Risk-Informing License Renewal Current Opportunities and Future Potential

Allen Hiser & Lauren Gibson

Division of New and Renewed Licenses

U.S. Nuclear Regulatory Commission

August 4, 2022

Why are we here today?

- NRC aspires to be a “modern, risk-informed regulator”
  - Currently evaluating industry-proposed risk-informed AMPs
- Can other aspects of license renewal be risk-informed?
  - To understand industry perspectives
  - To understand public perspectives
  - To enable development of a path forward

Outline

- Defining risk in a regulatory framework
- Assessment of use of risk in license renewal rule applications
  - Rule and current process
  - Discussion in rulemaking statement of considerations
  - Possibilities within the current rule
- Use of risk in program implementation
- Overall approaches to risk-inform license renewal

Defining risk

- The combined answer to three questions (risk triplet):
  - (1) what can go wrong
  - (2) how likely it is
  - (3) what would be the consequences
- These three questions allow the NRC to understand likely outcomes, sensitivities, areas of importance, system interactions, and areas of uncertainty, which can be used to identify risk-significant scenarios.

Related Concepts

- Risk-informed decision-making
  - Insights from probabilistic risk assessment are considered with other engineering insights.
- Risk-based decisionmaking
  - Considers only the results of a probabilistic risk assessment.
- Risk-informed regulation
  - Incorporates an assessment of safety significance or relative risk. Ensures that the regulatory burden is appropriate to its importance in protecting the health and safety of the public and the environment.
- Performance-based regulation
  - Focuses on desired outcomes rather than prescriptive processes, procedures, etc.

In all cases, the objective is to maintain adequate levels of plant safety

Outline

- Defining risk in a regulatory framework
- Assessment of use of risk in license renewal rule applications
  - Rule and current process
  - Discussion in rulemaking statement of considerations
  - Possibilities within the current rule
- Use of risk in program implementation
- Overall approaches to risk-inform license renewal

How Does this Relate to License Renewal?

Potential uses of risk information

- Part 54 License Renewal rule – governs the issuance of renewed operating licenses
  - Submittal of application
  - NRC review of application
- Plant implementation of license renewal activities
  - Aging management programs
  - Implementing changes
- Focus is on uses of risk information consistent with the current rule

How Does the License Renewal Rule Address Risk?

Part 54 does not directly mention "risk"

- Description of the Part 54 license renewal process
- Summary of Part 54 rulemaking statement of considerations (SOC)

License Renewal Process Short Description

Integrated Plant Assessment

1. Identify systems, structures and components (SSCs) that are in the scope of Part 54
2. For the “in-scope” SSCs, identify those structures and components (SCs) that require aging management review
3. For each SC identified in 2, demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained

Scoping for License Renewal (§ 54.4(a))

- Systems, structures and components (SSCs) that are
  - Safety-related
  - Nonsafety-related whose failure could prevent accomplishment of safety-related functions
  - Relied on for compliance with certain NRC regulations (fire protection, station blackout, etc.)
- Functions for safety-related SSCs
  - Integrity of the reactor coolant pressure boundary
  - Shut down the reactor and maintain it in a safe shutdown
  - Prevent or mitigate the consequences of accidents which could result in potential offsite exposures
- "*Intended function*" – those functions that are the bases for including them within the scope of license renewal

“Screening” for License Renewal (§ 54.21(a)(1))

- For the “in-scope” SSCs, identify those structures and components (SCs) that require aging management review
  - SCs which are “passive and long-lived”
    - “Passive” = Perform their *intended function* without moving parts or without a change in configuration or properties
    - “Long-lived” = Not subject to replacement based on a qualified life or specified time period

Aging Management Review Purpose

- Demonstrate that the effects of aging will be adequately managed so that the *intended function(s)* will be maintained consistent with the CLB for the period of extended operation
  - Identify aging effects that could prevent *intended functions* (e.g., cracking, loss of fracture toughness, loss of material)
  - Identify aging management programs to manage the effects of aging

Standards for Approval of a Renewed License

- § 54.29(a)
  - ". . . there is *reasonable assurance* that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB . . ."
  - "managing the effects of aging during the period of extended operation on the *functionality of structures and components* that have been identified to require review . . ."

Summary of Part 54

- Scoping is deterministic – *all SSCs* that meet the scoping criteria (based on SSC *intended function(s)*)
- "Screening" is deterministic – *all SCs* that are passive and long-lived
- Aging management review is deterministic – for *each SC* demonstrate that the effects of aging will be adequately managed so that the *intended function(s)* will be maintained

Outline

- Defining risk in a regulatory framework
- Assessment of use of risk in license renewal rule applications
  - Rule and current process
  - Discussion in rulemaking statement of considerations
  - Possibilities within the current rule
- Use of risk in program implementation
- Overall approaches to risk-inform license renewal

What do the SOCs say – 1991 Part 1?

- While the Commission believes that the methodology for conducting an integrated plant assessment needed to ensure that aging of SSCs is appropriately managed should emphasize deterministic approaches, the Commission also acknowledges that PRA techniques could be used as a supplemental tool in the renewal applicant's integrated plant assessment. The Commission recognizes that PRA can be an effective tool to provide *added assurance* that all SSCs important to license renewal have been evaluated . . .
- The screening methods, as well as aging management approaches selected by the license renewal applicants, may also include use of probabilistic risk assessment (PRA) techniques as a supplement to the primarily deterministic methods.

What do the SOCs say – 1991 Part 2?

