

## NRC's Long-Term Operation-Related Research

### Issue:

- As nuclear power plants (NPPs) age, the reactor structural components could degrade due to exposure to high temperature, neutron irradiation, stress, and corrosive media.
- Understanding the causes and mitigation of degradation mechanisms is the basis for developing and revising aging management programs (AMPs) to ensure functionality and safety margins for NPP systems, structures, and components (SSCs).
- The NRC, in cooperation with the U.S. Department of Energy's (DOE's) Light Water Reactor Sustainability (LWRS) program, identified key technical issues related to materials degradation in SSCs for operating periods from 60 to 80 years (NUREG/CR-7153, "Expanded Materials Degradation Assessment, Vols. 1-5") (ML14279A321).
  - The four most significant technical issues are reactor pressure vessel (RPV) embrittlement, irradiation-assisted stress corrosion cracking of reactor internals, concrete structures and containment degradation, and electrical cable qualification and condition assessment.

### NRC Key Messages:

- Licensees and applicants have the primary responsibility for providing the technical basis to support their safety analysis and application for license renewal and other licensing actions. The NRC staff conducts confirmatory research to independently verify licensee data, determine safety margins, and reduce uncertainties.
- Aging management research continues, as needed in some targeted areas, to allow better understanding of SSC degradation for robust long-term operation (LTO). Although a rich research basis is available to support LTO, this targeted research will inform staff reviews of future licensing actions and will support the technical basis for updating applicable AMPs and regulatory guidance in the future.

### NRC Status and Next Steps:

- The NRC's subsequent license renewal (SLR) guidance documents published in July 2017—"Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants" (NUREG-2192) (ML17188A158) and "Genergic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report" (NUREG-2191) (ML17187A031)—incorporated changes informed by the results of NRC-led and cooperative research addressing the key technical concerns. The NRC also audited licensee AMPs for effectiveness and used these results to inform the guidance.
- Licensees have submitted SLR applications for six reactors across three sites. The NRC staff has, so far, issued subsequent renewed licenses to Turkey Point Units 3 and 4. The Commission continues to review the applications for the remaining reactors.
- Research will continue to further knowledge and to confirm projections by:
  - Continuing to trend RPV properties.
  - Continuing to assess properties of RPV internals at medium and high fluence.
  - Evaluating the effects of long-term irradiation of concrete and methods for inspection.
  - Assessing cable condition monitoring techniques and confirming qualification for performance in harsh environments.
- The NRC staff continues to cooperate with the industry, DOE, and the Electric Power Research Institute (EPRI) to align research priorities and maintain transparency in addressing remaining technical issues for LTO.

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