

Summary of Active Topics with the Risk-Informed Steering Committee

This enclosure summarizes the active topics that are being addressed by the Risk-Informed Steering Committee (RISC). Many of these topics will directly address challenges outlined in the Commission paper regarding the technical acceptability (i.e., scope, level of detail, technical elements, and plant representation) and realism of probabilistic risk assessments (PRAs) (Challenges 4 and 5), as well as the use of quantitative thresholds in agency guidance (Challenge 6).

Topics are listed in order of U.S. Nuclear Regulatory Commission (NRC) staff priority. More information on the status of recent RISC initiatives can be viewed in the RISC 2016 Annual Update (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16362A332) and in the latest RISC meeting summaries and presentations (ADAMS Accession Nos. ML17104A314 (package), ML17079A036, ML17061A502, ML17061A748, ML17061A759, ML17061A797, ML16355A051, ML16342C542 (package), and ML17272A006).

Topic	Background	Product/Schedule	Status
10 CFR 50.69	Title 10 of the <i>Code of Federal Regulations</i> (10 CFR) 50.69, "Risk-informed categorization and treatment of structures, systems and components for nuclear power reactors," allows licensees to assign treatment requirements to structures, systems, or components according to their safety significance, which is determined using a risk-informed process. Treatment requirements span a wide range of activities, including the design, testing, procurement, installation, and reporting of defects.	The NRC has informed industry that it has resources to review 10 license amendment applications per year. The NRC expects to complete these reviews within 12 months, consistent with the metric for most licensing actions. The staff believes that the facts and observations (F&O) closure process (referenced below) will result in more efficient licensing reviews.	The NRC has completed the pilot license amendment request (LAR) for this initiative. As of September 27, 2017, seven additional LARs have been submitted. Of those seven, the NRC has accepted three, while the remaining are on schedule to have their acceptance reviews completed in October 2017. The NRC expects to receive two additional applications in October 2017.

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Risk-Informed TS Initiative 4b	<p>Risk-informed Technical Specification (TS) Initiative 4b allows licensees to extend TS completion times based on insights gained from their PRA models. Licensees rely on the numerical output from their PRA model to make real-time decisions about extending the allowed outage time on safety-related components as an alternative to shutting down the plant. Therefore, the NRC staff expended substantial effort to ensure that complex technical issues were addressed upfront during its review of the pilot plant TS Initiative 4b LARs. Notably, a 30 day defense-in-depth deterministic backstop applies to risk-informed completion times to account for uncertainties with PRA models and potentially changing plant or site conditions.</p>	<p>The NRC staff issued its amendment to implement TS Initiative 4b for the pilot plant in August 2017. The NRC is currently reviewing five other applications. The NRC staff has traditionally encouraged licensees to wait until the pilot application was complete before sending in similar applications. In the case of risk-informed TS Initiative 4b, licensees submitted applications during the staff's review of the pilot. Therefore, the staff's review of the nonpilot applications was delayed until technical issues with the pilot were resolved. The NRC expects to complete the review of new applications that follow pilot plant precedence or the associated revised Technical Specification Task Force (TSTF) Traveler-505, "Provide Risk-Informed Extended Completion Times—RITSTF Initiative 4B" (TSTF-505), within the 1-year metric. The agency expects several licensees to submit TS Initiative 4b applications in early 2018.</p>	<p>The NRC is developing a revised version of TSTF-505 with industry that is less complex but somewhat more restrictive than the approved pilot's TS Initiative 4b program. Two of the five licensees that submitted applications currently under review have submitted supplements to their applications to be consistent with the revised TSTF-505 and are working on responding to the NRC staff's subsequent requests for additional information. One or more of the remaining applications currently under review and some new applicants that have had presubmittal discussions with the NRC will reference the process approved for the pilot TS Initiative 4b instead of the revised TSTF-505. The NRC has held numerous public meetings with industry to reach a consensus on the revised TSTF. The agency expects the revised TSTF to be available for use by the end of calendar year 2017.</p>

