U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Advanced Reactor Stakeholder and Construction Permit Guidance Public Meeting

February 25, 2021
Microsoft Teams Meeting
Bridgeline: 301-576-2978
Conference ID: # 157 353 886

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

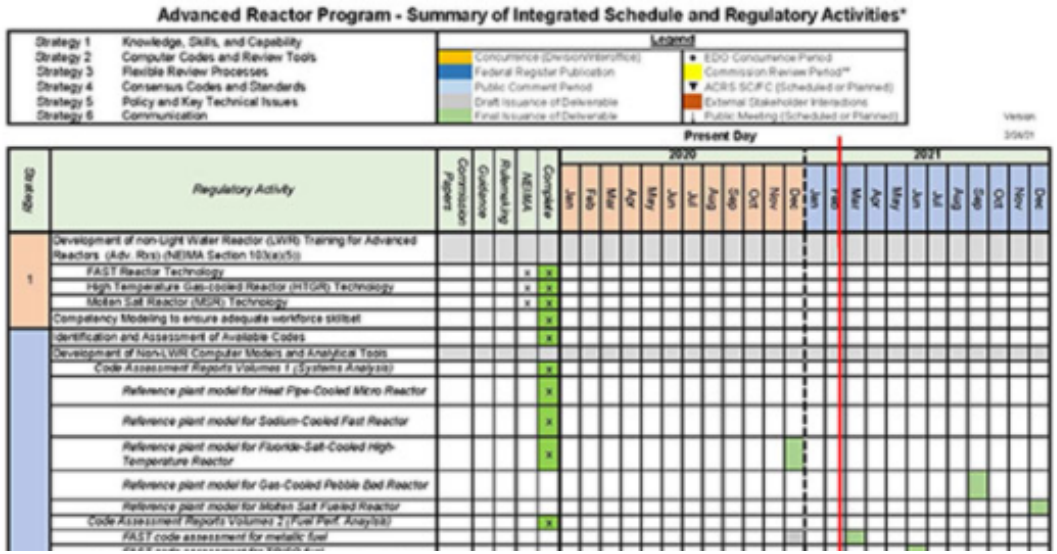
Agenda

Time	Topic	Presenter
10:00 – 10:10 am	Introduction	NRC
10:10 – 12:00pm	Construction Permit Guidance • Discussion of NRC Draft Staff White Paper "Safety Review of Power Reactor Construction Permit Applications" • Nuclear Energy Institute (NEI) Construction Permit (CP) topics • U.S. Nuclear Industry Council (USNIC) CP topics • Stakeholder comments	NRC NEI USNIC Other stakeholders
12 to 1:30 pm	Applicability of Regulations	NRC/other stakeholders
1:30 to 2:00 pm	Break	All
2:00 to 3:45 pm	Technology Inclusive Content of Application Project (TICAP) and Advanced Reactor Content of Application Project (ARCAP). Potential topics include: • Status of TICAP guidance documents (Industry and NRC staff) • ARCAP roadmap draft guidance document considerations • Discussion of Draft ARCAP Chapter 11, "Organization," and Chapter 12, "Initial Startup Program."	NRC/Southern and other stakeholders as appropriate
3:45 to 4:00 pm	Discussion of Possible Dates and Topics for Future Meetings and Wrapup	All

Advanced Reactor Integrated Schedule of Activities

Advanced Reactor - Summary of Integrated Schedule and Regulatory Activities

Summary of Integrated Schedule and Regulatory Activities (updated 02/24/2021)



https://www.nrc.gov/reactors/new-reactors/advanced/details.html#advSumISRA

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Construction Permit Guidance

Construction Permit (CP) Guidance Background

- June 12, 2020, ARCAP public meeting – Industry commented on the need to develop near-term CP guidance for small light-water reactors (LWR).
- July 31, 2020, ARCAP public meeting – Industry feedback:
  - Guidance options (Interim Staff Guidance (ISG), Draft Strategy and Office Instruction) are viable for further consideration.
  - ISG option considered most efficient and provides regulatory stability and durability.
  - CP guidance development challenges recognized:
    - May take 6-9 months to receive needed industry input due to on-going activities supporting DOEs ARDP program.
    - First CP application submittals possible by end CY2021/early CY2022.
    - Draft CP guidance with application content guidance for critical areas available by Spring 2021 could support possible CP submittal schedule.

