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Safety Analysis During Low-Pressure Case in VVER-1000 with ASYST

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This study evaluates the reactor degradation progression in VVER-1000 due to loss of coolant accident (LOCA) and total station blackout (SBO). The simulation evaluation was carried out using the adaptive SYStem Thermal-hydraulics (ASYST) program. The low-pressure scenario was simulated by modelling 80 mm small break LOCA (SBLOCA) in the cold pressurizer leg in during SBO. This double ended break size was selected to cause a significate faster depressurization during low-pressure simulation and a longer borated cold water injection from the passive hydro accumulators (HAs). This enabled evaluating the times required to attain critical set points during the transient progression. The investigation looked into loss of coolant circulation, fuel and clad heating up, commencement of hydrogen generation, the activation of the passive safety system, changes in pressure, and primary circulation. The results were compared to those obtained using ASTEC 2.1.1.0 for the same postulated events. Low pressure ASYST simulation results showed that the modelled break area was enough to allow primary loop depressurization. These kinds of analyses assist in estimating the time available to perform operator safety actions. This in turn aids in emergency planning and severe accident management. The results revealed that the fuel damage decreases after the introduction of HAs. Actuation of HAs at their actuation set-points provided core cooling by injecting water into reactor core.

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