

Burnup Credit Development and Implementation in the Slovak Republic

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Nuclear Regulatory Authority of the Slovak Republic (UJD) has prepared various research tasks under the R&D program. The Division of Nuclear Materials has executed a task of the burnup credit (BUC) application in the criticality calculation of the VVER-440 fuel assemblies in cooperation with Nuclear Power Plants Research Institute (VUJE). The task was divided into two parts. VUJE performed first task in 2005 through 2007.

The following subtasks have been addressed under this research task:

Verification of SCALE 5.0 calculation system

The aim was to verify applicability of the latest version of the SCALE 5.0 calculation system to the VVER-440 spent fuel storage and transport. It consists of the SCALE 5.0 system testing during the calculations of criticality nuclide composition and residual heat of the VVER-440 fuel and verification of the system applicability by means of the results comparisons with the ones of the numerical models.

Methodology of the BUC for the VVER-440 fuel

The aim was to develop appropriate methodology of the BUC application for the VVER-440 fuel. It consists of the proposal of the calculation analyses range in order to ensure sufficient subcriticality during the VVER-440 spent fuel storage and transport.

Application of the BUC for the dry storage conditions of the VVER-440 fuel

This task demonstrated that when the burn-up consequences are partially taken into account, it significantly decreases requirements on the VVER-440 spent fuel storage under dry conditions. The task puts an emphasis on the BUC analysis for the dry storage of the VVER-440 spent fuel. The results will serve for validation of the basic parameters of the Mochovce dry store.

Application of the BUC for the wet storage conditions of the VVER-440 fuel

The aim was to examine possibilities of the VVER-440 spent fuel storage and transport with higher original enrichment in the existing storage and transport facilities. It consists of the analysis of the possibility to transport and store the VVER-440 spent fuel with original

enrichment up to 5% U235 in the existing C-30 transport container with T-12 or KZ48 casks and in the at-reactor spent fuel storage pools.

Under those subtasks we have developed methodology for BUC utilization, taking into account actinides only, and we have validated the SCALE 5.0 system as a tool for VVER-440 fuel.

The second part of the project will also include fissile products. This subtask started in 2008 and will be finished in 2010.

In order to have validated results three Slovak organizations (VUJE, JAVYS, UJD) have joined an international consortium focused on further investigation of nuclide composition of VVER-440 spent fuel within the framework of project ISTC #3958. Having these results we will continue the verification of the SCALE 5.1 and 6 systems for nuclide composition calculations. The UJD will prepare a guide on BUC application in Slovakia.

The BUC will be necessary for the licensing of the new fuel with enrichment of 4.87% ²³⁵U in at reactor pool and in basket KZ-48.