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Revisions to *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants* (NUREG-0800)

Staff: Suzanne Schroer, Mark Caruso, Hanh Phan,

Odunayo Ayegbusi, Robert Vettori, Jonathan DeGange

Office of New Reactors

Presented to ACRS Subcommittee on Reliability and PRA

March 20, 2014

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Agenda

Section	Staff Presenting
• SRP Section 17.4	Suzanne Schroer
• SRP Section 19.0	Mark Caruso
• SRP Section 19.1	Hanh Phan
• SRP Section 19.2	Odunayo Ayegbusi
• SRP Section 19.3	Mark Caruso
• SRP Section 19.4	Robert Vettori
• SRP Section 19.5	Robert Vettori

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Revision 1 to SRP Section 17.4 "Reliability Assurance Program"

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SRP 17.4 Update
Reliability Assurance Program

- SRP 17.4 updated to incorporate DC/COL-ISG-18 Reliability Assurance Program
  - Sections of 17.4 were wholly replaced by ISG-018
- Also clarified “Review Procedures”

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SRP 17.4 Update
Reliability Assurance Program

- Sections replaced by DC/COL-ISG-018
  - Review Responsibilities
  - Areas of Review
  - Acceptance Criteria
  - Evaluation Findings
  - References

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SRP 17.4 Update
Reliability Assurance Program

- Replaced the term “quality elements” in SRP Section 17.4, Revision 0 and “essential elements” in SECY-95-132 with the term “implementation controls” in SRP Section 17.4, Revision 1

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SRP 17.4 Update
Reliability Assurance Program

- Additional Review Procedures
  - Documentation of NRC audits and inspections.
  - Regulatory guides that provide information on categorizing risk significance of systems, structures, and components (SSCs) which can facilitate the review of the methodology for identifying SSCs within the scope of the RAP.
  - Participation of other technical organizations in the review of the list of RAP SSCs and the evaluation methodology.
  - Interfacing with other organizations to review the process for integrating RAP into operational programs.
  - Procedure for reviewing the proposed Tier 1 inspections, tests, analyses, and acceptance criteria for RAP.

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SRP 17.4 Update
Public Review and Comment

- 90 day public comment period initiated 10/09/2012
- 42 comments received:
  - Nuclear Energy Institute
  - Jim K. August
- NEI comments were minor; changes in language for clarity requested; most accepted by staff
- August comments concerned plant maintenance programs

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Revision 3 to SRP Section 19.0 "Probabilistic Risk Assessment and Severe Accident Evaluation for New Reactors"

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SRP 19.0 Update
PRA & Severe Accident Evaluation for New Reactors

- SRP 19.0 Updated to incorporate:
  - DC/COL-ISG-03 PRA Info for DC/COL Applications
  - DC/COL-ISG-20 PRA Based Seismic Margins Analysis
  - DI&C-ISG-03 Risk-Informed Digital I&C Review
  - New Reactor Review Experience
    - ESBWR
    - AP1000
    - EPR
    - APWR

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SRP 19.0 Update
PRA & Severe Accident Evaluation for New Reactors

- Additional review interfaces identified
  - Structural Engineering
  - Human Factors Engineering
  - External Hazards Review (Chap 2)
  - Digital I&C review
  - Regulatory Treatment of Non-safety Systems
  - Severe Accident Management Alternatives (Environmental Report)

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SRP 19.0 Update
New Guidance Based on New Reactor Review Experience

- Review Procedures for PRA Technical Adequacy
  - Conformance with RG 1.200
  - Requirements in PRA Standard not met
  - Peer Review
- Review Procedures Specific to Passive Designs
  - Effect of uncertainty in passive system thermal-hydraulic performance on system success criteria
  - Use of the MAAP code
  - Focused PRA sensitivity studies for RTNSS

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SRP 19.0 Update
New Guidance Based on New Reactor Review Experience

- Review Procedures Specific to iPWRs
  - Assure that risk from multi-module events is assessed
  - General guidance for novel shutdown or low power operations
- Level II PRA Results
  - Do confirmatory analysis with MELCOR