CP Guidance Background (continued)

- August 27, 2020, ARCAP public meeting – NRC staff stated it is developing an ISG to clarify:
  - CP regulatory requirements and findings necessary for NRC to issue permit.
  - Information and level of detail needed in a CP application for NRC to review and issue a construction permit.
  - Specific topics; e.g., siting.

- Subsequent to August 27, 2020, ARCAP public meeting:
  - NEI indicated it was developing a technology inclusive CP white paper.
  - NRC expanded scope of CP guidance to consider LWR and advanced reactor designs based on:
    - Scope of NEI white paper, and
    - Possible near-term need for CP guidance for non-LWRs.

CP Guidance

- Staff issued Draft White Paper, “Safety Review of Power Reactor Construction Permit Applications,” (ADAMS Accession No. ML21043A339)
- Draft White Paper Highlights
  - Focuses on the safety review of CP applications.
  - Tentative plan is to develop further into an ISG.
  - CP Guidance consists of three sections:
    - Common guidance for both LWR CP applications following NUREG-0800 standard review plan (SRP) structure and advanced reactor CP applications
    - Guidance applicable to LWR CP applications following NUREG-0800 SRP approach
    - Guidance applicable to advanced reactor CP applications (i.e., Appendix C)

CP Guidance Applicable to both LWRs following NUREG-0800 and Advanced Reactors

- Common Section includes:
  - Requirements applicable to CPs
    - Includes discussion regarding finality
  - Lessons Learned from recently issued CPs
    - Stresses need for preapplication engagement with NRC to optimize application reviews
    - Early interaction to support common understanding of level of information needed in preliminary safety assessment report (PSAR) to support NRC review
    - Early interaction to identify areas where only limited descriptions may be provided by applicant along with regulatory commitments to provide the complete information in the operating license application
    - Staff's CP review is focused on ensuring appropriate use of methodologies for analyses needed to demonstrate that requirements in the regulations are met

CP Guidance Applicable to both LWRs following NUREG-0800 and Advanced Reactors

- Common Section includes:
  - Special Topics
    - Concurrent applications
    - CP application incorporating prior NRC approvals
    - Discussion of potential impact of ongoing rulemaking activities on CP reviews
    - Caution - does not include guidance for obtaining licenses for receipt, possession and use of Source, Byproduct and Special Nuclear Material (10 CFR 40, 30 and 70, respectively)

CP Guidance Applicable to LWRs following NUREG-0800

- Guidance refers to NUREG-0800 with clarifications for a subset of areas for a CP application including:
  - Siting
  - Radiological consequence analyses
  - Transient and accident analyses
  - Structures, systems and components (SSC categorization including codes used to design and build the plant)
  - Instrumentation and control
  - Electrical Systems
  - Radiological Waste Management
- The clarifications address a subset of topics that are reviewed in the CP application and not intended to be inclusive of all topics expected in a CP application.
- Regulatory Guides 1.70 and 1.206 provide insights on the level of detail for an LWR CP application consistent with the NUREG-0800 SRP structure.

CP Guidance for Advanced Reactors (Appendix C)

- References Advanced Reactor Content of Application Project (ARCAP) guidance instead of NUREG-0800
  - ARCAP guidance is broad and addresses complete application
  - ARCAP guidance references technology inclusive content of application project (TICAP) guidance under development
- Uses italics to identify ARCAP/TICAP guidance and industry codes currently under development
- Consistent with:
  - Non-Light Water Reactor Review Strategy Staff White Paper," dated September 2019 (ADAMS Accession No. ML19275F299)
  - Preapplication Engagement to Optimize Application Reviews January 12, 2021, version (ADAMS Accession No. ML21014A267)

CP Guidance for Advanced Reactors (Appendix C)

- This guidance addresses the minimum information necessary in a CP application for the staff to issue a CP under 10 CFR 50.35(a) when the applicant has not supplied all of the technical information required to complete the application (i.e., 50.34(a)) and support the issuance of a CP which approves all proposed design features (i.e., obtains finality for the design).

- Where an applicant desires design finality regarding a specific topic, the application should provide sufficient information about the topic at a level of detail that is expected at the operating license (OL) stage.

