Environmentally induced transgranular stress-corrosion cracking of 304l stainless steel components at Koeberg

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[en] Koeberg is a seawater-cooled, 2 x 920 MW Pressurised Water Reactor plant, with a three-loop Framatome nuclear steam supply system. Koeberg is situated 30 km North of Cape Town, South Africa, on the Atlantic coast. Koeberg have detected numerous externally initiated cracks, some through-wall, on seamed piping of safety related systems, the refuelling storage water tanks and cast valves of both units. The tanks, piping and valves are manufactured out of austenitic stainless steel grade 304L and the systems typically operate at temperatures below 50 C. Metallurgical assessment of the cracks concluded it to be transgranular stress-corrosion cracking (SCC) associated with the marine environment (chlorides), susceptible material (304L) and stresses associated with cold forming, welding and casting shrinkage. The cracking was almost exclusively initiated through surface pitting of the components. The problem presented a challenge in that a vast number of components were affected by SCC and due to the largely subsurface nature of the cracking the inspection method had to include grinding of all the pipe surfaces to allow use of dye penetrant testing (PT) to reveal cracks. This paper describes the background to the problem, the inspection method, the morphology and the recovery strategy. (authors)

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