



PREPARATION OF EFFECTIVE CROSS-SECTION LIBRARIES FOR CALCULATION OF SPENT NUCLEAR FUEL INVENTORY OF RBMK TYPE REACTORS

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ABSTRACT

Depletion of RBMK-1500 spent nuclear fuel (SNF) with erbium burnable absorber was modelled and one group burnup dependent cross-section libraries for Origen-ARP were created. Calculations were performed using SCALE 6.1 code package. Depletion calculations for generation of cross-section libraries were performed using T-DEPL sequence – NEWT deterministic 2D transport code with 238-group energy library based on ENDF-B VII was used for neutron spectra and reaction rate calculation and nuclide composition was calculated using ORIGEN-S code. Fuel irradiation conditions were simulated using 4x4 channels RBMK-1500 reactor lattice with 14 fuel channels and 2 control rod channels. Cross-section libraries were prepared depleting one fuel bundle while keeping constant average RBMK-1500 reactor fuel burnup of surrounding fuel channels and using different coolant densities. ARP (Automatic Rapid Processing) cross-section libraries may be used for fast burnup inventory modelling used in source term, criticality safety and other calculations. Concentration of most important elements for criticality safety was calculated using these libraries and values were compared with concentrations of non-erbium fuel values obtained from pre-generated and experimentally validated libraries for RBMK-1000 type reactor available with SCALE 6.1 code package. Fuel enrichment was different: 2.4-2.8 % enrichment for erbium fuel libraries and 1.8-2.2 % enrichment for fuel without erbium libraries. Composition differences were evaluated for different fuel enrichment and water density. Evolution differences of most important actinides for both types of libraries were identified.

Keywords: RBMK, numerical modelling, nuclear fuel, actinides