

Failure Analysis of leakage in NEK Reactor Cooling System

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Operators at Nuklearna Elektrarna Krško (NEK) identified a leak in the Reactor Coolant System (RCS) on October 4th, 2023. Two days later, on October 6th, the decision was made to shut down the plant in order to determine the source of the leakage. The investigation revealed the leakage on the SI-53 Safety Injection line to the reactor vessel. As a result, both SI-53 and its sister line, SI-52, along with the associated reducers and elbows, were removed and replaced.

The failure analysis process involved close collaboration between Westinghouse Electric Company (WEC), NEK, and Institute of Metals and Technology (IMT). A section of the SI-53 piping was subjected to detailed destructive examination at Westinghouse Churchill Site (WEC) to investigate the Direct Cause Analysis (DCA) for the crack initiation and its propagation. The crack was identified as circumferential crack, which initiated in the heat-affected zone (HAZ) on the Inner Diameter (ID), very close to the fusion line with further transgranular propagation through the weldment. Two different crack propagation mechanisms were identified on the fractured surface. Chemical analysis, tensile tests and hardness measurements were also performed on the investigated sections of the pipe, all of which did not reveal any irregularities.

The findings of the investigation were the basis for the Root Cause Analysis (RCA).