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SRP 19.0 Update
New Guidance Based on New Reactor Review Experience

- PRA for Non-Power Modes of Operation
  - Assure that key assumptions documented
  - Availability controls for risk-significant SSCs
  - Lessons learned from operating Reactors (e.g., GL-88-17, NUMARC 91-06)
- Treatment of Internal Fire Initiators
  - NUREG/CR-6850 and FIVE are acceptable methods
  - Conservative simplification ok for DC and COL applicant; examples given

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SRP 19.0 Update
New Guidance Based on New Reactor Review Experience

- Treatment of High Wind Initiators
  - Guidance for assessing tornado frequencies provided
- Procedures for Specific PRA Audit Topics
  - Digital I&C (DI&C-ISG-03)
- Severe Accident Evaluation
  - Design features address operating reactor vulnerabilities
  - Design features balance prevention and mitigation
  - Containment performance better than current plants
  - Severe Accident Management Design Alternatives (SAMDA) Addressed

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SRP 19.0 Update
Public Review and Comment

- 90 day public comment period initiated 10/09/2012
- 22 comments received:
  - Nuclear Energy Institute
  - Ameren (Westinghouse SMR partner)
- Comments were minor; changes in language for clarity requested; most accepted by staff

Revision 3 to SRP Section 19.1 "Determining the Technical Adequacy Of Probabilistic Risk Assessment for Risk-informed License Amendment Requests After Initial Fuel Load"

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Revision 3 to SRP Section 19.1

- The main purpose of this update is to:
  - incorporate regulatory requirements for new reactors
  - include the applicability of NFPA 805
  - reflect the issuance of Revision 2 to RG 1.200, addenda to the ASME/ANS PRA Standard, and additional PRA-related guidance
- No new sections or subsections added to the SRP Section 19.1 Revision 3

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Revision 3 to SRP Section 19.1

The title is modified:

- Revision 2

  "DETERMINING THE TECHNICAL ADEQUACY OF PROBABILISTIC RISK ASSESSMENT RESULTS FOR RISK-INFORMED ACTIVITIES"

- Revision 3

  "DETERMINING THE TECHNICAL ADEQUACY OF PROBABILISTIC RISK ASSESSMENT FOR RISK-INFORMED LICENSE AMENDMENT REQUESTS AFTER INITIAL FUEL LOAD"

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SRP 19.1 Rev. 3
Section I. "AREAS OF REVIEW"

- Updated to:
  - shorten the introductory/history discussion of the ASME and ANS Standards
  - add the transition to NFPA 805 to subsection "Applicability"

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SRP 19.1 Rev. 3
Section II. "ACCEPTANCE CRITERIA"

- Updated to include:
  - Regulatory requirements in 10 CFR 50.71(h)(1), (h)(2), and (h)(3) for new reactors
  - "If the applicant shows that its PRA model meets the regulatory positions set forth in RG 1.200, the technical reviewer should be able to conclude that the PRA is technically adequate. If exceptions to RG 1.200 have been identified and the staff has determined that the exceptions would not affect the risk results sufficiently to affect the regulatory decision, the staff should also be able to conclude that the PRA is technically adequate."

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SRP 19.1 Rev. 3
Section III. "REVIEW PROCEDURES"

- Section III.1.2, "Scope of the PRA Model" updated to include:

  "For reactors licensed under Part 52, CFR 50.71(h)(1) requires that each COL holder shall develop a Level 1 and a Level 2 PRA no later than the scheduled date for initial loading of fuel. The PRA must cover those initiating events and modes for which NRC-endorsed consensus standards on PRA exist 1 year prior to the scheduled date for initial fuel load. In addition, 10 CFR 50.71(h)(3) requires that each COL holder shall upgrade the PRA required by 10 CFR 50.71(h)(1) to cover all modes and all initiating events no later than the date on which the licensee submits an application for a renewed license."

