



PSA 2017

**A Tool for planning the Safety Review of SSCs:
Development and Application**

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- Background
- Enhanced Safety Focused Review
 - Interdisciplinary working group
 - SSC Review Tool – key review considerations
 - SSC Review Tool Application
- Summary

Commission Direction

- Develop a framework...to more fully integrate risk insights into pre-application activities and small modular reactor (SMR) reviews
- Align review focus and resources...to risk-significant structures, systems, and components (SSCs) and other aspects of the design that contribute most to safety to enhance the efficiency of the review process

- Staff proposed and Commission approved, a plan for integral pressurized water reactor (iPWR) design applications:
 - NUREG-0800, Introduction - Part 2
 - Design Specific Review Standard

- Designed with SMRs in mind
- Early NRC-Applicant Engagement
- Preparation of DSRSs
- Application of risk information feeds review scope and depth determination:
 - A1 Safety-related, risk-significant
 - B1 Not safety-related, risk-significant
 - A2 Safety-related, not risk-significant
 - B2 Not safety-related, not risk significant

- Safety classification (A or B) is reviewed as part of SRP Section 3.2 “Classification of SSCs”
- Risk-significance determination (1 or 2) is reviewed as part of SRP Section 17.4 “Reliability Assurance Program”:
 - Probabilistic risk assessment
 - Regulatory treatment of non-safety systems
 - Expert panel

Design Specific Review Standard

- DSRS incorporates current SRP sections or includes new review sections based on:
 - Technology differences
 - Risk information
 - Lessons learned from previous reviews
 - Interim staff guidance
- NuScale DSRS sections issued in August 2016

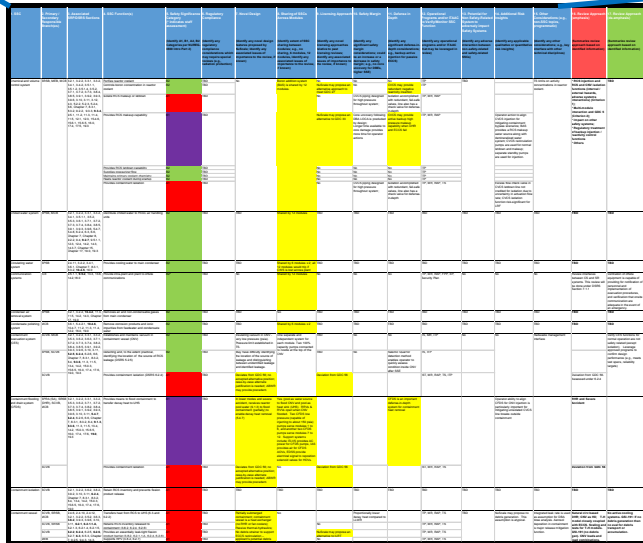
Working Group Goals

- Provide reviewers and branch chiefs with tools for conducting the NuScale safety review consistent with NUREG-0800, Introduction, Part 2 and additional approaches developed by working group
 - Help reviewers and Branch Chiefs define optimal scope and depth of reviews
 - Supplement, and in some cases clarify, SRP and DSRS

Key Review Considerations

Safety-significance	Regulatory Compliance	Novel Design	Shared SSCs	Licensing Approach	
Safety margin	Defense-in-depth	Operational Programs	Non-safety SSCs impacting Safety functions	Additional Risk Insights	Other Considerations

SSC Review Tool



The screenshot shows a complex spreadsheet with multiple columns and rows. The cells are color-coded: red, yellow, green, and purple. The columns represent different review considerations, and the rows represent individual SSCs. The tool is used to systematically evaluate each SSC against these considerations.



Output: Scope and Depth of Review

- Improves review decisions between Branch Chief and technical staff
- Clarifies review approach when applying NUREG-0800, Introduction - Part 2 and DSRS for SSCs
- Provides systematic thought process that may be applied to non-SSC and programmatic reviews

- A1, B1, A2, B2 **safety significance** categories
(i.e., NUREG-0800 Intro Part 2)
- **Regulatory compliance** issues
(e.g., radiation protection)
- **Novel design** features
(e.g., passive safety design features)
- Extent of **SSC sharing** between modules
(e.g., fires and floods)
- Unique **licensing approaches**
(e.g., deviations from guidance, exemptions)

- **Safety margin** considerations
(e.g., no core uncover for design basis events)
- **Defense-in-depth** considerations
(e.g., active injection back up for passive systems)
- **Operational programs** that may be leveraged for review
(e.g., tech specs, maintenance rule, initial test program)
- **Adverse interactions** between non-safety-related and safety-related SSCs
- Other qualitative or quantitative **risk insights**
(e.g., key PRA assumptions)
- **Other considerations**
(e.g., key design or operational assumptions)

SSC Review Tool Application (Review Emphasis Example)