- The Commission considers that at the present time appropriate aging data and models have not been developed for many SSCs for inclusion in the PRAs, and uniform criteria do not exist for evaluating the PRA results.
- Nevertheless, at the present time, probabilistic assessments can be a useful adjunct to deterministic methods to help draw attention to specific vulnerabilities and to help guard against significant oversights in the screening process. In view of the PRA limitations discussed, probabilistic assessment alone is not an acceptable basis for the exclusion of SSCs to be evaluated as part of an IPA. It may be useful *to identify additional SSCs to be evaluated* as part of the IPA

What do the SOCs say – 1995?

- Without the necessary regulatory requirements and appropriate controls for plant-specific PRAs, the Commission concludes that it is inappropriate to establish a license renewal scoping criterion, as suggested by Illinois, that relies on plant-specific probabilistic analysis. Therefore, within the construct of the final rule, PRA techniques are of very limited use for license renewal scoping.

- In license renewal, probabilistic methods may be most useful, on a plant-specific basis, in helping to assess the relative importance of structures and components that are subject to an aging management review by helping to draw attention to specific vulnerabilities (e.g., results of an IPE or IPEEE). Probabilistic arguments may assist in developing an approach for aging management adequacy. However, probabilistic arguments alone will not be an acceptable basis for concluding that, for those structures and components subject to an aging management review, the effects of aging will be adequately managed in the period of extended operation.

Summary of SOCs Statements

- PRA can be an effective tool to provide added assurance that all SSCs important to license renewal have been evaluated, and may be useful to identify additional SSCs to be evaluated as part of the IPA
- PRA techniques could be used as a supplemental tool in the renewal applicant's integrated plant assessment, and as a supplement to the primarily deterministic methods for the screening methods and aging management approaches
- Appropriate aging data and models have not been developed for many SSCs for inclusion in the PRAs and uniform criteria do not exist for evaluating the PRA results
- PRA techniques are not an acceptable basis for the exclusion of SSCs to be evaluated as part of an IPA and are of very limited use for license renewal scoping

Consideration of Risk in SRP-SLR

- The reviewer should focus on individual plant examination (IPE) information pertaining to plant changes or modifications that are initiated by the licensee in accordance with the requirements of 10 CFR 50.59 or 10 CFR 50.90
- Potential augmented requirements include: alternative examination methods (e.g., volumetric versus external visual), augmented inspections (e.g., a greater number of locations, additional locations based on risk insights based on susceptibility to aging effect and consequences of failure, a greater frequency of inspections), and additional trending parameters and decision points where increased inspections would be implemented.
- The risk significance of a structure or component could be considered in evaluating the robustness of an AMP. Probabilistic arguments may be used to develop an approach for aging management adequacy. However, use of probabilistic arguments alone is not an acceptable basis for concluding that, for those SCs subject to an AMR, the effects of aging will be adequately managed in the subsequent period of extended operation. Thus, risk significance may be considered in developing the details of an AMP for the structure or component for SLR, but may not be used to conclude that no AMP is necessary for SLR.

Outline

- Defining risk in a regulatory framework
- Assessment of use of risk in license renewal rule applications
  - Rule and current process
  - Discussion in rulemaking statement of consideration
  - Possibilities within the current rule
- Use of risk in program implementation
- Overall approaches to risk-inform license renewal

Opportunities for Use in Part 54 Review

- Development of risk-informed AMPs for inclusion to GALL-SLR
  - Letter from Nuclear Energy Institute dated January 12, 2022, proposed two AMPs (ML22019A292)
- NRC level of review of aging management review line items
- Enhancements or exceptions within aging management programs

Aging Management Review Line Items

- Using 10 CFR 50.69 or similar risk categorizations
  - How could this information be used to adjust the NRC review effort?
  - Are the PRAs sufficiently detailed to be useful for relevant SSCs?
- Open Question—Exactly how applicable is PRA to the subsequent period of extended operation, and is aging appropriately modeled in the PRA?

Aging Management Programs

- How can risk information (risk categorization or PRA results) be used to support enhancements or exceptions?
- How could the risk information be used to modify the way that an aging effect is managed (e.g., more or fewer inspections)?
- Covered under a separate on-going activity

Outline

- Defining risk in a regulatory framework
- Assessment of use of risk in license renewal rule applications
  - Rule and current process
  - Discussion in rulemaking statement of considerations
  - Possibilities within the current rule
- Use of risk in program implementation
- Overall approaches to risk-inform license renewal

What if the renewed license has already been issued?

10 CFR 50.59 governs the approach to changing aging management program commitments.

Outline

- Defining risk in a regulatory framework
- Assessment of use of risk in license renewal rule applications
  - Rule and current process
  - Discussion in rulemaking statement of considerations
  - Possibilities within the current rule
- Use of risk in program implementation
- Overall approaches to risk-inform license renewal

Overall Approaches to Risk-Inform License Renewal

- Consistent with Part 54
  - Include risk-informed AMPs in GALL-SLR
  - Plant-specific AMP implementation
- Rulemaking to change Part 54
  - No plans or on-going activities
- Application-specific exemptions
  - Individual applicant decision

The NRC's Next Steps

- Evaluate information from today's meeting
- Develop a path forward

Initialisms

AMP	Aging management program
AMR	Aging management review
CFR	Code of Federal Regulations
CLB	Current licensing basis
GALL-SLR	Generic Aging Lessons Learned for Subsequent License Renewal
IPA	Integrated plant assessment
IPE	Individual plant examination
IPEEE	IPE for external events
NRC	Nuclear Regulatory Commission
SC	Structure and components
SLR	Subsequent license renewal
SOC	Statement of Considerations
SRP	Standard Review Plan
SSC	System, structure and component