

ENDURANCE TESTS OF VALVES WITH COBALT-FREE HARDFACING ALLOYS

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Objectives: To develop weld procedures for the candidate alloys on 3-in. gate valves. To determine if the iron-based hardfacing alloys have wear properties matching those of cobalt-based alloys under simulated BWR conditions.

Comments: The performance of the alloys was assessed as follows:

- A number of diverse techniques were employed, including metallography, chemical analysis, hardness, and dye penetration tests
- The iron-based alloys used were NOREM, EB 5183, and EVERIT 50.
- The cobalt-based alloy Stellite 6 was used as a standard.
- The valves were operated under simulated normal BWR primary coolant chemistry conditions (200 ppb oxygen) for 970 full-stroke cycles.

After the first 500 cycles, the valves were characterized by using nondestructive examination techniques: visual examinations, leak rate measurements, and profilometry. After 970 cycles, these examinations were complemented by detailed metallurgical characterization of the valve trim.

Remarks/Potential for dose limitation: The results indicate that with the exception of EB 5183, which is susceptible to pitting attacks, the corrosion resistance of the iron-based alloys is equal or superior to that of Stellite 6. Cobalt-based hardfacing alloys are used in valves and other critical components in nuclear reactors. They are a significant contributor to radiation-field buildup and occupational exposure to plant maintenance personnel. Using cobalt-free alloys to replace or refurbish valves will significantly reduce released cobalt.

References: "Endurance Testing of Valves With Cobalt-Free Hardfacing Alloys," EPRI-TR-101847, Final Report, January 1993.

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