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## TESTING OF CONTAINER SEALING METHODS FOR RA-226 MEASUREMENTS USING HPGE DETECTORS

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The measurements of Ra-226 are often performed using gamma-ray spectrometry. These measurements are however usually not direct. In most cases, progeny radionuclides, such as Bi-214 and Pb-214 are used to calculate the Ra-226 activity. An important condition ensuring accuracy of these measurements is the secular equilibrium between Rn-222 and its progenies. This condition can be met by the use of tight containers or application of appropriate sealing methods. The tightness of the containers should be tested and the leakage rate should be included in the uncertainty budget of each Ra-226 measurement result.

A proficiency testing exercise on measurements of naturally occurring radionuclides (including Ra-226) in building materials was organised by the EC JRC-Geel. Laboratories participating in the study were asked to fill in a registration survey. In total, 108 answers were collected. Out of the 103 laboratories who reported using gamma-ray spectrometry, 72 indicated using a container sealing method. Among the most popular methods were sealing with different types of tape and parafilm. Only 25 laboratories confirmed testing the radon tightness of the containers used.

In order to assess the performance of some of the reported sealing methods a series of tests was conducted using Rn-222 gas. Two types of containers were used - a wide-mouth polypropylene container (Nalge Nunc International, USA) and a custom-made Teflon container with a rubber o-ring. The Rn-222 gas was transferred into the containers using a syringe. The polypropylene containers were sealed using three different methods - with an insulation tape, with parafilm and with paraffin disc topped with liquid paraffin. Measurements were performed using a radon chamber connected to an Alpha-Guard and high-purity germanium (HPGe) detectors.

The results show that the tape or parafilm sealing, if applied alone, does not stop the Rn-222 leakage. The best method out of the ones tested was use of Teflon containers or polypropylene containers and paraffin disc with liquid paraffin. The latter method is used routinely at the SCK CEN (Belgium) and was retained as the best option for use with relatively large volume samples in which, next to Ra-226, also other gamma emitters have to be measured with a requested sensitivity. The sealing with paraffin was also introduced as an alternative for mixing the sample with active charcoal, another method used to trap Rn-222 in the sample material and counting beaker. The method with active charcoal however is not applicable to liquid samples.

To promote the use of a method for testing Rn-tightness to monitoring laboratories it should be simple and easy to apply. The recommended method, which will be described, consist of following the decay of Rn-222 in a water sample using an HPGe detector. The radon-rich water can either come from a natural source or be induced by placing a water-tight Ra-226 source in the water for some time.

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