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Section III. "REVIEW PROCEDURES" (Continued)

- Section III.2.2, "Assessment of the Technical Adequacy" updated to include:

  "The capability category needed for each PRA supporting requirement of the applicable PRA standard technical element is dependent on the application. In general, the staff anticipates that current good practice, i.e., Capability Category II of the ASME/ANS Standard, is the level of detail that is adequate for the majority of applications. However, for some applications, Capability Category I may be sufficient for some PRA supporting requirements, whereas for other applications it may be necessary to achieve Capability Category III for specific PRA supporting requirements."

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SRP 19.1 Rev. 3
Sections IV, V, and VI

- Section IV. "EVALUATION FINDINGS"
  - No major changes
- Section V. "IMPLEMENTATION"
  - No major changes
- Section VI. "REFERENCES" added
  - NEI 05-04, "Process for Performing Follow-On PRA Peer Reviews Using the ASME PRA Standard"
  - NEI 07-12, "Fire Probabilistic Risk Assessment Peer Review Process Guidelines"
  - NUREG-1855, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making"

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SRP 19.1 Rev. 3
Public Review and Comment

- SRP Section 19.1 was posted for 30 days in May 2012 for public comment
- No comments received
- Final issued in September 2012

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Initial Issuance of SRP Section 19.2 "Review of Risk Information Used to Support Permanent Plant-Specific Changes to the Licensing Basis: General Guidance"

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SRP 19.2 Initial Issuance Review of Risk Information Used to Support Permanent Plant-Specific Changes to the Licensing Basis: General Guidance

- SRP 19.2 content was previously issued as SRP 19, Rev. 1 dated 11/2002
- New SRP 19.0 replaced SRP 19, Rev. 1 as part of Chapter 19 rearrangement (6/2007)
- SRP 19.2 retained previous guidance in SRP 19, Rev. 1 and made minor editorial changes (6/2007)

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SRP 19.2 Initial Issuance Review of Risk Information Used to Support Permanent Plant-Specific Changes to the Licensing Basis: General Guidance

- SRP 19.2 update extended its use to applicants pursuant to 10 CFR 52, as appropriate

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SRP Section 19.3 (NEW) "Regulatory Treatment of Non-Safety Systems for Passive Advanced Light Water Reactors"

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SRP 19.3 Regulatory Treatment of Non-Safety Systems (RTNSS)

- Overview
  - SRP 19.3 is a new section that addresses Regulatory Treatment of Non-Safety Systems for passive designs
  - SRP 19.3 is based on Commission policy described in SECY papers and SRMs for AP600/1000 reviews
  - SRP 19.3 provides top level guidance; SRPs that address specific SSCs provide additional detailed guidance
  - Review responsibility is spread widely over the technical staff

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SRP 19.3 Regulatory Treatment of Non-Safety Systems

- Areas of Review
  - Selection of RTNSS SSCs using the five RTNSS scoping criteria
  - Functional design of RTNSS SSCs
    - Adequacy of functional design requirements
    - Compliance with functional design requirements
    - Design improvements to minimize adverse interaction between passive safety systems and non-safety active systems
  - Focused PRA sensitivity studies
  - Augmented design standards for RTNSS “B” SSCs
  - Regulatory treatment of RTNSS SSCs

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SRP 19.3 Regulatory Treatment of Non-Safety Systems

- Acceptance Criteria
  - RTNSS SSC selection criteria have been met
  - Functional design requirements adequate
  - RTNSS SSCs meet their functional design requirements
  - Adverse interaction between passive safety systems and active non-safety back-up systems identified and removed through design
  - Focused PRA sensitivity studies are adequate
  - Proposed regulatory treatment of each SSC is commensurate with its reliability/availability mission
  - Controls for RTNSS "B" SSCs are provided in the Availability Controls Manual.
  - Tech Spec established for highly risk-significant RTNSS SSCs

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SRP 19.3
Public Review and Comment

- 90 day public comment period initiated 10/12/2012
- 64 comments received from 4 organizations and one private citizen
- Key topics in comments:
  - Expectations for RTNSS “B” SSCs
  - Design review – focus should be on reliability/availability mission
  - Protection of RTNSS SSCs from External Hazards
  - Regulatory basis for Technical Specifications

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SRP 19.3
Public Review and Comment

