

### **N113. Managing Of The Aging BWR Control Rod Drive Mechanisms**

The NRC Office of Nuclear Regulatory Research is sponsoring a Nuclear Plant Aging Research (NPAR) program at several national laboratories, including the Oak Ridge National Laboratory (ORNL). One of the NPAR program tasks is to understand the aging phenomena associated with boiling water reactor (BWR) control rod mechanisms (CRDMs) and to identify the unresolved technical issues associated with this component's aging. CRDM Degradation. Twenty-one utilities responded to the CRDM aging questionnaire and reported a good performance history for the BWR control rod drive mechanisms. The participants were also asked to share their observations regarding the primary causes of CRDM aging. In addition to normal service wear, the reported causes of CRDM degradation are corrosion, embrittlement, fatigue, fracture, and thermal degradation of the Graphitar seals, human errors made during drive change-out and rebuilding activities, and, to a lesser extent, plastic deformation due to improper and insufficient storage support.

Poor plant water chemistry has been a primary contributor to corrosion and "crud" formation. Debris becomes entrapped in the CRDM during normal operations and its accumulation augments corrosion activities by scarring metal surfaces and defacing the Graphitar seals. As crud accumulates in the CRDM, stall flows may temporarily decrease and drive temperatures increase, contributing to the thermal degradation of the seals. After a scram, stall flows may increase and CRDM temperatures decrease because some of the crud has been "shaken out" of the drive. To reduce the amount of crud that can become entrapped in the CRDM, some utilities are vacuuming the bottom of the reactor vessel around the guide tubes during outage operations. In addition, earlier-design CRDMs (models A, B, and C) had problems with the cooling water orifices becoming plugged with crud, which caused increased operating temperatures. Many utilities have retrofitted their older CRDMs with upgrade kits that modified the design of the cooling water orifice to avoid this potential problem.

*Taken From: "Managing the Aging of BWR Control Rod Drive Mechanisms," Rebecca H. Greene, Nuclear Plant Journal, p. 62, May-June, 1991.*