INCONEL AREAS IN PWR PRIMARY SYSTEM: FRENCH APPROACH FOR MAINTENANCE

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In 1991, in the Bugey nuclear power plant, for the first time a leak occurred at the level of a vessel head penetration made with base nickel alloy (Inconel 600). This leak was caused by a primary stress corrosion cracking coming from inside the penetration tube. The crack was through wall extent and primary fluid went out from the top of the vessel head.

Immediately, Electricité de France launched important research programs and expertises in order to understand the root causes and propose solutions to this problem. The root causes confirmed PWSCC, and in the same time solutions for repair were studied and an inspection program was established to check the base metal of other vessel head penetrations.

After several tests, repair solutions were abandoned because of their high costs (financial and dosimetry). EDF decided to replace all the vessel heads with Inconel 600 penetrations.

Non-destructive developments leaded to use eddy currents for detection and characterization but also video techniques to confirm. In a second step, in order to inspect without removing the inside thermal sleeve, eddy current and ultrasonic blade probes were achieved and used to inspect all vessel heads penetrations.

Up to now, 75% of the vessel head have been replaced on the 900 MW and 1300 MW fleets but to replace wisely the last vessel heads EDF continues to perform NDE of the penetrations on the basis of safety criteria.

In addition, other areas like RPV bottom head penetrations, SG partition plates are also maintenance concerns and an important inspection program has been developed.

This paper describes the different steps of the applied policy in France, NDE methods, safety criteria, laboratory and ISI results obtained.