

INFORMATION SHEET 3

RPA Leak Testing Service



Legislative Requirements

Regulation 27 (3) of the Ionising Radiations Regulations 1999 (IRR99), requires that radioactive sources (not gaseous type) are tested for leakage of radioactive material at suitable intervals. This is amplified in non-statutory guidance, which states that sealed sources should normally be leak tested at least once in any 2 year period. Additional leakage tests should be made when damage to the source is suspected, or when maintenance is carried out that could affect the containment of the source. Similarly more frequent leakage tests may be necessary if the source has been in use for longer than its recommended working life. The leakage tests must conform to the method as set out in section 5.3.1 of the International Standard ISO 9978: 1992. The currently accepted pass/fail for the measured activity from a leakage test is 200 Bq. Leakage test results must be kept by the employer for two years.

NOTE:

Regulation 27 of the IRR99 does not apply only to "sealed sources"; it applies equally to "...articles containing or embodying radioactive substances". Some sources – such as plated nickel-63 or surface adsorbed tritium (Hydrogen 3) used in gas chromatography - do sometimes show evidence of leakage. With these sources, an appropriate leakage pass/fail judgement can be made by comparing actual source leakage/dispersal to the relevant notification values shown in Schedule 8 of IRR99.

Leak test methods

The leakage test methods employed will vary depending on the particular source type and location. However, in most cases a simple source wiping method is used, where an absorbent material is used for a direct wipe over the actual source capsule/holder; the material used is often moistened with water or solvent to aid transfer of any radioactive material. The swab/wipe is then placed under a suitable detector which would identify any transferred radioactive material.

Other considerations that have to be taken into account when choosing which method of leak test to use are the potential dose rate hazard and the accessibility of the source. Further information on these considerations and other factors is contained in Table 2 below.

Different types of alpha sources

Alpha foil type sources are typically employed in static eliminators and smoke detectors. The activities can vary widely from a few tens of kBq to a few GBq.

Taking care of fragile alpha sources

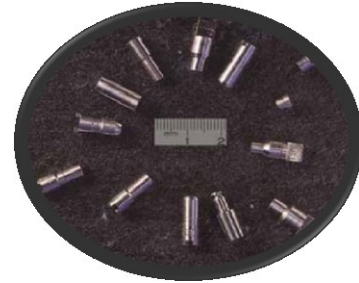
As alpha particles are only very weakly penetrating, the containment is normally at a minimum; otherwise it would absorb any alpha particles before they could be used. Foil type alpha sources are therefore very delicate, and must be protected against physical abrasion and any corrosive type atmospheres. These sources must not be tested using the direct swab method.

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Different types of beta and bremsstrahlung sources

Beta sources are typically used in thickness, density and backscatter gauges. The activities used can range from a few MBq up to several GBq. The types of beta sources can be split into broadly different groups as follows:-

- Low energy beta (i.e. thallium-204 and promethium-147)
- K-electron capture (nickel-63)
- Higher energy beta sources (strontium-90/Y-90 or phosphorus-32)
- Bremsstrahlung sources



Different types of gamma sources

Gamma ray sources are used for several different types of monitoring and process control. A few different types of gamma sources are referred to below.

Low energy gamma sources (less than 100 keV)

Americium-241 is a typical low energy gamma radiation source (60 keV).

Medium and high energy gamma sources (100-500 keV and above 500 keV)

Caesium-137 (660keV) and Iridium-192(Various energies) are high and medium energy gamma emitters.

Neutron sources

These types of sources are those found in moisture or density gauges. They normally generate neutrons from two elements e.g. radium/beryllium (older type) or americium/beryllium.





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TABLE 1

Examples of different types of radiation sources

Group	Example/physical description	Comments
Alpha	Americium-241: foil	Used in static eliminators and smoke detectors, fragile
Alpha	Polonium 210: foil	Used in static eliminators, fragile
Beta	Krypton-85: gas	Sealed in gas-tight containers, not wipe tested
Beta	Thallium-204/Promethium-147:foil	Used in backscatter/density gauges, fragile
Electron capture	Nickel-63: foil	Used in gas chromatographs, fragile
Beta	Strontium-90/Y-90 or carbon-14:foils, pellets or chemical salts	Various applications
Bremsstrahlung sources	Produced from low energy beta: foil, pellet or plastic	Used in analysers
Gamma	Americium-241:electro deposited type, ceramic	Used in gauges
Gamma	Caesium-137: double-walled welded steel containment	Used in gauges/density measurement
Neutron	Polonium-210(beryllium) or Americium – 241(beryllium)	Used in moisture determination



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TABLE 2

Suggested methods for leak testing sources

Appropriate wipe test method	Would fit	Comments
A wipe of the radioactive source (capsule/holder).	Relatively low dose rate source and welded steel type construction sealed sources.	This is appropriate test as the source will not be damaged by the wipe test, and dose rates are low.
A wipe of surfaces in the vicinity of the source, or a component that frequently comes into contact with the source.	Fragile type source or high dose rate.	Appropriate if high dose rates are very likely, or if wiping the source would cause damage.
A wipe test of the exterior of the shutter mechanism, source housing, source holder or the exterior of the equipment in which the source is installed.	Source installed inside equipment, eg density/level gauges and analytical equipment.	Close up access is not possible. Caution, as anyone wishing to gain much closer access to the source may encounter significant contamination.
Wipe of the exhaust vents (or source housing/pipes) of electron capture units.	Electron capture units such as nickel-63 gas used in chromatography units and other sniffer type devices.	Access to source is not normally possible. Some contamination may be detected on the vents and other surfaces due to heating effects (fragile foil).



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Leak Testing Services

Our leak testing service can cover tests on most types of sources. We offer a quick and professional service at a very competitive price. For further details please enquire through our RAPAS web site, or by email or telephone.



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