

Analysis of Subsequent License Renewal for Nuclear Power Plants

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BACKGROUND

- US NUCLEAR POWER PLANTS

- Initially Licensed for 40 years
- License Renewal (LR) for up to an additional 20 years
- Most plants have been approved for LR
- In 2016, ~20 plants have entered operations of greater than 40 years

- SUBSEQUENT LICENSE RENEWAL (SLR)

- Operations beyond 60 years
- 2 Sites have informed the NRC of their intent to pursue SLR
 - Peach Bottom (Exelon); Surry (Dominion)

- *Atomic Energy Act established the original 40-year term based on economic and antitrust considerations, not technical limitations*

- *All plants will not automatically apply for SLR*
- *Some plants that apply for SLR may not be approved for an additional 20 years*
- *There is no regulatory limit on how many 20 year SLR extensions a plant can apply or be approved*

OBJECTIVE

- What we intend to accomplish

- Derive a long-term operations qualitative vulnerability measure (QVM) to be utilized as an input to NEMS
- Identify/define timing and duration for the application of a QVM and CapAdd in NEMS

- Key Deliverables

- SLR Library
- Identify and provide a vulnerability measure for each reactor to be applied in NEMS
- SLR Manual (include all supporting documentation and materials)

ANALYTICAL APPROACH

- Review of nuclear industry information on LR, SLR, Aging Management
 - NRC, NEI, EPRI, National Labs
- Identify major technical, regulatory, and cost issues related to SLR
- Research issues for each plant or type/vintage of plant
- Rate applicable issue on likelihood to impact SLR
- Assign an overall SLR risk to each plant

KEY ISSUES AFFECTING SLR

1. Reactor Pressure Vessel **Condition ***
 - a) Embrittlement of the reactor pressure vessel at high fluence
 - b) Pressurized Thermal Shock (PTS) (PWRs only)
 - c) Vessel welds
2. Irradiation-assisted stress corrosion cracking (SCC) of reactor internals and primary system*
3. Electrical Cables*
 - a) Qualification
 - b) Condition assessment
4. **Possible** concrete and containment degradation*
 - a) Long-term radiation and high temperature exposure
5. Buried tanks and piping
6. Miscellaneous Items
 - a) Recent Extended Power Uprate (EPU)
 - b) Recent major equipment upgrades
 - c) Regulated vs. merchant
 - d) Rated power
 - e) Multi-unit site

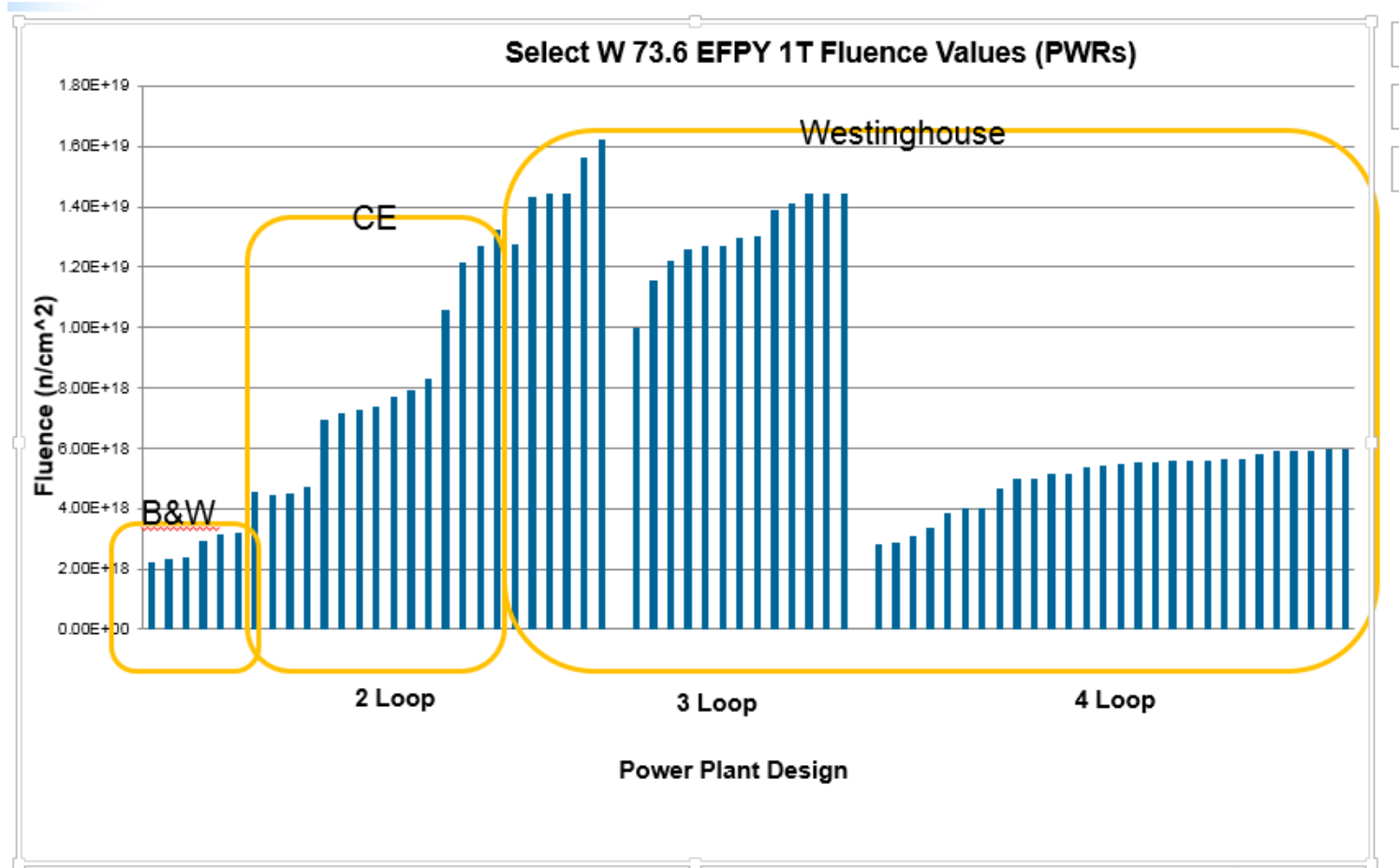
Note: These are the major technical issues identified by the NRC. **EIA does not evaluate or determine the operational safety of nuclear power plants.*

KEY ISSUES AFFECTING SLR

What issues do the utilities see as critical to SLR success?

EXAMPLE ANALYSIS

Reactor Pressure Vessel Fluence



EXAMPLE ANALYSIS

- Fluence varies by plant design
- High fluence plants may have more issues with vessel embrittlement, PTS, and SCC.
- Increase to SLR Risk if the vessel may not last an extra 20 years
- Even with a higher risk, there may be viable solutions for plants with high fluence issues
 - Increased inspections, alternative PTS methods, fuel management changes, conditional NRC approval