Filling the gaps in radiological dose assessment from natural radioactivity: Development of ^{231}Pa AMS measurements with the 14UD at ANU

Medley[1,2], P., Tims[2], S.G., Froehlich[2], M.B., Fifield[2], L.K., Böllhofer[3], A., Wallner[2], A., Pavetich[2], S.

[1] *Environmental Research Institute of the Supervising Scientist (eriss), Darwin, Australia*

[2] *Australian National University, Canberra, Australia*

[3] *Bundesamt für Strahlenschutz, Freiburg, Germany*

There is a wealth of published data on the movement and partitioning of the uranium-238 decay series radionuclides within the natural environment that can be used for radiological dose assessment. However, limited information exists for the uranium-235 decay series (also known as the actinium series). Only three isotopes in the actinium series, ^{235}U, ^{231}Pa and ^{227}Ac, have half-lives greater than a month. Biological accumulation of these isotopes can lead to a radiological dose to the environment or to humans, through ingestion of food and water or via inhalation of particulates. The degree to which these isotopes are biologically accumulated is therefore potentially controlled by the chemical properties of these elements. The extent of other radiologically-significant isotopes lower in the series present in biological systems is therefore controlled both by the chemical properties of these three isotopes in the environment, and their biological uptake.

While the activity concentrations of ^{235}U, at the head of the actinium series, are ~20 times smaller than those for ^{238}U, the effective dose per unit of activity for the actinium series isotopes can be 10 to 20 times higher than those for the ^{238}U series elements. Furthermore, there are no suitable chemical or isotopic analogues for modelling the significance of ^{231}Pa (and ^{227}Ac) movement and accumulation in environmental media, and hence there is a need for direct measurements.

We report on the development of AMS ^{231}Pa measurements on biological materials using the 14UD accelerator at the ANU, and on a new, safer radiochemical extraction method for the yield tracer ^{233}Pa. Ultimately this will allow more accurate prediction of the significance of the radiation doses received from actinium series radionuclides to the environment and/or humans through the ingestion or inhalation pathways.