USER MEETING 2016

24-25 NOVEMBER

National Centre for Synchrotron Science

Australian Government | ansto | Australian Synchrotron

Contribution ID : **217** Type : **Oral**

RADIOACTIVE PARTICLES AS CONCENTRATED SOURCES RELATED TO UPTAKE AND DOSE IN MAMMALS

Thursday, 24 November 2016 11:15 (15)

The radiological residues at the former weapons testing sites in Australia, at Maralinga, Emu and the Monte Bello Islands, often occur in particulate form (“hot particles”). Large numbers of these particles were emitted from nuclear test detonations and non-nuclear tests. For example, more than 3000 readily identifiable particles can occur in the soil of a single square meter, in a plume that extends for tens of kilometres at the Taranaki site (Maralinga). The physical and chemical characteristics of these particles affect their mobility and availability for uptake into living organisms. These particles, which are weathering slowly, may contain long-lived radionuclides (e.g. 239Pu) and thus will provide persistent sources of smaller, more readily respirable hot-particles, as well as ionic forms of radionuclides, for many thousands of years.
From these Australian sites, we have gathered a series of particles that have weathered and interacted with the environment for 50+ years since their initial formation and release events. The particles are being evaluated using a range of methods including gamma spectrometry, PSL autoradiography, Accelerator Mass Spectrometry analysis (AMS), leaching studies, and X-ray fluorescence microscopy (XFM) at the Australian Synchrotron. Significant findings include the clustering of 137Cs on the exterior of a glassy fission fragment, with 90Sr occurring in the nearby interior, suggesting the 137Cs may be more available for weathering processes, and the beta emissions from the 90Sr may be largely self-shielded within the particle. In contrast, a different particle from a nearby site lacked any fission products, but contained Pu(IV) oxyhydroxides, consistent with weathering in a semi-arid environment. The 239Pu would impart significant dose to nearby tissue. However, XFM data, including X-ray absorption near edge structure (XANES), and extended X-ray absorption fine structure (EXAFS) indicate particles with a “core-shell” structure, with most Pu(IV) oxyhydroxide clustered in the core surrounded by an external layer containing Ca, Fe, and U. Detailed dose modelling suggests most of the alpha emissions from particles > 5μm are self-shielded within the particles themselves, and therefore impart lower dose than the equivalent dissolved Pu. However, when Pu exists on exterior surfaces, a hot particle that has been internalised (e.g. lodged in a mammalian lung) may produce relatively intense dose rates to adjacent tissues.

Keywords or phrases (comma separated)

radiological particles, plutonium, cesium, strontium, mammals, dose

Are you a student?

No

Do you wish to take part in</br>the Student Poster Slam?

No

Are you an ECR? (<5 yrs</br>since PhD/Masters)

No

What is your gender?

Male

Primary author(s) : Dr JOHANSEN, Mathew (ANSTO, Environment)

Co-author(s) : Dr IKEDA-OHNO, Atsushi (Helmholtz-Zentrum Dresden-Rossendorf,); Mr CHILD, David (ANSTO); Dr CAFFREY, Emily (Oregon State Univ); Mr HOWELL, Nicholas (ANSTO); Dr COLLINS, Richard (The University of New South Wales); Dr PAYNE, Timothy (ANSTO)

Presenter(s) : Mr CHILD, David (ANSTO)

Session Classification : Concurrent Session 1: Earth & Environment

Track Classification : Earth and Environment