ACTINIDE AND FISSION PRODUCT EVOLUTION BENCHMARKING WITH VANDELLOS II (PWR-SPAIN) MEASURED ISOTOPIC VALUES WITH CONSIDERING ALL THE BURN-UP HISTORY WITH CONSECUTIVE CALCULATION

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Abstract

High burn-up spent fuel contains a rather large amount of long-lived actinides and fission products. Prediction of these amounts is important for the purposes of transmutation, safe guards and safe storage of the spent fuel. The isotopic evolution mainly depends on the neutron spectrum which the nuclear fuel is exposed during its life in the reactor core. Prediction of the amount of the isotopes which are accumulated in the spent fuel need to be performed with validated neutronic calculation codes.

Because of the restrictions placed on and the cost associated with experimental facilities, the value of computer modelling and calculation has increased. Nowadays, it has become possible to model many varieties of nuclear systems (including full reactor core) and perform burn-up and decay calculation.

Unfortunately, it is not easy to predict perfectly isotopic contents of the irradiated fuel by calculation because of many reasons such as uncertainties of the fuel fabrication, quality and uncertainties in the basic nuclear data (cross-section, fission yields, etc.), uncertainty of the representation of the irradiation geometry, etc.

Traditionally, isotopic evolution calculation of a spent nuclear fuel is performed cycle by cycle. The calculated amount of actinides and fission products for a cycle are introduced to next modelled core cycle until the last cycle of that fuel. Through that methodology the chain of isotopic evolution is lost. Consequence of this can be a significant uncertainty is added to prediction of the amount of the actinides and fission products.

At this study, isotopic evolution of the sample E58-263 of assembly WZR0058 of Vandellos Unit II (PWR-Spain) is calculated with MONTEBURNS code system. The sample was exposed with different neutron spectrum because of its different core location at the different cycles. At the calculation, all the cycle burn-up history of the sample is considered consecutively by using the 'remove' and 'add' option of the MONTEBURNS code. The calculated results are compared with the measurements and with the cycle by cycle calculation methodology results.