- Public meeting in January 2013 to discuss staff's review of comments
- SRP revised to address comments
- SRP re-noticed in July 2013 for public comment on single new staff position not reflected in original noticed version (selection of wind speeds)
- One comment received from NEI

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SRP Section 19.4 (NEW)
"Strategies and Guidance to Address Loss of Large Areas of the Plant Due to Explosions and Fires"

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Standard Review Plan 19.4

- New SRP – in the concurrence process
- Incorporates DC/COL-ISG-016
- Review conducted by
  - Organization responsible for the review of mitigating strategies
  - Organization responsible for the review of reactor systems

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Standard Review Plan 19.4

- The NRC staff considers conformance with the February 25, 2005, guidance, TI 2515/168, and NEI 06-12 "B.5.b Phase 2 & 3 Submittal Guideline," Revision 2, acceptable for use by holders of a construction permit or a license to operate a power reactor facility issued under 10 CFR Part 50 prior to May 26, 2009, in satisfying the Commission's requirements in 10 CFR 50.54(hh)(2) and 10 CFR 50.34(i).
- The NRC staff considers conformance with the February 25, 2005, guidance, TI 2515/168, and NEI 06-12, Revision 3, acceptable for use by applicants for a 10 CFR Part 52 COL or a 10 CFR Part 50 operating license, in satisfying the Commission's requirements in 10 CFR 50.54(hh)(2), 10 CFR 50.34(i), and 10 CFR 52.80(d), with some exceptions.

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Standard Review Plan 19.4

- Public comments received July 2013
  - 11 Comments
  - Nuclear Energy Institute
    - Minor; changes in language for clarity

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SRP Section 19.5 (NEW)
"Adequacy of Design Features and Functional Capabilities Identified and Described for Withstanding Aircraft Impacts"

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Standard Review Plan 19.5

- New SRP - dated April 2013
- Incorporates Reg Guide 1.217, Rev 0, “Guidance for the Assessment of Beyond-Design-Basis Aircraft Impacts”
- Considers conformance with Nuclear Energy Institute (NEI) 07-13, Revision 8, “Methodology for Performing Aircraft Impact Assessments for New Plant Designs,” an acceptable method for use in satisfying the NRC requirements in 10 CFR 50.150(a).

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Standard Review Plan 19.5

- Primary aircraft impact assessment review is conducted by three different branches
  - Organization responsible for the review of fire protection
  - Organization responsible for the review of structures
  - Organization responsible for the review of reactor systems

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Standard Review Plan 19.5

- Public comments received August 2012
- 10 Comments
  - Erin Engineering
  - KEPCO E&C
  - One individual
- Two resulted in added text to the SRP

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Standard Review Plan 19.5

- Section 3.9 Review of Design Features for Core Cooling
  - "In most cases, operators are expected to have some warning prior to damage so a reactor scram would be expected to occur prior to damage. However, in other cases, damage could impair the ability of the reactor to scram. An assessment will be made of the potential for damage to prevent a scram should it have not previously occurred. The Staff reviewer shall initiate a review to confirm that design features are in place to protect equipment relied upon for reactor scram."

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Standard Review Plan 19.5

- Section 3.9 Review of Design Features for Core Cooling
  - "The Staff reviewer shall consider the design features credited by the applicant for core cooling, including front line systems and support systems. As part of core cooling, front line systems, support systems, and borated water may be required to maintain the core with sufficient shutdown margin."

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ACRONYMS

- ANS - American Nuclear Society
- ASME - American Society of Mechanical Engineers
- CFR - Code of Federal Regulations
- COL - Combined License
- DC - Design Certification
- I&C - Instrumentation and Control
- ISG - Interim Staff Guidance
- NEI - Nuclear Energy Institute
- NFPA - National Fire Protection Association
- PRA - Probabilistic Risk Assessment
- RAP - Reliability Assurance Program
- RG - Regulatory Guide
- RTNSS - Regulatory Treatment of Non-Safety Systems
- SAMDA - Severe Accident Management Design Alternatives
- SRP - Standard Review Plan
- SSC - Structures, Systems and Components