THERMAL-HYDRAULIC MODELING OF RERACKED SPENT FUEL POOL

Davor Grgić
Faculty of Electrical Engineering and Computing, University of Zagreb
Department of Power Systems
Unska 3, 10000 Zagreb, Croatia
davor.grgic@fer.hr

Radomir Ječmenica, Dubravko Pevec
Faculty of Electrical Engineering and Computing, University of Zagreb
Department of Applied Physics
Unska 3, 10000 Zagreb, Croatia
radomir.jecmenica@fer.hr, dubravko.pevec@fer.hr

EXTENDED ABSTRACT

The most attractive option for solving the problem of increasing spent fuel pool capacity is reracking of spent fuel assemblies. As by reracking the number of spent fuel assemblies and generated decay heat will be increased and the distance between spent fuel assemblies will be decreased, it will affect thermal-hydraulic parameters of spent fuel pool. Our aim was to develop a simple model of the spent fuel pool which will enable calculation of thermal-hydraulic parameters of the reracked spent fuel pool.

The capacity of the NPP Krško spent fuel pool will be also increased by reracking. With the assumptions of 12 months working cycle and 40 years of operation, at the end of the NPP Krško lifetime 1527 spent fuel assemblies will be stored in the spent fuel pool. We have investigated the impact of spent fuel reracking on thermal-hydraulic parameters of NPP Krško spent fuel pool.

The total generated heat in the spent fuel pool at the end of the NPP Krško lifetime (year 2023) is calculated using the ORIGEN-PC computer code. The ORIGEN-PC computer code has been developed at Oak Ridge National Laboratory for calculation of isotopic inventory, activity and decay heat of nuclear fuel. According to discharge burnup and cooling time the NPP Krško spent fuel assemblies are divided into 77 groups and decay heat of each group has been calculated using ORIGEN-PC. The total generated heat in the spent fuel pool at the end of the NPP Krško lifetime (year 2023) has been estimated to 6,520 kW.

The thermal-hydraulic modeling of the NPP Krško reracked spent fuel pool has been performed using the computer code GOTHIC. The computer code GOTHIC is general purpose thermal-hydraulic computer code for designing, licensing as well as safety and operational analyses of containment and other confined buildings. A model of the NPP Krško spent fuel pool for the computer code GOTHIC has been developed, containing 8 control volumes, 17 junctions, and 14 heat structures. Using this model and total generated heat of 6520 kW the NPP Krško reracked spent fuel pool thermal–hydraulic parameters for steady state and during loss of cooling were determined.
References