Reactor Oversight Process Enhancement Project
Baseline Inspection Program
Special Topic – Aging Management

Background

The license renewal process is an established process that has resulted in the issuance of a number of renewed operating licenses since 2000. Since 2009, plants have begun to enter and operate in the period of extended operation (PEO), which is the 20-year period commencing immediately after the expiration of an applicant's initial 40-year operating license.

Inspection Manual Chapter (IMC) 2516, "Policy and Guidance for the License Renewal Inspection Program," states,

> With the exception of age-related degradation and possibly a few other issues related to safety only during extended operation of nuclear power plants, the existing regulatory process is adequate to ensure that the licensing bases of all currently operating plants provide and maintain an acceptable level of safety so that operation will not be inimical to public health and safety or common defense and security.

Based on this principle, the license renewal review verifies that applicants have identified the appropriate systems, structures and components (SSCs) that require aging management. Applicants also propose the appropriate programs and activities that will adequately manage these aging effects, and incorporate these proposed programs and activities as their new licensing basis for post-license renewal. Thus, when the Division of License Renewal (DLR) issues a renewed operating license, it is the expectation that the existing oversight process will monitor and assess licensee processes and activities to manage age-related degradation.

Equipment failures related to aging degradation have been known to occur at plants that have entered the PEO and operated beyond 40 years. For example, at Monticello Nuclear Generating Plant, the fire protection system was declared non-functional when fire piping was identified to be completely blocked due to corrosive buildup. Various stakeholders question why plants with renewed operating licenses are experiencing these issues and ask what the oversight process is doing to address these issues.

Passive structures are considered inherently reliable in the oversight process. The oversight process could be enhanced to incorporate inspection guidance regarding when and how to specifically assess age-related degradation issues at plants.

Analysis

At the time the ROP Enhancement Project effort began, three inspection procedures (IPs) had been updated to include limited aging management inspection guidance. The procedures are IP 71111.06, "Flood Protection Measures," IP 71111.21, "Component Design Basis Inspection," and IP 71152, "Problem Identification and Resolution."

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For the analysis phase of the review, the team used the information and knowledge from inspectors, recent events and results from previous inspections. DLR worked closely with its regional counterparts to understand which changes were necessary and how resources would be impacted. The team was sensitive to resources for additional inspections not being available. This would mean that other inspections would have to be removed from the baseline inspection program in order to add new aging management inspections to the program.

The team focused on the most non-intrusive method of inspecting aging management with the least amount of change to the existing and available inspection resources. The team also focused on leveraging existing inspections in baseline inspection program and limiting the scope of the review to equipment in the scope of license renewal at plants that are in the PEO.

The methods considered for incorporating aging management into the oversight process are below:

Option	Focus of Inspection	Justification	Pros	Cons	Estimated Resources Needed
Option 1: Create an inspection procedure under Appendix C of IMC 2515, Infrequently Performed Inspections	a. Review is program-based b. Review implementation of aging management programs (AMPs) c. Review AMP effectiveness d. Review licensee changes to AMPs or other renewal activities	• Evidence of licensees applying non-conservative changes to new and existing AMPs	• Resources are available • Inspections performed by experienced regional inspectors	• Appendix C does not specify required periodicity	Performed 2-3 years into plant's PEO; triennial frequency; 1-2 inspectors for 1-2 weeks
Option 2: Create an inspection procedure under Appendix A of IMC 2515, Baseline Inspections	a. Review can be program-based or performance-based b. Review of any equipment whether active or passive c. Review implementation of AMPs d. Review AMP effectiveness e. Review licensee changes to AMPs or other renewal activities f. Verify issues related to aging of equipment are identified and resolved in a timely manner	• Evidence of licensees applying non-conservative changes to new and existing AMPs • Evidence of aging of active components (Thompson report; ADAMS ML13044A69) • Risk-informed ROP may give lower priority to the inspection of aging management issues	• Portions of inspection performed by experienced regional inspectors • Integrated approach to aging management reviews	• Resources not available to support inspection • Portions of inspection performed by generalists	Performed at every plant regardless of whether the plant has a renewed operating license; 10 hours, semiannually
Option 3: Integrate aging management inspection guidance into each existing and applicable baseline inspection procedure	a. Review is performance-based b. Age-related degradation has to occur to trigger additional review of aging management issue c. Verify issues related to aging of equipment are identified and resolved in a timely manner d. Verify continued implementation and updates of AMPs and/or implementing procedures	• Risk-informed nature of ROP may give lower priority to the review of aging management issues	• Uses small portion of existing resources • Portions of inspection performed by experienced regional inspectors	• Portions of inspection performed by generalists	Performed at plants in PEO as part of existing sample hours if performance related issues identified; may be performed on one sample per year

Recommendations

The team agreed to proceed with recommending Option 3: Integrate aging management inspection guidance into each existing and applicable baseline inspection procedure as this was the most resource-neutral option that would fulfill the desired inspection objectives for aging management inspections.

