The prediction of tritium level reduction of NPP Cernavoda using CTRF

Anisia Bornea*, Liviu Stefan, Ioan Stefanescu, Marius Zamfirache

National Research & Development Institute for Cryogenics and Isotopic Technologies-ICIT Rm.Valcea, OP Raureni, CP.7, 240050, Romania

The CNE Cernavoda detritiation installation (CTRF) was designed primarily to reduce the level of tritium from the reactor moderator 1 of the nuclear power plant, from 1.99 TBq/kg- an estimated value to be achieved in 15 years of continuous operation, up to a threshold of maximum 0.037 TBq / kg.

Under a contractual agreement, National Research & Development Institute for Cryogenics and Isotopic Technologies-ICIT Rm.Valcea and AECL are to jointly produce both a pre-feasibility and feasibility study for the project. The pre-feasibility study completed in August 2006, provided the rationale for choosing the Liquid Phase Catalytic Exchange-Cryogenic Distillation process for the Cernavoda TRF.

The sofware developed for simulating the detritiation process was used as a support for sizing the CTRF installation.

The simulation performed for the heavy water detritiation from reactor 1 proves that the activity can be reduced up to a value of approx. 0.011TBq/kg

After reaching the planned threshold in the water of moderator 1, the CTRF can alternatively provide the reduction in heavy water activity from the moderator of reactor 1 and 2 respectively. The heavy water activity in the reactor's moderator 2 when the detritiation process begins, is estimated to reach values of 0.081 TBq / kg

The possibility of CTRF operation for simultaneous heavy water detritiation from the four reactors of the plant, has also been analysed. The analysis shows that for the 4 reactors the detritiation installation can sustain a maximum of 0.07Tbq/kg.

A series of simulations were run for a theoretical demonstration and the results are presented in this paper as graphs.