CP Guidance for Advanced Reactors (Appendix C)

- Built on ARCAP/TICAP structure
  - Alternate approaches to TICAP (which is based on the licensing modernization project (LMP) process) are recognized
    - Preapplication engagement with NRC is highly encouraged if applicant chooses an alternate approach to LMP
    - Several topical areas identified in Appendix C provide guidance applicable to approaches following NRC RG 1.233 guidance and to alternate approaches, such as:
      - Safety and Accident Analysis Methodologies and Associated Validation
      - Site Information
      - Licensing Basis Event/Design Basis Accident selection

CP Guidance for Advanced Reactors (Appendix C)

- Highlights/Discussion Topics
  - 10 CFR 50.35(a)(1) states in part that the Commission may issue a construction permit if it finds that the applicant "has identified the major features or components incorporated therein for the protection of the health and safety of the public."
    - Confirmation or discussion that this statement applies to safety-related and non-safety related SSC with special treatment following the LMP approach
  - Guidance follows the ARCAP/TICAP structure and references industry TICAP CP guidance under development
    - Staff would like to have a better understanding of topics to be included in industry guidance and timing for providing this guidance

CP Guidance for Advanced Reactors (Appendix C)

- Highlights/Discussion Topics
  - Structure/Content of Appendix C minimizes duplication of guidance
    - Points to ARCAP/TICAP guidance and industry codes under development
    - How best to ensure that as guidance is developed expectations are clear? Examples include:
      - SSC capabilities section follows the TICAP process.
        - » Staff considers Design Review Guide for instrumentation and control (I&C) would be useful if applicant using LMP identifies need for I&C that is safety related or non-safety related with special treatment
      - Expectation that the application will include consensus design codes and standards (ASME, ANSI, IEEE, etc.) used for the design along with applicability to design of specific SSCs
        - » Staff consider ASME Section III Division 5 under development would be included in the CP application as appropriate.

CP Guidance for Advanced Reactors (Appendix C)

- Highlights/Discussion Topics
  - How best to ensure that as guidance is developed expectations are clear. Examples include (continued):
    - 10 CFR 50.35(a) provides minimum requirements for the PSAR including the following:

      Special attention should be directed to the site evaluation factors identified in 10 CFR Part 100:
      - References to 100.21(f): "Site characteristics must be such that adequate security plans and measures can be developed"
      - 100.21(g): "Physical characteristics unique to the proposed site that could pose a significant impediment to the development of emergency plans must be identified"
      - 10 CFR Part 50 appendix E requirement that PSAR include preliminary plans for coping with emergencies

CP Guidance for Advanced Reactors (Appendix C)

- Highlights/Discussion Topics
  - For emergency planning, guidance uses content requirements similar to an ESP application and includes references to new 10 CFR 50.160 rule:
    - Describe any physical characteristics of the proposed site, such as egress limitations from the area surrounding the site, that could pose a significant impediment to the development of emergency plans
    - Describe the major features of the emergency plans which are aspects of the plan necessary to:
      - Address in whole or part either one or more of the 16 standards in 10 CFR 50.47(b) or the proposed requirements of 10 CFR 50.160(b) , as applicable; or
      - Describe the emergency planning zones as required in 10 CFR 50.33(g).

Next Steps

- Consider stakeholder feedback and further develop guidance
- Issue Draft LWR CP ISG for public comment in Summer 2021
- Appendix C – may be issued separately when the draft guidance is more developed

Industry Construction Permit Guidance Task Force initial observations and feedback on NRC Draft CP Guidance

