HRP Workshop, 7th-9th Feb 2017 – Bernard PONCET (EDF-DP2D)

Long history of ^{36}Cl assessment of graphite waste by EDF engineering and the latest suggested developments

About 17,000 tons of irradiated graphite waste will be produced from the decommissioning of the six gas-cooled nuclear reactors operated by Electricité De France (EDF) company.

Determining the radionuclide content of this waste is an important legal commitment for both safety reasons and best suited management strategy.

As evidenced by numerous studies nuclear graphite is a very complex material that cannot be considered on an analytical viewpoint as any usual homogeneous material.

Radionuclide measurements in irradiated graphite exhibit very high discrepancies especially when corresponding to precursors at trace level.

This huge discrepancy cannot be avoided and can be easily explained by Pierre Gy's theory of sampling applied to finely divided materials.

The assessment of a radionuclide inventory only based on few number of radiochemical measurements leads in most of cases to a gross over or under-estimation that can be detrimental to graphite waste management.

Prior to 2005, the EDF initial version for the radiological inventory of graphite was based on the maximum values of the measures, namely a very pessimistic way.

In 2008, a scientific method was developed by EDF to evaluate the inventory by reverse activation calculation, in order to limit the overestimation.

The radiological inventory computation principles can be compared to those of all engineering studies. First, the calculation is simplified by taking margins, and if the results are not satisfactory enough, some simplifications are suppressed to reduce these margins even if computation becomes more complicated.

On EDF piles, the gain obtained in 2008 represented a factor 50 relative to the initial version of ^{36}Cl, even with a very penalizing multiplicative factor for uncertainty.

Today, the accurate calculation of the uncertainty no longer justifies such a factor. A gain of about 150 now occurs compared to the initial version of ^{36}Cl.

It is more than 2 orders of magnitude, which is already enough to assess again the necessary type of disposal because ^{36}Cl is one of the key radionuclides.

After global presentation of graphite waste management in France, the presentation focuses on the inventory scientific process of EDF nuclear graphite, the purity of graphite and its consequences, its particular sampling, the lessons learned, the initial method description.

The link is shown with the demonstration of the completely random point process of chlorine in nuclear graphite and the last suggested precise uncertainty computation of inventory of ^{36}Cl.

The method confirmation for average concentration assessment, the history of the EDF method development and its benefits are also emphasized.