

Scientists discover historic sample of bomb-grade plutonium

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(PhysOrg.com) -- Scientists in Washington state are reporting the surprise discovery of the oldest known sample of reactor-produced bomb-grade plutonium, a historic relic from the infancy of America's nuclear weapons program. Their research, which also represents the first demonstration of how radioactive sodium can be used as a tool in nuclear forensics, appears in the current issue of ACS' *Analytical Chemistry*.

In the new study, Jon Schwantes and colleagues note increased concern about the possibility of terrorists smuggling radioactive materials to make illegal nuclear weapons. As a result, scientists are stepping up efforts to identify and track the source of these radioactive materials using the advanced tools and techniques of a new field called "nuclear archaeology."

The scientists describe efforts to determine the origin of an unknown sample of plutonium (Pu) found in 2004 in a bottle at a waste burial trench at the Hanford nuclear site in Washington. Hanford is the earliest location for U.S. plutonium production for nuclear weapons and now the focus of a massive environmental cleanup effort due to high levels of radioactive waste that remain at the site.

Using multiple pairs of "parent" Pu and "daughter" uranium (U) isotopes, the researchers were able to correct for chemical fractionation that occurred as a result of repackaging in 2004 and determine the age of the sample. Using this technique, they estimated that the Pu in the

sample had been separated from U and fission products in 1944, making it the oldest known sample of bomb-grade plutonium produced in a reactor. The only older known samples of Pu-239 were produced by the late Glenn Seaborg and his associates in the beginning of the 1940's when the existence of the element was first confirmed and characterized.

The study identified the Clinton reactor in Oak Ridge, Tenn., as reactor of origin for this material, by comparing reactor burnup modeling results with measurements of minor Pu isotopes. These results were also supported by a series of historical documents tracking the material's movement from Oak Ridge and the processing at Hanford. “Aside from the historical significance of this find, this work provides the public a rare glimpse at a real-world example of the science behind and power of modern-day nuclear forensics,” the scientists note.

Provided by ACS

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