

N405. CHROMIUM COATINGS TO REDUCE RADIATION BUILDUP

Surface preconditioning of reactor components can reduce the incorporation of radiation that contribute to occupational radiation exposure. Significant reductions have been achieved by electroplating thin layers of chromium onto the base metal of a component, which is then preoxidized before exposure to primary coolant. Small test coupons exposed in the Doel-2 PWR showed greater than a factor of 10 reduction in activity pickup compared with an electropolished surface. Similar reductions were found in two chromium-coated manway seal plates, examined after exposure for one fuel cycle in the Millstone-2 PWR.

For the past several years, EPRI has been intensively investigating new methods to mitigate radiation buildup on out-of-core surfaces in LWRs in order to reduce occupational radiation exposure. As a result, a new surface preconditioning method known as stabilized chromium has been developed for pretreatment of reactor piping and other components. This treatment has been showing very favorable results in retarding radiation buildup.

The test in the Doel-2 PWR showed that thin preoxidized chromium films were extremely effective in reducing activity pickup compared with an electropolished surface. Reduction factors ranged from 5 to 150. Thinner chromium films proved more effective than thick ones. Furthermore, specimens preoxidized in moist air typically showed higher reduction factors than those that had been coated only with chromium. Finally, high reduction factors were found for stainless steel than for Inconel substrates.

Consistently high reduction factors were found in the chromium-coated coupons that were exposed at Doel-2 during cycles 15, 16, and 19. The much lower reduction factors measured in cycle 17 were consistent with subsequent surface characterization measurements showing little chromium remained at the end of this fuel cycle.

A reduction factor of about 12 in activity pickup was measured on chromium coated manway seal plates that were exposed in Millstone-2 for one fuel cycle. A more modest reduction factor of about 2.5 was measured on the section of the RHR system piping at Diablo Canyon-2, the lowest activity pickup measured of the various treatments that were evaluated.

Stabilized chromium treatment is an exciting new surface preconditioning method that can reduce activity buildup by an order of magnitude or more. The results from the chromium-coated manway seal plates exposed in Millstone-2 steam generator are especially encouraging and suggest that utilities should have spare manway seal plates chromium-coated so they can be installed as needed. The program is being implemented to develop and evaluate techniques for applying chromium coatings to large and more complex shaped components.

For more, "Chromium Coatings to Reduce Radiation Buildup," EPRI TR-105813, Final Report, December 1995.