

Environmentally Assisted Fatigue Screening

Background

License renewal for nuclear power plants requires consideration of aging management of plant structures and components including environmentally assisted fatigue (EAF).

The Generic Aging Lessons Learned (GALL) report (NUREG-1801, December 2010), Rev. 2, incorporates changes based on: (1) lessons learned from reviews of previous license renewal applications, (2) operating experience obtained after the Nuclear Regulatory Commission issued GALL report, Rev. 1, and (3) other public input, including industry comments.

Regulatory Information Summary (RIS) 2011-5 issued in July 2011 provides highlights of the GALL Rev. 2 changes. Although it requires no specific action or written response, it encourages licensees with renewed operating licenses to review the GALL report changes and consider actions necessary to incorporate the updates, as appropriate, into existing aging management programs (AMPs) at their plants.

In AMP X-M1, "Fatigue Monitoring" (Chapter X, "Time-Limited Aging Analyses, Evaluation of Aging Management Programs"), the scope of locations to be considered for EAF was expanded beyond the minimum set provided in NUREG/CR-6260. The incremental task to comply with GALL Rev. 2 is to identify any other Class 1 locations that might be more limiting than the NUREG/CR-6260 locations, so that those new locations can be evaluated and/or included in the fatigue monitoring program.

In response, the Electric Power Research Institute® (EPRI®) developed a screening methodology (EPRI Technical Report 1024995, "Environmentally-Assisted Fatigue Screening, Process and Technical Basis for Identifying EAF Limiting Locations") for the Class 1 locations that provide a ranking process considering environmental influence on fatigue for the identification and comparison of limiting locations.

Description

To implement the basic EPRI methodology, Westinghouse developed a three-phase approach, using alternate methods in the detailed comparison process:

- Phase 1. Identification of initial leading locations (initial screening)
- Phase 2. Detailed review of fatigue analyses of record for further comparison and reduction in the number of limiting locations
- Phase 3. Performance of detailed EAF analysis for leading components that could not be eliminated in Phase 2 (e.g., detailed finite element analysis, full time history stress analysis)

The Westinghouse screening approach takes advantage of our extensive experience in Class 1 fatigue analysis to perform an equivalent "common stress basis" evaluation for the individual systems. The approach uses Westinghouse's large Reference Fatigue Database of component fatigue evaluations and related experience to establish a common basis of comparison, as opposed to a more rudimentary approach using a combination of new analysis and approximations.

Benefits

Our approach avoids additional analytical solutions in the initial screening process to address common stress basis comparisons and provides bases of comparison consistent with similar systems and components in Westinghouse plants.

Experience

Westinghouse has performed evaluations and analyses to the GALL Rev. 2 requirements for EAF for more than nine units.