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Method Vetting	<p>The introduction of novel methods in past PRA applications involving significant changes to the licensing basis (e.g., National Fire Protection Association Standard 805, “Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants”) caused substantial delays in schedules. To avoid this in future applications (e.g., TS Initiative 4b and 10 CFR 50.69), industry developed a process with the goal of streamlining the NRC’s review and the acceptance of new PRA methods for use in licensing applications. Nuclear Energy Institute (NEI) 16-04, “New PRA Method Acceptance Process Guidelines,” issued February 2016, embodies this process. This process is also known as the “vetting panel process,” and both the NRC and industry participate in the vetting panel review. Several review options to address simpler methods to more complex methods constitute the process, and the process concludes with an NRC closure process in which the NRC may accept or reject the recommendation by the vetting panel and include considerations and qualifications.</p>	<p>In April 2017, the staff approved a fee waiver to industry to permit the piloting of three new PRA methods through the vetting panel process. In June 2017, the staff and industry discussed and agreed on changes to draft NEI 16-04 that would guide the pilot actions for the vetting panel process. As of September 29, 2017, the NRC has not received the revision to NEI 16-04 that incorporates coordinated process changes from the June 2017 public meeting. Additionally, NEI has been working through the TSTF to promulgate language that would allow licensees to address new methods using a focused-scope peer review process that would not require NRC approval. The NRC and industry are currently working diligently to resolve this issue.</p>	<p>During an October 17, 2017 public meeting on RG 1.200, NEI informed the staff that the NEI 16-04 guidance document effort was suspended, and proposed that new PRA methods be addressed via existing processes with augmented guidance for peer review teams.</p>

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<p>Fire PRA Realism</p>	<p>Since the late 1990s, the NRC and the Electric Power Research Institute (EPRI) have been working collaboratively under a memorandum of understanding (MOU) to develop tools, methods, and data related to fire PRA modeling. This collaboration resulted in the first jointly published NRC/EPRI guidance document, NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities, Final Report," Volumes 1 and 2, issued September 2005 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML16223A496 and ML16223A503). NUREG/CR-6850 reflects the state of the art at the time. In addition, because the NRC and EPRI developed NUREG/CR-6850 generically, it includes many screening values with the intent that licensees would adjust those values to reflect actual plant configurations. However, most licensees relied on contractors to develop the fire PRA and adopted the screening values that may not have reflected the operating plant. This was most prevalent in the assessment of electrical cabinet fires and the associated heat release rates, which dominates fire core damage frequency (CDF). In addition, many licenses found detailed cable tracing to be cost prohibitive and impractical, which further resulted in the development of conservative PRA models.</p>	<p>The NRC's Office of Nuclear Regulatory Research (RES) is working closely with EPRI to address a number of areas to improve the level of realism in fire PRA. This effort encompasses topics such as main control room abandonment, heat release rates, fire ignition frequencies, fire growth rate assumptions, and the potential influence of aluminum in high-energy arcing faults. Industry and the NRC are discussing the most effective means to update the NUREG/CR-6850 methodology. During an October 2017 public meeting, industry indicated that the current fire risk will be decreased by their planned new methods. In the shorter term, licensees may adopt refinements in realism through an active frequently asked questions (FAQ) process agreed on by the NRC or as the result of interim NRC guidance. The October 2017 public meeting on fire PRA realism resulted in a list of industry-proposed topics that could be supported through additional testing, and/or data collection, or both, before submittal for consideration for the NRC staff's endorsement. Potential realism credits that have a potential to be disseminated within 2 years were identified and considered for high-priority status.</p>	<p>Subsequent to the issuance of NUREG/CR-6850, RES pursued additional testing under an MOU to better refine assumptions in the guidance document. A good example of this effort is the testing conducted with EPRI to better refine and characterize the heat release rates from electrical enclosures during a fire (NUREG-2178, "Refining and Characterizing Heat Release Rates from Electrical Enclosures during Fire (RACHELLE-FIRE)—Volume 1: Peak Heat Release Rates and Effect of Obstructed Plume, Final Report," issued April 2016). NUREG-2178 provides a more realistic model for electrical cabinet fires, and some licensees have used the guidance to reduce their fire CDF.</p> <p>Current reductions in fire PRA CDF will rely on a more complete adoption of available newer methods (e.g., electrical cabinet heat release rates in NUREG-2178) and other more realistic modeling of individual plant configurations that will likely require more extensive resource expenditures to perform the PRA.</p> <p>Follow-on actions from the October 2017 public meeting, to be completed within 2 years, include continued discussions between NEI and NRR as to the viability of proposed FAQs on fire modeling. RES will continue discussions and collaborations with EPRI on testing and data collection tasks, with the goal of collaborating on ongoing research and issuing joint reports, where appropriate. The staff will discuss this collaboration in the next quarterly management call with EPRI on November 2, 2017.</p>

