TRANSMUTATION OF TECHNETIUM IN THE PETTEN HFR: A COMPARISON OF MEASUREMENTS AND CALCULATIONS

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Abstract
Within the framework of the EFTTRA cooperation between CEA, ECN, EDF, FZK, IAM and ITU, six metallic $^{99}$Tc rods have been irradiated in the Petten HFR for 193 effective full power days. During this irradiation, more than 6% of the $^{99}$Tc has been transmuted to the stable $^{100}$Ru. At ECN, one of the six rods has been examined in the hot cell laboratory. The ruthenium concentration in the rod measured by Isotope Dilution Mass Spectrometry reaches 6.4% at 5 mm from the bottom of the rod and 6.0% at 5 mm from the top. Also the axial and radial distributions of the ruthenium have been measured by Electron Probe Micro Analysis. The ruthenium concentrations calculated by the three-dimensional Monte Carlo code KENO reach 6.1% at 5 mm from the bottom of the rod and 5.7% at 5 mm from the top. These values are in reasonable agreement with the measured ones. However, the calculated radial distribution of the ruthenium concentration is not in agreement with the measurements. The radial profile calculated by the Monte Carlo code MCNP, which uses a point-wise cross-section library, agrees much better with the measurements. To solve the remaining small differences between the measured and calculated ruthenium concentrations in the rod, the thermal absorption cross section of $^{99}$Tc will be measured in the Petten HFR in the course of this year.