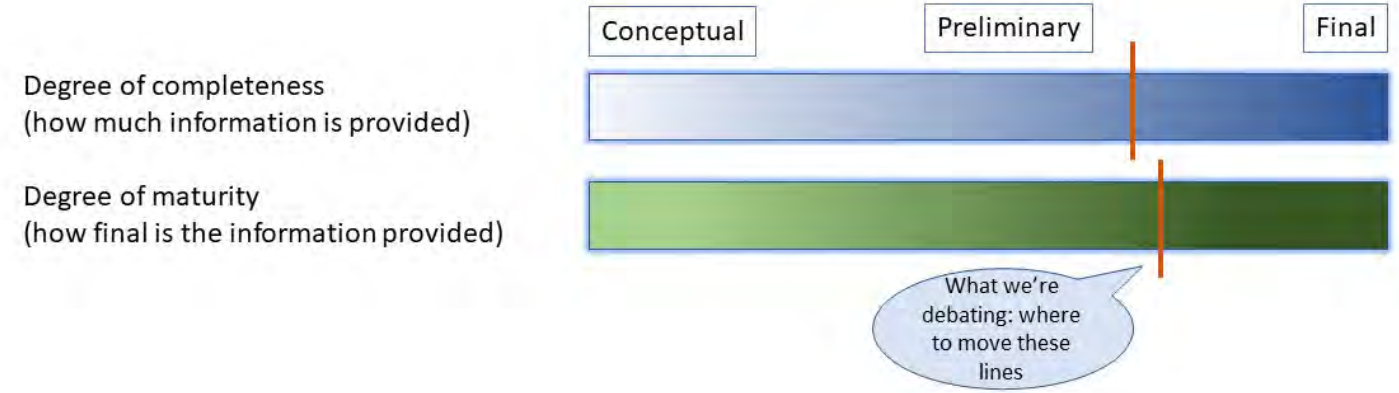
February 25, 2021

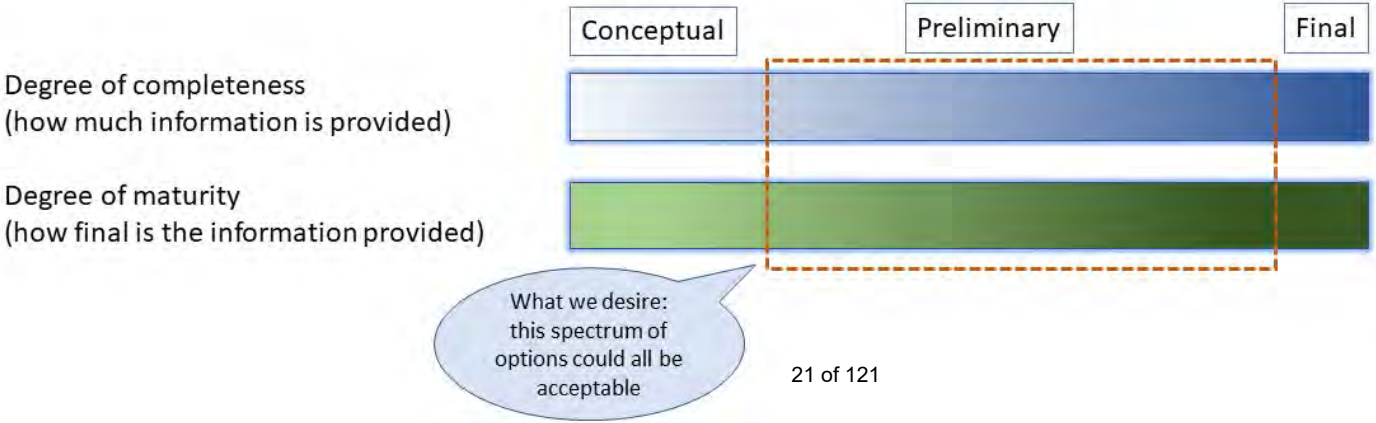
NUCLEAR ENERGY INSTITUTE

NEI CP GUIDANCE TASK FORCE

Task Force Observations concerning NRC Draft CP Guidance

Advanced Reactor Design Completeness and Maturity





General Observations on NRC Draft Guidance

- *The guidance for various topics is inconsistent concerning the completeness of design information and analyses necessary at the CP application stage.*

  Some portions of draft NRC guidance recognize that CP application may include preliminary design information in other parts the guidance seems to specify a more complete set of design information that appears to be more appropriate for the OL stage.

- *The rationale for the specific topic areas covered in the guidance is unclear vs the use of a comprehensive/methodical review of topics on a chapter by chapter basis.*

- *Appendix C (sections applicable to use of NEI 18-04 methodology) requires more information than appropriate when using the LMP safety case approach in a CP application.*

- *NRC expectations for the PRA for a CP application go beyond what is feasible for a preliminary design.*

- *Appendix C is structured around the use of NEI 18-04 methodology for NLWR applicants and does not provide CP application guidance for NLWR applicants that do not intend to use the licensing approach in NEI 18-04.*

General Observations on NRC Draft Guidance

- *Appendix C has numerous sections that include the following statement:*

  "for applications using the LMP approach, the staff should refer to draft TICAP ISG-XXX, Section 3.1.X for additional information regarding expected CP application content in this area.."

