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Keeping up the Standards: Applying New Nuclear Decay and Structure Data for Radionuclide Metrology

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The radioactivity group based at the UK's National Physical Laboratory (NPL) is responsible for traceability of radiological standards and sources. This work requires the use of a range of novel and high-precision radiation detection systems which can be utilised to provide definitive standards of the stoichiometry, decay rate and physical nature of emissions from different samples of radioactive materials. The link in the unbroken calibration chain for measurements of activity concentrations of radiopharmaceuticals and other radioactive sources / reference materials is based at the NPL, which is responsible for the ultimate traceability to the Becquerel (Bq) within the UK.
This talk will outline some of the experimental techniques which are used to provide primary and secondary standards for radioactivity calibrations based on gamma-ray and/or charged particle spectrometry and highlight the importance of robust, evaluated nuclear data in such underpinning applications. An example of the recent standardisation of the naturally occurring isotope 223Ra [1,2] will be presented. This is of particular current focus as this radionuclide is both a member of the actinium (4n+1) decay chain headed by 235U and also the main therapeutic component in the radiopharmaceutical XOFIGO© [3]. The presentation will also outline some of the other methods for the production and radiochemical separation of 236Np as a long-lived tracer for 237Np via ICP - Mass spectrometry measurements in nuclear waste management [4]. Finaly, progress on the use of a digitally-based system for primary standardisations of 60Co and 134Cs, using coincident gamma-ray spectroscopy using LaBr3(Ce) detector modules (the NANA spectrometer) will be presented [5].
References:
[1] Collins, S.M; et al., 2015. Direct measurement of the half-life of 223Ra. Applied Radiation and Isotopes, 99, pp.46-53; Collins, S,M. et al., 2015. Precise measurements of the absolute γ-ray emission probabilities of 223Ra and decay progeny in equilibrium. Applied Radiation and Isotopes, 102, pp.15-28.
[3] https://www.xofigo-us.com/patient/index.php
[4] Larijani, C. et al., 2015. Progress towards the production of the 236gNp standard sources and competing fission fragment production. Radiation Physics and Chemistry, 116, pp.69-73.
[5] Lorusso, G. et al., 2016. Development of the NPL gamma-ray spectrometer NANA for traceable nuclear decay and structure studies. Applied Radiation and Isotopes, 109, pp.507-511.

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