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SMALL BREAK LOCA ANALYSIS OF MOCHOVCE NPP VVER-440/213 WITH OPERATOR ACTION

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INTRODUCTION

The results of small break LOCA analysis with equivalent diameter 40 and 80 mm are presented in this report. The analyses were performed with the code RELAP5/Mod3.2.2β and a 6-loop design model for Mochovce NPP was used. The aim of performed analyses is to evaluate the operator action under the small break LOCA conditions and defined emergency core cooling system (ECCS) configuration, when the operator action leads to ensuring of core cooling. Success of operator action achievement was evaluated following the behaviour of core outlet coolant temperature and cladding temperature that was reached during the accident.

INITIAL AND BOUNDARY CONDITIONS

Initial and boundary conditions, used for deterministic LOCA analyses within the framework of safety assessment, are selected in order to ensure a conservatism from point of view of core cooling or of mass and energy release into the hermetic zone (HZ). For analyses presented in this report, conservatism is applied for ECCS configuration only. The other initial and boundary conditions were assumed nominal, without uncertainties that could lead to conservatism of core cooling:

- nominal initial and boundary conditions,
- single failure and Loss Of Off-Site Power (LOOP) were not assumed,
- nominal value of scram and ESPAS signals setting,
- reactor power controller and turbine power controller were not assumed and operation of rest of non-safety systems was assumed in nominal mode.

ECCS CONFIGURATION

ECCS consists of high-pressure injection system (3 HP pumps), low-pressure injection system (3 LP pumps) and passive system (4 hydroaccumulators). The core cooling during the accident was supplied by 1 LPI pump and one/none HA only.

OPERATOR ACTION

The operator action is necessary to recover core cooling after initial event because HPIS is not assumed in any case. The base of successful core cooling recover is secondary circuit depressurisation, which leads to decreasing of temperature and pressure of primary circuit and

beginning of LP pumps injection. Parameter, which defines beginning of operator action, is core outlet coolant temperature equal 370 °C. The delay between reaching of this temperature and the first operator action was assumed circa 10 min. because operator has to do some sequential steps leading to the action considered in RELAP5 calculation. Some essential operator actions are listed below:

- 1 make-up pump start-up,
- secondary circuit depressurisation through all four BRU-K,
- start-up of two main circulation pumps.

These operator actions were used in the LOCA 40 mm as well as LOCA 80 mm calculation.

CONCLUSION

The results of performed analyses indicate that the depressurisation of secondary circuit is effective from the point of view of core cooling when the 1 HA and 1 LPI pump are considered. After reaching of core outlet coolant temperature equal to 370 °C, operator can recover core cooling and maximum cladding temperature does not exceed 1200 °C. In the case without HA, operator action is not effective and maximum cladding temperature exceeds 1200 °C.