Review Considerations

SSC

Review Topic

Safety-significance

Novel Design

Defense-in-Depth and Safety Margins

Containment

Containment pressure and temperature

A1 - Safety-related, risk-significant

Design outside of review and operating experience base

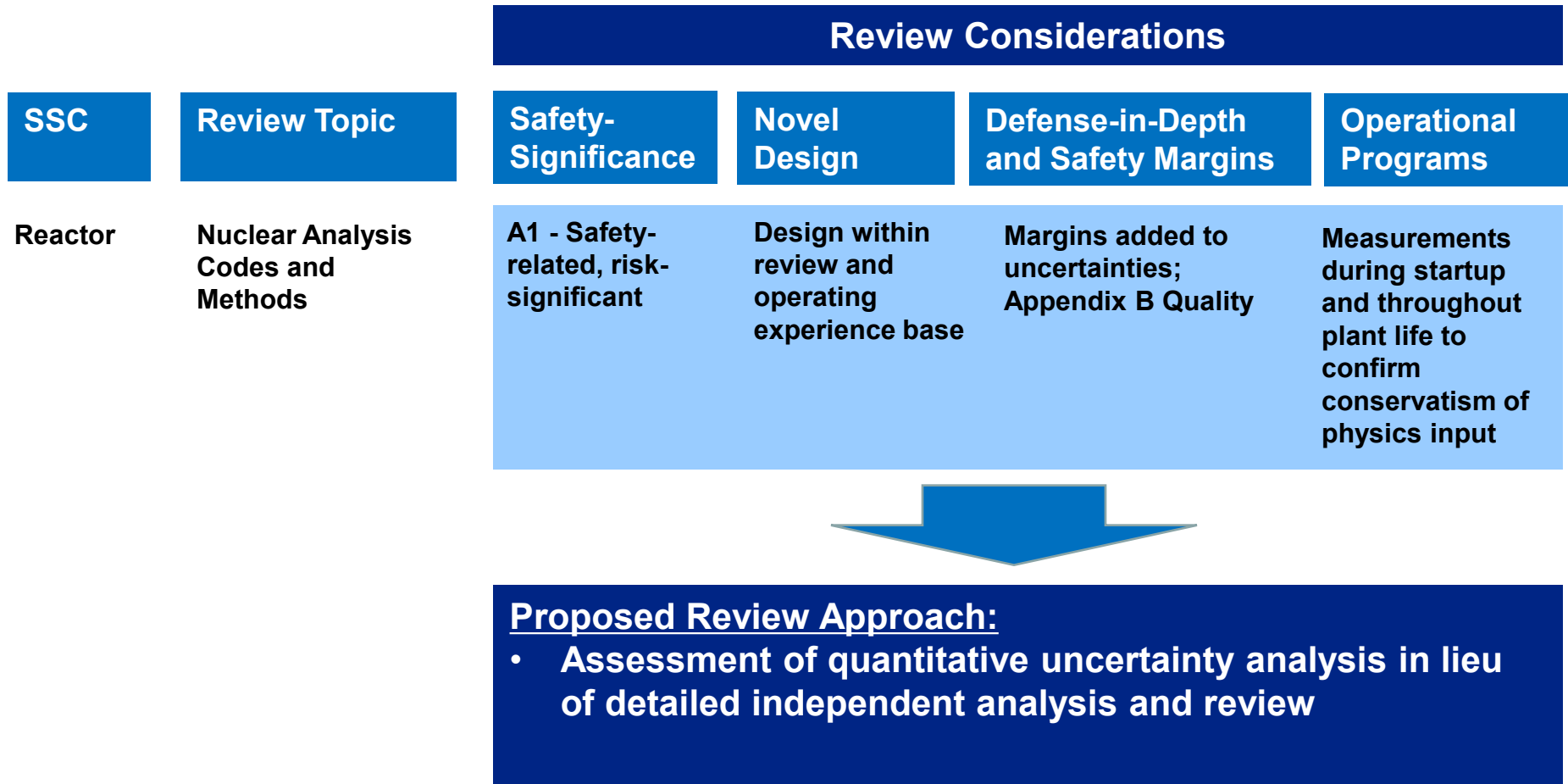
Supports primary safety case to provide passive safety using fail-safe features



Proposed Review Approach:
Detailed review of design and analyses

- Perform independent confirmatory calculations
- In-depth assessment of test data

SSC Review Tool Application (Reduced Effort Review Example)



Senior Management Reviews

Example “review emphasis” areas

Review Topic	Basis
Containment pressure and temperature	<ul style="list-style-type: none"> • Safety-related and risk-significant • Novel design, test, and analysis • Lack of operating experience • Not self-revealing from operation
Post-event re-criticality	<ul style="list-style-type: none"> • NuScale approach on GDC 27 may introduce policy issues due to design of reactivity control system
Multi-module risk	<ul style="list-style-type: none"> • New issue staff has not previously reviewed • New quantitative and qualitative approaches proposed by applicant to evaluate multi-module risk
Heavy Load Handling	<ul style="list-style-type: none"> • Risk-significant • Novel design, test, and analysis • Lack of operating experience • Highest contributor to single and multi-module CDF • Novel use to transport freshly shutdown core

Example “reduced effort review” areas

Review Topic	Basis for Reduction
Spent Fuel Pool Area Ventilation System	<ul style="list-style-type: none"> • Not safety-related and not risk-significant • NuScale expected to use traditional ventilation design
Spent Fuel Criticality	<ul style="list-style-type: none"> • No burnup credit • High pool boron concentration vs. the minimum boron concentration credited in the analysis
PRA technical adequacy	<ul style="list-style-type: none"> • Staff has already conducted two audits of PRA • Less complex PRA models
Aircraft Impact Assessment (systems and fire)	<ul style="list-style-type: none"> • Underground structures and equipment less prone to be adversely affected by aircraft impact

- NRC staff is implementing strategies to achieve more effective and efficient regulatory reviews
- Opportunity to apply review tool concepts to advanced reactor design reviews