  These topics will be discussed separately at a later date as a part of ongoing TICAP/NRC interactions on the development of draft TICAP guidance for Section 3 of the guidance document.

Initial observations divided into 3 categories

1. Topics where NRC Draft Guidance provides the appropriate level of detail and flexibility for a CP application;

2. Topics where NRC Draft Guidance is too prescriptive and does not provide adequate flexibility for content of a CP application; and

3. Topics where NRC Draft Guidance would benefit from additional detail to establish a common understanding of CP application content.

Examples of Topics where NRC Draft Guidance provides the appropriate level of detail and flexibility

- Lessons Learned from Recently Issued CPs
  - If the PSAR includes preliminary or limited descriptions of the facility's programs, structures, systems, or components, the staff may accept and approve the application with regulatory commitments from the applicant to provide complete information in its OL application.
  - The staff should review the description of plans to perform safety and accident analyses that include testing of applicable SSCs and validation and verification of associated engineering computer programs.
  - The staff's construction permit safety review is focused on ensuring appropriate use of analysis methodologies to meet the requirements in the regulations.
- App C Security - note that no Physical Security Plan, Security Training and Qualifications Plan, or Safeguards Contingency Plan information is required at the CP stage.

Examples of Topics where NRC Draft Guidance is too prescriptive and does not provide adequate flexibility

- Fuel qualification - The fuel procurement specification should describe the characteristics the fuel must have to be acceptable. The reviewer should determine how the applicant intends to ensure the as fabricated fuel complies with the procurement specification.
  - *Is it necessary or appropriate to require fuel procurement specifications in a CP application?*

- Radiological Consequence Analyses
  - *It should be acceptable for a CP application to qualitatively demonstrate that the radiological consequences to the public during a dba are very low (e.g., bounding calculations)*
  - *If analyses demonstrates that all of the barriers are not damaged in any DBA, is it necessary to provide detailed dose results?*

Examples of Topics where NRC Draft Guidance is too prescriptive and does not provide adequate flexibility

- Transient and Accident Analyses

  - *The NRC is expecting more detail/degree of completion in the safety analyses than considered necessary for a CP application.*

    Discussion of the analysis methods, assumptions and results for the total calculated radiological consequence dose at the exclusion area boundary (EAB), low population zone (LPZ) and control room (if operators are relied upon for safety-significant functions) from the DBAs.

  - *The guidance should allow for qualitative arguments for why certain transients or accidents are bounding.*

  - *There are inconsistencies in the allowances for the use of bounding events as providing acceptable detail for the evaluation for credible accidents.*

    Discussion of the characteristics of fission product releases from the proposed site to the environment including the rates of fission product release, the isotopic quantities and the chemical forms of fission products released to the environment.

Examples of Topics where NRC Draft Guidance is too prescriptive and does not provide adequate flexibility

Integrated Evaluations (Evaluation of Integrated Plant Risk)

