

EE01

Co-free Valve Evaluation for Activity Reduction of PWR 원전 1차 계통 밸브 재질특성 평가

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Radioactive nuclei, such as Co^{58} and Co^{60} , deposited out-of core surface in PWR primary coolant system, caused by the transport of soluble or particulate crud through the primary coolant, are major sources of occupational radiation exposure to plant maintenance personnel and costly impediment to prompt and effective repairs.

SNU COrrOSion Test Loop [SCOTL] designed to evaluate the Co-free valve (NOREM 02, Deloro 50) in a simulated PWR primary condition was developed. We performed the cold leak test at room temperature and non-chemical treatment prior to cycling test and posterior to 2000 cycles test. We found out that the leakage rate of NOREM 02 (Fe-based) didn't satisfy the nuclear grade valve leak criteria of AECL after 1000 cycles, while there was no leakage in case of Deloro 50 (Ni-based) after 2000 cycles test.

To estimate the activity reduction effect by using a computer code in case of the Co-free valves, we modified CRUDSIM-MIT, which modeled the effects of coolant chemistry on the crud transport and activity buildup in the primary system of PWR. In a new code named CRud Evaluation and Assessment [CREAT], Co^{60} activity buildup prediction include 1) Co-based valve replacement effect, 2) Co-based valve maintenance effect, and 3) CRDM and MCP shaft contribution. With good cleaning after maintenance, the application of CREAT to KNGR resulted in about 64% Co activity reduction in Steam Generator surface, and the value was about 72% with Co-free valves.