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Realism in ROP	<p>Since implementation of the Reactor Oversight Process (ROP) in 2000, the NRC has undertaken efforts to continuously maintain and improve the high quality of guidance documents (e.g., Inspection Manual Chapter (IMC) documents) and NRC risk tools used in everyday ROP activities, such as the significance determination process; event assessments under Management Directive 8.3, "NRC Incident Investigation Program," dated June 25, 2014; and Notification of Enforcement Discretion request reviews. In addition to IMC guidance documents, the NRC developed the Risk Assessment Standardization Project Handbook (RASP Handbook), Volumes 1, 2, 3, and 4, for the NRC staff to use in performing risk assessments of "internal event" and "external event" conditions at U.S. nuclear power plants. The RASP Handbook is a practical "how to" handbook of state-of-the-art PRA methods and best practices for using standardized plant analysis risk (SPAR) models to evaluate the risk of reactor incidents and inspection findings. The RASP Handbook provides guidance on various PRA methods (e.g., exposure time determination and modeling, common-cause failure (CCF) analysis, human reliability analysis modeling) to enable quantitative risk assessments that reflect realistic conditions to ensure consistent and repeatable results for regulatory decision-making applications.</p>	<p>The development and maintenance of risk tools to support realism in the ROP is a high priority, and the NRC staff continues to improve current methods (i.e., enhancement of the RASP Handbook) and develop new tools (e.g., improvements to IMC documents and SPAR modeling).</p>	<p>On January 12, 2017, Exelon Corporation (Exelon) transmitted a memorandum to the Office Director of the NRC's Office of Nuclear Reactor Regulation, identifying several areas in RASP guidance that concern the company. These areas of concern included the treatment of CCF, the treatment of dependency between human errors in accident sequences, and the methods used to model various performance deficiencies. On March 21, 2017, the NRC transmitted its plans to address industry concerns. Subsequently, on May 3, 2017, the NRC staff held a half-day public meeting to receive additional clarifications of industry concerns and to align priorities. Because the staff's PRA resources are limited, industry proposed pursuing the issue on CCF as the highest priority. On September 19, 2017, the staff held another half-day public meeting to receive the industry's proposed alternatives to the staff's methods. During that meeting, industry discussed its views at a general level and committed to provide concrete alternatives for the staff's consideration at a future meeting.</p>

