Aging and PSA

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License Renewal and Standardization Branch

United States Nuclear Regulatory Commission

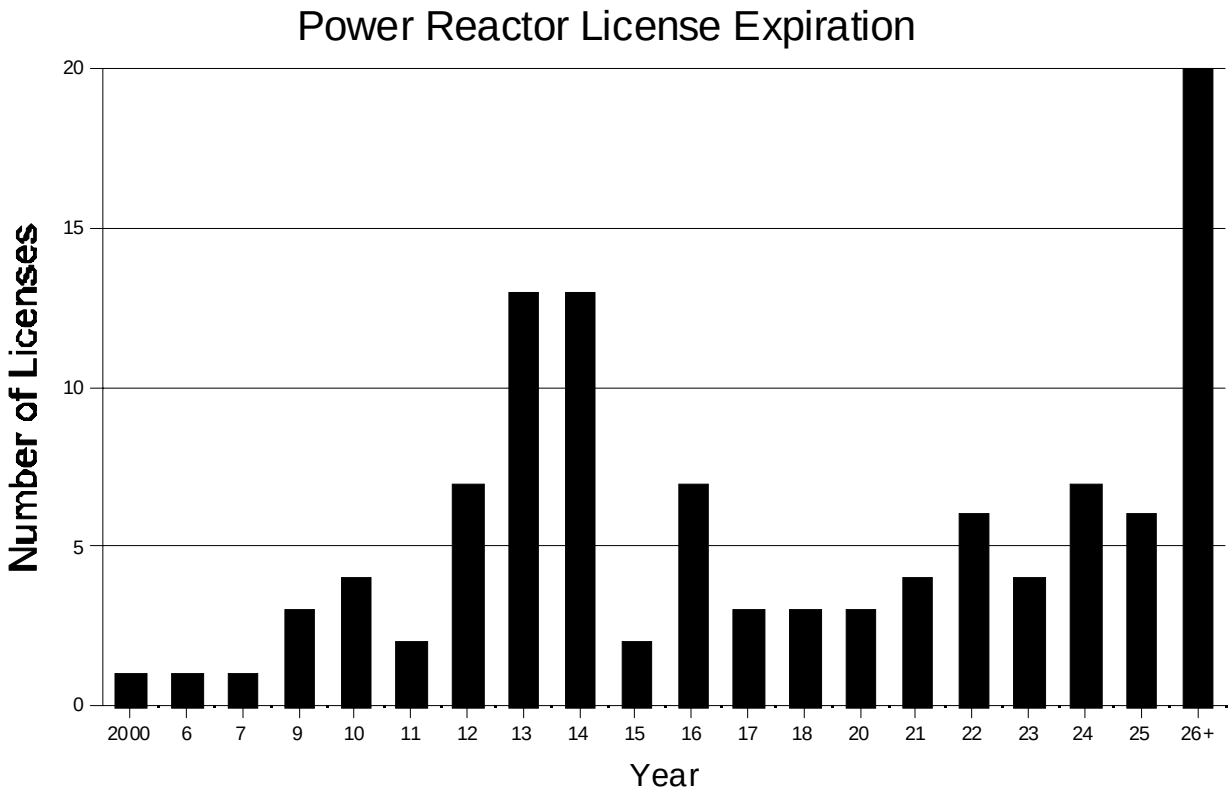
Background

- The Nuclear Regulatory Commission (NRC) issues operating licenses for commercial power reactors to operate for up to 40 years
- The NRC allows these licenses to be renewed for up to an additional 20 years.

Aging US Nuclear Reactors

- The next 40-year operating license will expire in the year 2006.
- Approximately 10 percent of the 102 remaining operating plants will expire by the end of the year 2010, and more than 40 percent will expire by the year 2015.
- The decision whether to seek license renewal rests entirely with nuclear power plant owners, and typically is based on the plant's economic situation and whether it can meet NRC requirements.

