Radiocaesium in the environment: re-investigating an old adversary

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International interest in the environmental fate and impact of radiocaesium has been re-ignited as a result of the dispersal of ^{134}Cs and ^{137}Cs from the Fukushima Daiichi Nuclear Power Plant. Six years after the accident at Fukushima and 31 years after Cherrnobyl, studies into radiocaesium behaviour in the environment have burgeoned. These focussed in the regions of Japan contaminated after the catastrophic tsunami and nuclear disaster of 2011. However, lingering contamination in the close vicinity of the Chernobyl Power Plant still provides substantial cause for concern. In July 2016, a major forest fire occurred in the Red Forest, the most severely contaminated part of the Chernobyl Exclusion Zone. The potential impacts of unpredictable events such as these remain largely uninvestigated, though they have the capacity to re-distribute radiocaesium spatially and to alter its biogeochemical behaviour. Experience gained from this and other events since the Chernobyl accident is being applied to forecast and mitigate the impacts of radiocaesium releases from Fukushima [1]. This is not always straightforward because of major mineralogical differences between soils in Chernobyl and Fukushima, and fundamental differences in the physico-chemical properties of radioactive deposits associated with each accident.

While ^{134}Cs and ^{137}Cs have been at the centre of investigations into the impacts of nuclear weapons testing, Chernobyl and Fukushima, the need to understand the very long-term biogeochemical behaviour of ^{135}Cs (half-life = 2.3 $\times$ 10^6 years) has been recognised in studies of radioactive waste disposal [2]. Recent developments of triple-quadrupole ICP-MS with chemical pre-concentration and separation steps now facilitate analysis of ^{135}Cs down to ppq levels [3]. This, in combination with isotopic dilution methods, provides unprecedented tools for the reconstruction and risk evaluation of historic source terms. Furthermore, the radioactive fingerprint provided by radiocaesium has recently been proposed as a means of distinguishing the beginning of the most recent geological epoch, the Anthropocene. Our old foe from the atomic age still has its uses in the modern era.

[1] Hashimoto *et al*. (2013) Scientific Reports **3**, 2564. [2] Soderlund *et al*. (2014) J Radioanal Nucl Chem **309**, 637–645. [3] Zheng *et al*. (2014) ES&T **48**, 5433−5438.