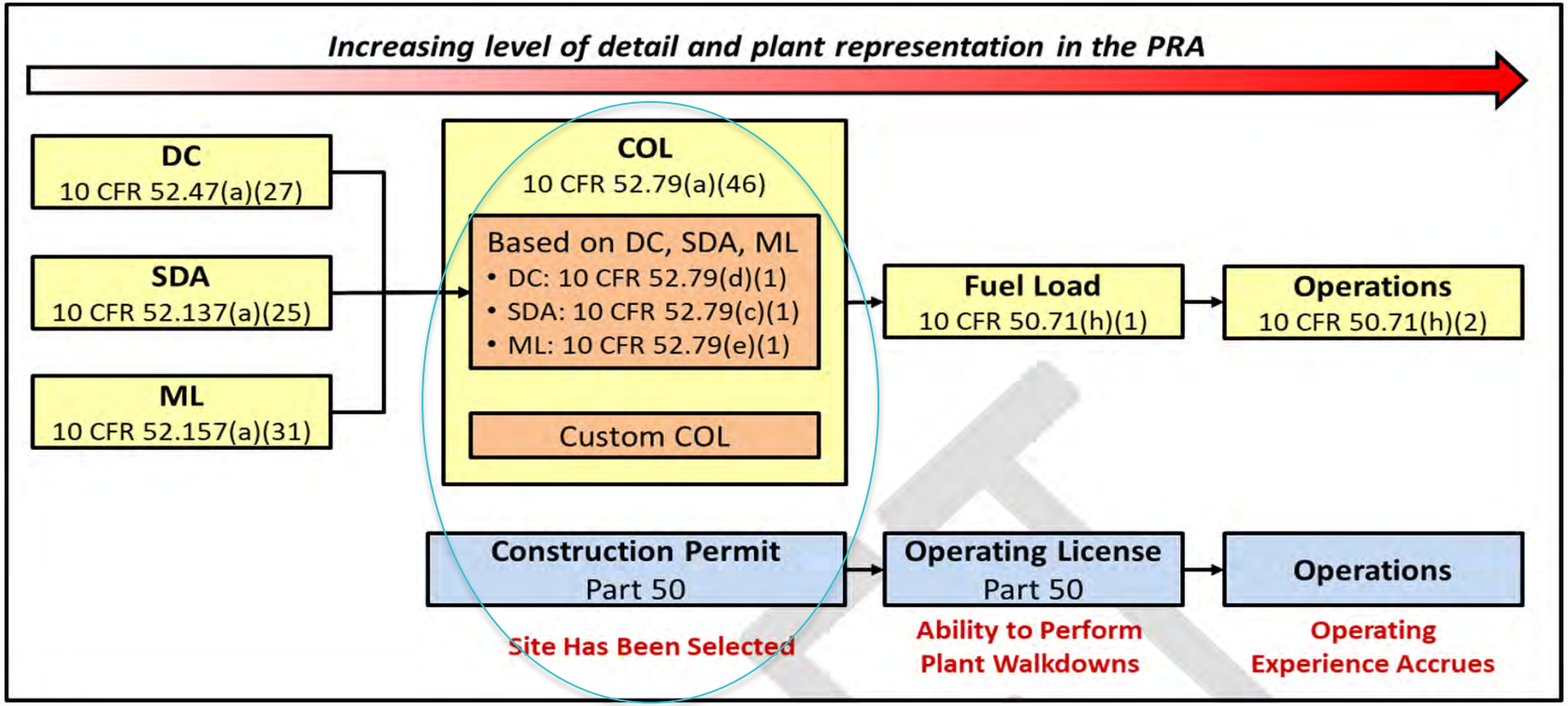
- *It seems unreasonable to expect these results be available at the CP stage.*
- *It would be more appropriate to include the approach/methodology and initial, preliminary, results and the remaining actions to get to final level of detail/completion.*
- *The completion of a comprehensive and detailed PRA may not be achievable in the absence of essentially complete and final detailed design information.*

PRA

- *The Policy Statement on "Severe Reactor Accidents Regarding Future Designs and Existing Plants" does not specify when a PRA needs to be complete and what level of completion is required.*
- *The "Pedigree of PRA" for a CP application as specified is not realistic. It is not reasonable to require that a peer review be performed at the CP stage.*
- *The description of the PRA methodology is not needed in the application as it is reviewed for acceptability during the peer review. The PRA methodology documents are available for NRC audit.*
- *NRC seems to specify that the PRA requirements for a CP are the same as for a COL.*

Figure 1. Evolution of the PRA as the Plant is Designed, Constructed, and Operated

(Excerpt from NRC Staff Draft White Paper: Demonstrating the Acceptability of Probabilistic Risk Assessment Results Used to Support Advanced Non-Light Water Reactor Plant Licensing)



CP application stage: The site has been selected; the PRA represents the conceptual design.

PRAs that support custom COL or CP applications: A full-scope peer review should be conducted.

Examples of Topics where NRC Draft Guidance would benefit from additional detail

- Include NRC's approach for addressing Aircraft Impact for micro-reactors.
- Confirm NRC views concerning CP applicant programs needed to be in place for construction.
- Provide for additional flexibility in CP application format for NLWR non-LMP applicants.
  - An option should be provided that moves away from fixed Chapter topics that were created for an LWR applicant. The content of CP application should be focused on methods and approaches with level of detail to support 10 CFR 50.34(a) requirements and applicant-provided acceptance criteria as applicable.
- Allow the complexity of a quality assurance program to be reflective of the complexity and inherent safety of a design.
  - The intended outcome is to allow simpler designs to implement a quality assurance program that are not overly prescriptive for features that are not relied upon to ensure safe operation. It is beneficial for an advanced reactor designer to have a QAPD that covers design activities that is flexible enough to be used for any prospective applicant and NRC licensing pathway, as well as any design-specific activities like Part 52 DC or SDAs.