However, additional technical guidance and training on the contents of the various AMPs and aging effects would be needed for inspectors. This may require the development technical guidance document and/or an IMC 1245, "Qualification Program for Operating Reactor Programs" training module. The team developed recommendations to update the following IPs:

In the Engineering Inspection Area
71111.05A/Q/T Fire Protection
71111.06 Flood Protection Measures
71111.17 Evaluations of Changes, Tests, or Experiments
71111.18 Plant Modifications

In the Maintenance Inspection Area
71111.04 Equipment Alignment
71111.12 Maintenance Effectiveness
71111.19 Post Maintenance Testing
71111.22 Surveillance Evaluations

In the Operability Inspection Area
71111.07A/T Heat Sink Performance

In the ISI Inspection Area
71111.08 In-service Inspection Activities

In the Problem Identification and Resolution Inspection Area
71152 Problem Identification and Resolution

In the Miscellaneous Inspection Area
71111.01 Adverse Weather Protection
71111.20 Refueling and Other Outage Activities

As an example, IP 71111.05, Fire Protection, may be enhanced to state:

> 02.04 Aging Management.
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> For plants in the PEO, verify that issues related to aging of fire protection equipment within the scope of license renewal and this procedure are being identified and properly resolved in a timely manner in accordance with the applicable AMP or implementing procedure. Verify the implementation of the AMPs as approved by the staff to ensure the licensee continues to meet the program attributes/actions described in the plant's current licensing basis.
> 03.04 Aging Management.

Review the applicable AMP or implementing procedure to determine whether:

- preventive actions were taken to mitigate or prevent aging effects
- the aging effects were monitored or inspected
- aging effects were detected before loss of intended function occurred
- monitoring and trending provided for prediction of the extent of the aging effects acceptance criteria were evaluated to ensure intended functions maintained
- corrective actions were timely
- preventive actions were adequate and appropriate corrective actions completed and effective
- administrative controls provided a formal review and approval process for changes to the implementing procedures
- relevant operating experience provided objective evidence to support a determination that the effects of aging were adequately managed so that intended functions were maintained during the PEO

Review the AMP or implementing procedure requirements to verify the completion of surveillances and preventative actions. Verify the adequacy of the physical material condition to ensure indications of aging degradation are identified prior to loss of intended function; problems are incorporated into the Correction Action Program; and the AMP or implementing procedure is revised as necessary. Issues associated with aging management or aging of plant equipment may be discussed with the regional license renewal lead. Additional guidance for specific AMPs and aging effects applicable to the equipment inspected by this procedure may be found in Technical Guidance Part 9900: Aging Management Inspection Guidance and in the aging management appendix of the plant's updated final safety analysis report (UFSAR).

Also, as another example, IP 71111.18, Plant Modifications, may be enhanced to state:

02.04 Aging Management.

For plants in the PEO, verify whether modifications to equipment in the scope of license renewal did not adversely introduce a new aging mechanism (potential for cavitations, accelerated corrosion, etc.), impact an existing aging mechanism (increased the rate of deterioration) or affect previously evaluated analyses.

03.04 Aging Management.

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- acceptance criteria were evaluated to ensure intended functions were maintained
- corrective actions were timely
- preventive actions were adequate and appropriate corrective actions were completed and effective

- administrative controls provided a formal review and approval process for changes to the implementing procedures
- relevant operating experience provided objective evidence to support a determination that the effects of aging were adequately managed so that intended functions were maintained during the PEO

Verify that necessary changes to Technical Specifications, the UFSAR and other licensing basis documentation have been identified and NRC approvals, if required, were obtained in accordance with requirements. Changes may be made using the commitment change process in NEI 99-04, "Guidelines for Managing NRC Commitment Changes" for commitments, the 10 CFR 50.59, "Changes, Tests and Experiments" process for aging management activities described in the UFSAR, or require a license amendment for aging management activities required by a license condition. Verify issues associated with modifications of equipment within the scope of license renewal and this procedure are identified and properly resolved in a timely manner in accordance with the applicable AMP or implementing procedure. Issues associated with aging management or aging of plant equipment may be discussed with the regional license renewal lead. Additional guidance for specific AMPs and aging effects applicable to the equipment inspected by this procedure may be found in Technical Guidance Part 9900: Aging Management Inspection Guidance and in the aging management appendix of the plant's UFSAR.

Generic guidance was drafted for incorporation into applicable procedures to ensure: performance-based aging management inspections occur at plants in the PEO on equipment in the scope of license renewal, and inspectors verify issues related to aging of equipment are identified and resolved in a timely manner.

In order to ensure the addition of inspections remains resource-neutral, the team is not recommending that a whole sample be designated for an aging management inspection in each of the applicable procedures. Instead, it is recommended that the aging management inspection is performed as a small part of existing sample hours, e.g., 5 to 10 percent of the allotted inspection sample hours might focus on aging management.