RAPID FUSION METHOD TO DETERMINE RADIOSTRONTIUM IN LARGE CONCRETE SAMPLES

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Rugged digestion methods are required to ensure the reliable measurement of Sr-89/90 following a radiological event as well as for routine laboratory operations. Following a radiological event, refractory particles may be present in environmental samples, including solid samples such as concrete or other urban matrices such as asphalt or limestone. Typically, required detection limits following a radiological event can be achieved with the digestion of 1-2g aliquots of these solid samples. For decontamination and decommissioning (D&D) activities, however, lower detection limits are required to determine Sr-90 in concrete and meet lower D&D regulatory requirements. This means 5-10 g concrete aliquots must be digested. A new rapid fusion method has been developed by the Savannah River Environmental Laboratory to prepare up to 10 g concrete sample aliquots in just hours. The large concrete aliquot is fused with sodium hydroxide in a 250 ml zirconium crucible. This enables complete dissolution of the sample. No pre-treatment with HF to remove Si prior to fusion is required.

The ability to rapidly measure Sr-89 and Sr-90 when high levels of Sr-89 are present is very important. Following a nuclear accident or an incident involving a radiological dispersive device (i.e. dirty bomb), large amounts of fresh fission products may be present. Large amounts of Sr-89 can result in a large analytical uncertainty in the Sr-90 results when using the traditional "two count" method. In this method, Sr-89 and Sr-90 are calculated after a second count following the ingrowth of Y-90, which can be very small relative to the total Sr-89+Sr-90 activity in the sample.

A new technique for concrete samples that separates and purifies Y-90 after initial counting of Sr-89+Sr-90 will be presented similar to what has been reported for seawater.[1,2] Gas flow proportional counting is used to allow simultaneous counting of samples and achieve a low MDA (minimum detectable activity). A new radiometric detection option that allows the direct assay of Y-90 in large concrete samples will also be presented. This also allows the rapid determination of Sr-90 in large concrete sample aliquots without waiting on Y-90 ingrowth. This direct approach provides a much lower MDA than a new ICP-MS method [3] recently reported, where Sr-90 is measured after removal of the isobaric interference Zr-90. While there is no waiting on Y-90 ingrowth using ICP-MS, this method approach has a very high MDA (1.5 Bq/L for water samples).

1 S. L. Maxwell, B. K. Culligan , J. B. Hutchison, R. C. Utsey and D. R. McAlister , Rapid Determination of ^{90}Sr in Seawater Samples, JRNC, 2014, 300(3);1175-118

2 S. L. Maxwell, B. K. Culligan ,and R. C. Utsey , Rapid determination of radiostrontium in seawater samples, November 2013, Volume 298(2) 867-875

3 INNOVATIVE TECHNOLOGY TO PROVIDE FASTER RESULTS ON WATER QUALITY AT FUKUSHIMA http://www.tepco.co.jp/en/press/corp-com/release/2014/1244484_5892.html