QUESTIONS?

By Third Way, GENSLER

U.S. Nuclear Industry Council Comments for NRC Stakeholders meeting: Construction Permit Guidance

Cyril Draffin
Senior Fellow, Advanced Nuclear
U.S. Nuclear Industry Council

Jeff Merrifield
Chairman, Advanced Nuclear Working Group
U.S. Nuclear Industry Council

Jeff Hawkins
EPIC - Energy Production & Infrastructure Center
University of North Carolina, Charlotte

Travis Chapman
X- Energy

25 February 2021

Construction Permit – Introduction

USNIC appreciates NRC providing draft white paper (*"SAFETY REVIEW OF POWER REACTOR CONSTRUCTION PERMIT APPLICATIONS")* to facilitate discussion of the safety review of LWRs and non-LWR construction permit (CP) applications– as precursor to interim staff guidance.

Important because U.S. DOE Advanced Reactor Demo program CP applications expected in next few years

Following are some preliminary ideas for consideration

Construction Permit – Response to NRC Staff – Major features or Components

NRC: How best to ensure that as guidance is developed expectations are clear

- 10 CFR 50.35(a)(1) states in part that the Commission may issue a construction permit if it finds that the applicant "has identified the major features or components incorporated therein for the protection of the health and safety of the public."
- Confirmation or discussion that this statement applies to safety- related and non-safety related SSC with special treatment following the LMP approach

Response:

- Requires understanding of what constitutes a major feature or component to protect public health and safety. Includes building structures that house, process or store radionuclides
- Could identify each system that is present to control reactivity, control heat removal, and retain radionuclides both for normal and off normal events
- Next level would be the materials and components that comprise those systems (tanks, vessels, fluids, etc.). Question is where does the detail stop?
- A perspective is the classification of the system or component does not matter much, but what is important is what the system or component does. This raises question about how much of the balance of plant would need to be provided

Construction Permit – Response to NRC Staff – PSAR

Response:

- The PSAR should enable the public to understand how the design is expected to work and the major features that support the facility in safely performing the expected work.
- While the classification of systems is important and will likely be a requirement for the content in a PSAR, it should not be used as a singular selection criteria for content in a PSAR.

Question:

- How much detail would be needed for each system or structure and how close to final design maturity will be needed to pass the review test, and what areas could still permit additional research or refinement while the plant is under construction?

Construction Permit – Response to NRC Staff – Guidance

NRC: How best to ensure that as guidance is developed the expectations are clear? Examples include: – SSC capabilities section follows the TICAP process. Staff considers Design Review Guide for instrumentation and control (I&C) would be useful if applicant using LMP identifies need for I&C that is safety related or non-safety related with special treatment

Question:

- Would the staff accept anything less than what is in the current Standard Review Plan for I&C systems?

Construction Permit – Response to NRC Staff – Emergency Planning (EP)

NRC: For emergency planning, guidance uses content requirements similar to an ESP application and includes references to new 10 CFR 50.160 rule

Question:

- Will CP contents require that only impediments to preparing an emergency plan need to be identified, and it would not require the development of any EP at the time of CP application?

Response:

- Assume the EP would be developed during construction and final plans would be submitted with the Operating License.
- Discussion of emergency preparedness seems muddled. The cross-referencing of the various regulations does not lead to a fulsome understanding of the requirements for EP. The most complete discussion presented in Appendix E Part II. Added discussions in the guidance seem to sometimes contradict Appendix E . References to ESP in 50.47 do not provide any better clarity. There is little discussion of how this EP guidance would affect content of a PSAR for a CP.
- This area would benefit from a more cohesive presentation in the next iteration.

