a size no larger than necessary for the effective operation of the in stream analysis probe. ***RPS 13* C1.2**
Collimator requirements †	Where a collimator insert or diaphragm is required to limit the size of the useful beam, such a modification must: (a) only be fitted by the manufacturer or authorised service representative; and (b) not interfere with the effective operation of the in stream analysis probe; and (c) not reduce the shielding properties or other safety features of the containment. ***RPS 13* C 1.3**
Means for terminating exposure †	The in stream analysis probe must have a shutter, and/or a means of moving the source to a safe position**. Note an external transport and storage shutter (biscuit) is acceptable for this purpose.** ***RPS 13* C 1.4**

Exposure rates	When the source container is loaded with the source of greatest activity for which it is designed, the radiation level must not exceed 500 µSv/h at any point 5 cm from the external surface and 10 µSv/h at any point 1 metre from its surface. Determination of these radiation levels are to be made with the shutter or source control mechanism in the beam off position. ***RPS 13 C2.3***
Temperature variation while source container is in use †	The in stream analysis probe must be designed to withstand variations of temperature to which it may be subjected in use, without deterioration either of containment or ease of operation of the shutter or source control mechanism that may be fitted; and with due consideration given to brittle fracture of the materials used. ***RPS 13* C 1.8 (a) (d)**
Lifting attachments for the source container †	The in stream analysis probe must be designed so that when any incorporated lifting attachments are used in the intended manner, they do not impose damaging stresses on the structure of the source container, shielded tube housing or shielded enclosure. ***RPS 13* C 1.8 (b)**
Quality of welding and brazing used in constructing the source container †	Any welded, brazed or similar joint must: (a) be in accordance with published standards (AS2205.1 to AS2205.10) ***RPS 13* C 1.9**
Damage to the source container from vibration, acceleration and vibration resonance †	The in stream analysis probe must be designed and constructed so that it can withstand the effects of all vibrations, acceleration and vibration resonance likely to arise during its use, without damage, or reduction in ease of operation of the shutter, where fitted, or source control mechanism. ***RPS 13* C 1.8 (c)**
Compatibility of materials used in constructing the source container †	The in stream analysis probe must be constructed of materials that: (a) are physically and chemically compatible with each other and, where applicable, the materials of the radioactive sources that it is designed to contain; and (b) can withstand the effects of prolonged irradiation without significant deterioration of any physical properties necessary for the safety of the in stream analysis probe; and (c) are resistant to corrosion or other physical or structural damage which may occur during the use, transport and storage of the in stream analysis probe. ***RPS 13* C 1.10**
Manual and mechanical handling for the source container †	The in stream analysis probe must be provided with features to maintain safe: (a) manual handling, if it has a gross mass of 10 kilograms to 50 kilograms; or (b) mechanical handling, if it has a gross mass of greater than 50 kilograms. ***RPS 13* C 1.11**

Labels and markings required on the source container	Each label located on an in stream analysis probe must be made of a material that can withstand the long-term effects of corrosion and general exposure to the environment in which it is to be used. ***RPS 13* C 1.14**
Marked with trefoil and CAUTION or WARNING	The in stream analysis probe must be durably marked with a legibly stamped or engraved label incorporating the trefoil radiation hazard symbol followed by words of the general form: "Radiation Source, In stream analysis probe". ***RPS 13* C 1.12** The symbol and markings on the label specified above must be black on a yellow background. ***RPS 13* C 1.13**
Information required on the durable label on an in stream analysis probe	The durable label on the in stream analysis probe must contain the following information: (a) manufacturer name, model and serial number of the in stream analysis probe and/or container (b) * name and address of the source supplier and/or manufacturer; (c) name of the radioactive material (d) serial number of the radioactive source (e) * model and serial number of the radioactive source (f) * ISO class number of the radioactive source (g) original activity of the radioactive source and date the activity was measured (h) maximum radiation dose rate at one metre from the surface of the source container (with all shutters closed) and date this measurement was made. ***RPS 13* C2.5** * **Note this requirement does not apply to gauges manufactured prior to 1 January 2008**
Immersed In stream analysis probe	If the source is immersed or covered by the material being gauged during the normal operation of the device: (a) the containment must be designed so that loss of the material and the shielding that it provided does not result in the radiation levels exceeding 500 micro Sv/h at 5 cm from the surface of the gauge and 10 micro Sv/h at any point 1 metre from its surface; and (b) the gauge must be durably marked with a legibly stamped or engraved label incorporating the trefoil radiation hazard symbol followed by words of the general form of those given below:  ***RPS 13* C 4.5 (a), (b), (c)**

	If the material being gauged provides shielding for accessible areas: (a) the loss of the material must not result in the direct radiation beam becoming accessible; and (b) the gauge must be durably marked with a legibly stamped or engraved label incorporating the trefoil radiation hazard symbol followed by words to the general form of those given in Figure below  ***RPS 13* C 4.6 (a) (b), (c)**
	If any moving part represents a risk of damage to the radiation source, a suitable protective guard or stop must be fitted between the source and moving part to prevent damage of the source from occurring. ***RPS 13* C 4.7** Such a protective guard or stop must be designed so as to: (a) prevent loss of the source from the containment; and (b) enable safe retrieval of the source if dislodged from the normal position. ***RPS 13 C* 4.8** In those devices where the source is immersed in a flowing liquid and could be carried away if dislodged, a suitable trap must be fitted to prevent loss of the source downstream. ***RSP 13 C* 4.9**
Test for non fixed contamination	The source holder (spider and areas near by) is to be wipe tested [1] for the presence of non-fixed radioactive contamination. **Note many XRF type sources have thin windows that could be damaged if wiped. Wipe testing is only to be carried out by a person authorised by a licence or other authority to do such testing.** **A wipe test taken and analysed 3 months prior to issuing a certificate of compliance is acceptable for the purpose of complying with this requirement.** ***Compliance for this item must be demonstrated every two years from the date of the original certificate of compliance for a radiation source*.** ***RAR***
Non fixed contamination levels	Non fixed contamination levels must not exceed those specified in ISO 9978. **RAR**
Preventative maintenance	The source container must be inspected to ensure all control mechanisms operate properly. ***RAR***
Presence of moisture and corrosion	The internal parts of the in stream analysis probe in regions near the source must be inspected for the presence of corrosion or other damage due to moisture. If damage due to moisture and corrosion is likely to affect the source integrity, the source must be removed for

[1] **WIPE TEST** is based on taking with wet or dry tissue possible radioactive contamination from source surface. The tissue may be wetted with water, diluted nitric acid or another solution inactive for capsule material but actively removing radioactive contamination. If measured activity of tissue does not exceed 185 Bq (5 nCi) the source surface proves to be non-contaminated.

	further testing or storage. ***Compliance for this item must be demonstrated every two years from the date of the original certificate of compliance for a radiation source*** ***RAR***
Corrosion and damage to source identification labelling	The markings on a source required for its identification must be viewed and assessed to be legible. If corrosion or other damage is occurring this must be recorded on the assessment report. ***Compliance for this item must be demonstrated every two years from the date of the original certificate of compliance for a radiation source*** ***RAR***
Moisture alarm	Where a moisture alarm is fitted between an outer and inner window it must be demonstrated to function and provide the necessary alerts to an operator. ***Compliance for this item must be demonstrated every two years from the date of the original certificate of compliance for a radiation source*** ***RAR***