Establishing the Source of Radionuclides in the Severn Estuary

Research area: Nuclear Hazards and Risks

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Project website: https://southwestnuclearhub.ac.uk/2017/12/06/university-of-bristol-academic-speaks-to-bbc/

Figure 1

The Challenge

As part of the Hinkley Point C new build construction project, EDF Energy obtained a licence from the Welsh Government to dredge 300,000 tonnes of sediment from the Somerset coastline and dispose of it in the Severn Estuary at a site off the coast of Cardiff (Figure 1). This work is to prepare for the installation of six vertical shafts that form part of the cooling water system for the new Hinkley Point C nuclear reactor.

Once this operation became public knowledge there was a significant backlash from environmental protesters, including a petition led by Greenpeace, who were concerned that the sediment contained high levels of radioactive material.

Therefore the challenge was to identify the source of radionuclides in sediment, in a challenging environment; low levels in the Severn Estuary and availability of samples.

Info from https://research-information.bristol.ac.uk/files/119260134/Full_text_PDF_final_published_version_.pdf

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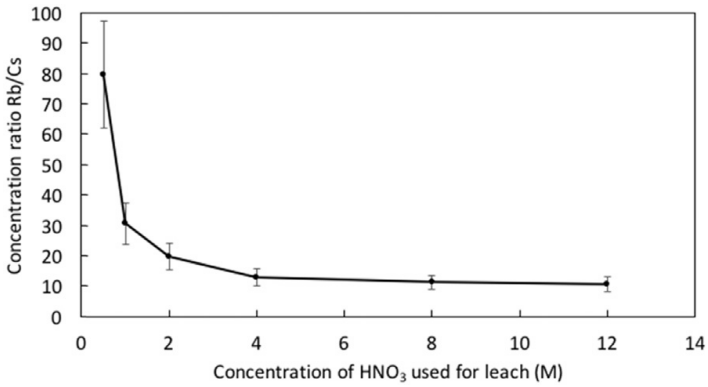
The Solution

Optimized chemical separation techniques and thermal ionization mass spectrometry (TIMS) protocols were created to obtain precise $^{135}Cs/^{137}Cs$ atom ratios for a range of environmental sample types. Determination of $^{135}Cs/^{137}Cs$ atom ratios has the potential to be a powerful tool for nuclear forensics and monitoring environmental processes, thus vital on the issue of identifying radionuclides in sediment.

This experiment was performed on homogenized sediment (1g), sampled from the Esk Estuary, Cumbria. The site has sequestered radiocaesium introduced to the Irish Sea by Sellafield Nuclear Reprocessing Plant over the last 50 years. The respective leachates underwent chemical separation prior to isotopic analysis by TIMS.

Figure 2 shows concentration ratios of Rb/Cs leached from estuarine sediment by nitric acid at a range of concentrations; the similarities between rubidium and caesium mean successful separation of the two is indicative of successful separation of Cs from other problematic matrix components. Hence giving an indication of radionuclides.

Figure 2



The Impact

The methodology developed effectively separates caesium from a range of analytically challenging environmental samples such as sediments, soil, and spinach. It provided excellent separation from species that can potentially be problematic for analysis of caesium isotopes by TIMS such as alkali metals and organic species.

Figure 3

In late 2017 media coverage on this issue increased, including multiple articles on the BBC website. Dr David Richards, from the School of Geographical Sciences, was interviewed by the BBC and he gave evidence from his research to show that the sediment did not contain extraordinary levels of radioactivity and therefore posed no significant threat to public health. This interview was featured on the regional evening news programme BBC Points West in December 2017.

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