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Processes and Practices Related to Occupational Dose

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SPECIFICATION OF COBALT IN STEAM GENERATORS (PWRs)

Keywords: SPECIFICATION OF COBALT IN STEAM GENERATORS; COBALT; STEAM GENERATORS; PWR; CONSTRUCTION MATERIALS; LOW COBALT

Description:

Numerous studies have shown that corrosion product releases from steam generator tubing are a major (from 1/3 to 2/3) contributor of cobalt in PWRs. The release of cobalt is expected to decrease as the concentration of the cobalt in the tubing material decreases. Typical alloy 600 tubing has had 0.04% cobalt. Recent discussions with alloy 690 tubing suppliers have shown that it is practical to obtain tubing with 0.015% cobalt maximum average, 0.02% maximum cobalt for any one heat. These values are consistent with EPRI specifications currently being developed for alloy 600 and alloy 690 tubing. These low levels are expected to significantly reduce cobalt release to the reactor coolant.

References and Selected Abstracts:

1. Ocken, H., "Cobalt Reduction Guidelines," EPRI Special Report NP-67-37, March 1990. (Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.)
2. Bergmann, C.A., "Sources of Cobalt in Westinghouse Designed PWRs," Proceeding of the International Workshop on New Developments in Occupational Dose Control and ALARA Implementation at Nuclear Power Plants and Similar Facilities, held at Brookhaven National Laboratory, Upton, Long Island, New York, September 18-21, 1989. NRC Report NUREG/CP-0110, p. 183.

ABSTRACT: An estimate of sources of cobalt in Westinghouse designed plants was made in 1982. The estimate was on current knowledge of cobalt releases due to corrosion and wear of high cobalt alloys (Stellites) as well as corrosion release of the major primary system materials (stainless steel and Inconel). Based on these estimates, a ranking of the major sources by components was made using a simple cost-benefit model. The major source of cobalt was found to be the corrosion release of cobalt from the Inconel 600 steam generator tubing. On this basis, most utilities now request the specifications for cobalt in the tubing for replacement steam generators be changed to 0.015 percent in lieu of 0.10 percent. In 1986, additional data concerning the corrosion release of cobalt from stainless steel, Inconel and Stellite was determined by the Atomic Energy of Canada Laboratories (AECL) using radiotracers under several simulated PWR coolant chemistry conditions. On this basis, the 1982 estimate was updated and a revised listing of sources was made. This revision again indicated that the steam generator tubing was still a major source; however, the corrosion and wear of high cobalt materials and the corrosion of stainless steel was also found to be more significant than noted before.

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Since 1986, the cobalt input from wear of high cobalt materials in CVCS system valves has been determined based on plant experience, and the cobalt release from materials of construction has been further defined by the AECL tests. This topic will update the estimates originally made using the aforementioned new data and provide a revised listing of sources. In addition, the results of CORA code studies and actual plant experience showing the exposure rate benefit of replacing the cobalt containing Inconel 718 fuel grids with Zircaloy fuel grids will be presented.