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FLEX in Risk-Informed Decision-Making	<p>Following the March 2011 event at the Fukushima Dai-ichi nuclear power plant in Japan, the NRC issued orders to implement a comprehensive set of recommendations that would enhance the mitigating strategies intended to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities following a beyond-design-basis external event (BDBEE). Although the equipment and strategies were specifically intended to mitigate the effects of a BDBEE, the NRC staff recognizes that the equipment can also be used to enhance plant safety against other events (e.g., station blackout events associated with plant-centered events). Therefore, the staff is evaluating how to credit mitigating strategies equipment (e.g., Diverse and Flexible Coping Strategies (FLEX)) in various risk-informed regulatory decisions.</p>	<p>FLEX is currently being credited in multiple-risk applications. The NRC staff has developed several guidance documents to promote consistency and efficiency in applications in these areas. The staff is continuing to monitor the licensees' use of FLEX and is evaluating the need for additional guidance changes.</p>	<p>In August 2016, NEI submitted NEI 16-06, "Crediting Mitigating Strategies in Risk-Informed Decision Making," for the NRC's information. NEI 16-06 is an industry-developed guidance document for use by licensees. It outlines a three-tiered approach for evaluating the potential safety benefits of plant mitigation strategies: (1) qualitative assessments, (2) semiquantitative streamlined assessments, and (3) full PRAs. The NRC staff has reviewed the document and developed staff positions for consideration when licensees use the approaches for requesting credit in various risk-informed decision-making areas. The NRC staff has also identified a number of areas for which licensees may credit FLEX and the regulatory processes and guidance documents in those areas. In a number of these areas, the NRC staff has evaluated and concluded that the current regulatory structure is adequate to evaluate licensees' requests to credit FLEX (e.g., significance determination process).</p>

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Risk Aggregation	<p>Risk aggregation is the mathematical combination of disparate quantitative PRA results (e.g., large loss-of-coolant accident, transient, flooding) with deterministic information (e.g., defense in depth, safety margins). PRA methods have existed for decades allowing for the combination of probabilistic point estimates and risk result distribution. In addition, Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," contains guidance on what probabilistic and deterministic information needs to be considered when making risk-informed licensing decisions. RG 1.174 also contains quantitative probabilistic thresholds for decision-making. In addition, Chapter 9 of NUREG-1855, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decisionmaking," Revision 1, issued March 2017, contains insights on considering probabilistic uncertainties in regulatory decision-making. The concern is that there is limited guidance on how to balance deterministic and probabilistic risk results when the results approach or somewhat exceed regulatory thresholds.</p>	<p>NUREG-1855, Revision 1, provides significant guidance on the treatment of risk aggregation within the context of uncertainty analysis. The NRC will consider its efforts on this topic closed once it updates RG 1.174 in March 2018 to reference Revision 1 to NUREG-1855. However, draft guidance is currently available for licensees and staff to use to address aggregation issues that may arise.</p>	<p>The staff has prepared training material for NUREG-1855, Revision 1 that will discuss uncertainty and decision-making in risk-informed applications (see Enclosure 1 for additional detail). Additionally, the upcoming revision to RG 1.174 (Revision 3) in March 2018 will expand the explanations and definitions of deterministic considerations, which should help when making risk-informed licensing decisions. EPRI has also published a report that provides its approach for addressing risk aggregation (EPRI Report 3002003116, "An Approach to Risk Aggregation for Risk-Informed Decision-Making," dated April 29, 2015). At this time, the Pressurized-Water Reactor Owners Group is in the process of piloting that framework.</p>

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F&O Closure Process	<p>The NRC staff reviews risk-informed licensing actions to ensure adequate PRA acceptability. The NRC staff accomplishes this, in part, by ensuring the proper resolution of F&Os generated from PRA peer reviews. Industry, in coordination with the NRC, proposed an independent assessment process that enables licensees to resolve most F&Os without direct NRC involvement. The NRC expects to receive an increased number of risk-informed applications over the next several years. The staff's acceptance of the independent assessment process for licensee use in risk-informed licensing actions is important to improve the effectiveness and efficiency of licensing action reviews while at the same time ensuring PRA acceptability. Closure of F&Os through an independent assessment process will streamline the NRC staff's review of risk-informed LARs, thus providing more focus on concerns pertinent to safety.</p>	<p>Although the staff will continue to observe F&O closures and conduct audits of the process during licensing reviews, the NRC considers this complete.</p>	<p>The NRC staff provided a letter dated May 3, 2017, accepting industry's guidance on the F&O independent assessment process (ADAMS Accession No. ML17079A427). The NRC staff plans to incorporate its expectations for closure of F&Os (ADAMS Accession No. ML17121A271) as a staff regulatory position in the next update to RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities." The staff regulatory position will be used as the basis for endorsement of NEI's guidance for the F&O independent assessment process.</p>