Contribution ID: **88** Type: **Poster**

Innovative technique for rapid measurement of post-accidental 89Sr in water: use of the Cerenkov Effect combined with color quenching

Monday, 12 May 2014 17:15 (1h 30m)

Many techniques have been developed in the interest of measuring radionuclides activity concentration in environment in case of a nuclear accident. Some so called "crisis"techniques are currently under development at the Institut de Radioprotection et de Sûreté Nucléaire in France in order to rapidly measure radioactive isotopes of interest and provide information to the authorities.

Especially, strontium 89 and 90 can be radioactive isotopes of interest. They are both pure beta emitters. Because of their toxicity and the similarity of their physical and chemical behavior with calcium, these elements may be found through the food chain. Strontium 89 has a half-life of 50.5 days and can reach an activity concentration 10 to 170 times higher than strontium 90 in case of accidental reject. After the Fukushima accident, the necessity of quantifying rapidly strontium 89 and 90 appeared. It is therefore essential to measure their activity concentration in the environment [1].

The technique we are going to present concerns the determination of the activity concentration of strontium 89 and 90 in water, according to the 89Sr/90Sr ratio. It consists of two stages: the chemical separation by ionic chromatography and the measurement of the activity concentration of strontium 89 and 90 with a liquid scintillation counter.
The automated separation is performed from the adaptation of an existing ionic chromatography, whose features are not to measure cations but to separate and isolate strontium. It is important to understand that right after the isolation of strontium, the decay product of 90 strontium (yttrium 90) will grow instantly. The measurement step is also singular because of the use of Cerenkov Effect on a quenched sample. The quenching is realized by applying a thin colored film on the sample vial. As beta particles energy of strontium 90 is low for Cerenkov Effect (540 keV), its counting efficiency is very low. The colored quench is therefore used to make disappear the number of counts on the spectrum caused by strontium 90. This way, yttrium 90 ingrowth and strontium 89 decay are exclusively measured (E90Sr < E89Sr < E90Y). Successive countings and modeling of the ingrowth/decay kinetics allow us to evaluate the activity concentration of strontium 89, and 90 depending on the 89Sr/90Sr ratio.

The results we are going to present at Radchem 2014 concern the development of the chemical separation by ionic chromatography and measurement of strontium by Cerenkov Effect. Studied parameters such as the quenching parameter to use, the sample geometry and the influence of 89Sr/90Sr ratio will be discussed. Results on proficiency test samples and standard solutions will also be shown. At last, an estimation of the total analyzing time comprising the separation and measurement steps will be given.

[1] Tovedal A, Nygren U, Ramebäck H. Methodology for determination of 89sr and 90sr in radiological emergency: i. scenario dependent evaluation of potentially interfering radionuclides. J Radioanal Nucl Chem 2009, 282(2), 455–459.

Primary author: Dr GALLIEZ, Kevin (IRSN)

Co-authors: FAYOLLE, Corinne (IRSN); Mrs AUGERAY, Céline (IRSN); Mrs LOYEN, Jeanne (IRSN); TARLETTE, Lucie (IRSN); MOUTON, Magalie (IRSN); GLEIZES, Marc (IRSN)

Presenter: Dr GALLIEZ, Kevin (IRSN)

Session Classification: Poster Session - Nuclear Analytical Methods

Track Classification: Nuclear Analytical Methods