# USE OF ACCELERATOR MASS SPECTROMETRY IN RESEARCH ON FALLOUT PLUTONIUM AND URANIUM FROM NUCLEAR TESTS

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As a result of atmospheric nuclear weapons tests, around 4 tonnes of plutonium were dispersed into the environment. A high proportion of this material was produced in high-yield nuclear explosions in the late 1950s and early 1960s and injected into the stratosphere, resulting in global dispersion of the material. On average, the plutonium in fallout amounted to around 1pg/cm2 across the earth's surface.

Using Accelerator Mass Spectrometry (AMS), fallout plutonium is readily detected in soils and sediments. Studies of plutonium in natural archives such as lake and estuarine sediments can provide information about the source of sediments and erosion rates in water catchments. By identifying the 'bomb pulse' peak from the early 1960s, models of sediment age and deposition rate can be verified.In addition, the $^{240}Pu/^{239}Pu$ ratio can be determined. Variations in this ratio can be indicators of the influence of specific test sites.

With the sensitivity of AMS, other long-lived fallout radionuclides can be detected. For example, $^{236}U$ ($t_{1/2}$=24Ma) is detectable in the environment and found to occur with a concentration in the range 0.1 to 1 times the concentration of $^{239}Pu$. Its distribution in natural archives may differ from the Pu distribution, depending on the chemical environment to which the fallout particles have been exposed.

Close to former nuclear test sites, a broader range of fallout radionuclides and activation products are detectable. The former test sites in Australia (Maralinga and Emu in South Australia, Monte Bello Islands in Western Australia) provide opportunities for research in several aspects of environmental radioactivity. We are studying the physico-chemical form of radioactive particles formed in different types of tests, and investigating the bioavailability of radioactive species. With high sensitivity analyses, we can measure the uptake of radionuclides by free-living animals and the distribution of radionuclides in their organs. Results can differ significantly from the uptake factors measured in laboratory settings.

This paper will discuss recent developments of the AMS technique at ANSTO and results from the studies described above.