License Expiration



NUREG-1350, Information Digest

60 Year Operating Licenses Approved

- Calvert Cliffs Nuclear Power Station Units 1 and 2
- Oconee Nuclear Station Units 1 and 2
- Arkansas Nuclear Station One

LR Applications in Progress

- Turkey Point Unit 3 and 4
- Hatch Unit 1 and 2
- McGuire and Catawba
- Peach Bottom
- Surry and North Anna

License Renewal Regulation

- 10 CFR 54 provides for a new license to operate for up to 20 years beyond current terms
- 10 CFR 54 focuses on aging management for passive systems, structures and components

Improved Regulatory Guidance

- NUREG-1800, “Standard Review Plan (SRP-LR) for the Review of License Renewal Applications for Nuclear Power Plants”
- NUREG-1801, “Generic Aging Lessons Learned” (GALL)
- NEI 95-10, Revision 2, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54*, Nuclear Energy Institute
- All of these documents were published in July, 2001
- http://www.nrc.gov/NRC/REACTOR/LR/

Significant NRC Determinations

- Regulatory process is adequate for ensuring safety of operating plants. 10 CFR 54 amendment in 1995 based partly on achievements of the maintenance rule (10 CFR 50.65).
- Issues relevant to current operating plants will be addressed by the regulatory process and carried forward into the period of extended operation.
- Compilation of the current licensing basis (CLB) or reverification of CLB compliance is not necessary for a license renewal review. CLB carries forward into the period of extended operation.

Significant NRC Determinations

- Focus of renewal review is passive, long-lived structures and components and time-limited aging analyses
- 1991 renewal rule focus on age-related degradation unique to license renewal (ARDUTLR) was impractical
- 10 CFR 54 is a deterministic rule (not risk informed)
- Focus on managing the effects of aging during the period of extended operation

LR Scope (Graded Approach)

- Safety related systems, structures, and components relied upon to:
  - Maintain integrity of the reactor coolant pressure boundary
  - Ensure capability to shut down & maintain a safe shutdown condition
  - Prevent or mitigate offsite exposures comparable to 10 CFR 100 offsite dose analyses for siting

LR Scope (continued)

- Non-safety related systems, structures, and components whose failure could prevent safety related function as outlined in the previous slide

LR Scope (continued)

- Systems, structures, and components relied upon for compliance with regulations:
  - Fire protection (10 CFR 50.48)
  - Environmental qualification (10 CFR 50.49)
  - Pressurized thermal shock (10 CFR 50.61)
  - Anticipated transients without scram (10 CFR 50.62)
  - Station blackout (10 CFR 50.63)

SSCs subject to review (Passive)

- Reactor vessel
- Reactor coolant pressure boundary
- Steam generators
- Pressurizer
- Piping
- Pump casings
- Valve bodies
- Core shroud
- Component supports
- Pressure retaining boundaries
- Containment
- Containment liner
- Penetrations
- Electrical cables and cabinets
- Cable trays

SSCs not subject to Review (Active)

- Motors
- Diesel generators
- Air compressors
- Snubbers
- Control rod drive
- Pressure transmitters
- Pressure indicators
- Transistors
- Batteries
- Breakers
- Relays
- Switches
- Power inverters
- Circuit boards
- Battery chargers
- Power supplies

Aging Management Program Elements (Beyond PSA)

- Scope
- Preventive Actions
- Parameters Monitored or Inspected
- Detection of Aging Effects
- Monitoring and Trending
- Acceptance Criteria
- Corrective Actions
- Confirmation Process
- Administrative Controls
- Operating Experience

Sample of Existing Programs that are part of the CLB before LR

- Maintenance Rule (10 CFR 50.65)
- Boric Acid Corrosion Program (GL88-05)
- Chemistry Control Program (Technical Specifications)
- Coatings Program (RG 1.54)
- Inservice Inspection (10CFR50.55a)
- Environmental Qualification (10CFR 50.49)
- Heat Exchanger Performance Testing (GL89-13)
- Erosion/Corrosion Program (BL-01)
- Reactor Vessel Integrity Program (10 CFR 50.60)

Arkansas Nuclear One

- ANO-1 credited Risk Informed Inservice Inspection in their License Renewal Application.
- Information on this approach may be obtained in Regulatory Guide 1.178, “An Approach For Plant-Specific Risk-informed Decisionmaking Inservice Inspection of Piping.

Other LR PSA applications

- Inspection is part of the License Renewal Process
- Inspection samples are chosen partially based on IPE and IPEEE importance measures

PSA Barriers:

- PSA models are not available that account for all of the passive components in the LR Scope (Extensive Research Task)
- Traditional PSAs do not explicitly model the effectiveness of tests and maintenances in controlling aging effects

Conclusion

- License Renewal is a deterministic rule
- PSA is used in limited applications