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International Rn-222 in drinking water interlaboratory comparison

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Content

Radon in domestic water supplies can cause human exposure to a radiation dose through inhalation and ingestion.
In 2013, the European Commission published a Directive (ECDWD) outlining requirements for the protection of the health of the general public with regard to radioactive substances in water intended for human consumption. This Directive states that remedial action is deemed to be justified on radiological protection grounds where radon activity concentrations in drinking water exceed 1000 Bq/l. It also states that the measurement technique must be "reliable and comparable" and "have a system of analytical quality control that is subject to checking".
The Environmental Protection Agency, Ireland (EPA) has a radon in water measurement technique accredited to ISO 17025. As a result of this, and the requirements outlined in the new ECDWD, the EPA are required to demonstrate on-going proficiency of the analytical method through participation in proficiency tests (PT) and interlaboratory comparisons (ILC). However, there is a considerable lack of relevant PT schemes and ILCs available for radon in drinking water analyses for the EPA to participate in. Therefore, the EPA conducted its own ILC for radon in water in 2014 in conjunction with eight other laboratories from Ireland, Norway, Finland, Estonia, Spain and Portugal.
The water supply chosen for the ILC was a private drinking water supply with a radon activity concentration of between 500 Bq/l and 1000 Bq/l. A radon activity concentration in this range would determine whether the participating laboratories could demonstrate a proficiency of measurement close to the remediation action level of 1000 Bq/l. It also ensures that the radon activity concentration of the samples would not decay sufficiently, between sampling and the delivery of sample to the participating laboratories, to be below limits of detection.
The samples for the ILC were all taken on the same morning in October 2014. The samples taken used the EPA's standard sampling protocol for radon in water analysis, unless otherwise specified by a participating laboratory. Samples were also taken for homogeneity checks during the sampling period. The samples were then dispatched by courier to all participating laboratories and were received within 48 hours. Results from participating laboratories were then submitted within three months of the sampling date. The radon in water results from each laboratory were collated and the data was interpreted in order to determine whether the results were in agreement with each other. The homogeneity of the samples were also checked and the sample set was found to be homogeneous. The results submitted by the participating laboratories were compared using ISO 13528 "Statistical Methods for use in proficiency testing by interlaboratory comparisons". Each result submitted by a laboratory was compared to the consensus value of 606 $\pm$ 12 Bq/l (k=1). The submitted results were assigned an overall classification based on the combination of their z-score, En-score and an outlier test.
In total, 16 measurement results were submitted by the participating laboratories. Twelve of the measurement results submitted are in agreement with the assigned value, with four of the results deemed questionable. Although three of these four results do not deviate significantly from the assigned value, the calculated En-score values (less than 1), could be indicative that the measurement uncertainties associated with these results are too small.
The results from this ILC indicate that there is good agreement between the participating laboratories for radon in water measurements.

About the Presenter

Kevin Kelleher is the manager of the radiochemistry laboratory in the Office of Radiological Protection of the Environmental Protection Agency, Ireland. Kevin has worked in the radiochemistry laboratory since 2005 and oversees the environmental radioactivity monitoring programmes of the EPA as well as maintaining the radiochemistry laboratory's ISO 17025 accreditation. This work includes the development and validation of new radiochemical techniques and participating in proficiency testing schemes and interlaboratory comparisons. Kevin has also been an international expert on several

IAEA missions to Japan, participating in an international interlaboratory comparison on marine samples taken off the coast of the Fukushima Dai-ichi nuclear power plant and has advised the Fukushima prefecture government on how best to map and display monitoring and measurement data in the Fukushima prefecture. Kevin is Ireland's representative on the European Commission's Articles 35 and 36 Expert Group and a member of the European Radioecology Alliance.

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