Construction Permit – Comments & Questions

Comments:

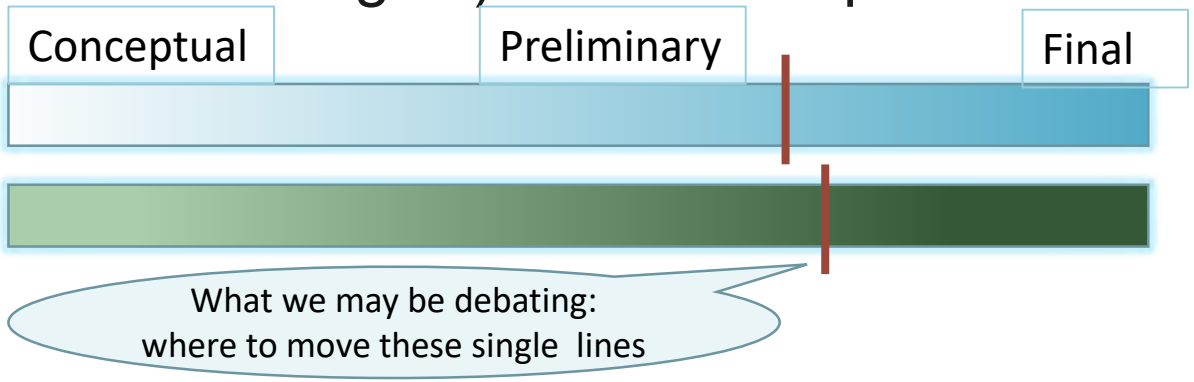
- TICAP/ARCAP can solve many near-term challenges, but the draft guidance communicates too strong a reliance on those efforts.
- Several types of information are described in a way that suggests near-final level of maturity/detail will be expected, which made it challenging to understand what an acceptable definition of “preliminary” will be. (PRA results, some transient analyses, aircraft impact?)
- Want consistency of interpretation by field inspectors, and by all stakeholders

Questions:

- Do applicants need to meet the 10 CFR 50.55a LWR-centric Codes and Standards?
- Will a preliminary security plan be required?
- How will manufacturing (e.g. for microreactors) be addressed?

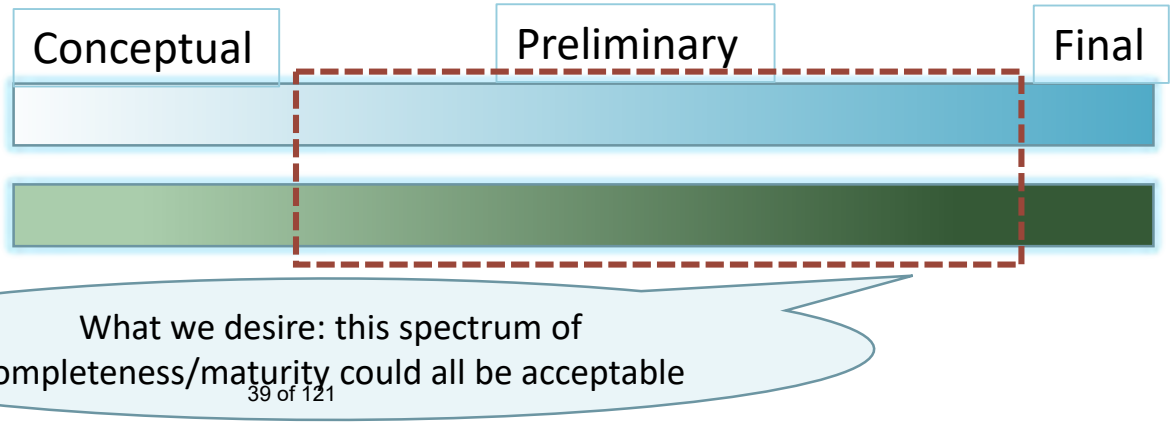
Construction Permit – Discussion of Completeness and Maturity

Image shows conceptual thinking to discuss how compliance will be assessed (i.e. “What size box of possible information (which will vary in completeness and maturity for different advanced reactor technologies) will be acceptable for CP?”



Degree of completeness
(how much information is provided)

Degree of maturity
(how final is the information provided)



Lessons Learned topics that require focus – Communication & Teaming (consistent interpretation, compliance & execution)

1) High-quality Construction Permit applications, with sufficient level of design detail and environmental information, are significant contributor to overall project planning & performance.
2) Timely development and maintenance of regulatory guidance and clear acceptance criteria are important to support development of high-quality application as well as contribute to efficient regulatory reviews.
3) Strong design standardization contributes to efficient regulatory review while on-going design changes have the opposite effect.
4) Early identification and timely resolution of complex technical issues minimize negative impacts on review schedules and project planning.
5) Improvements to NRC's management system for requests for additional information (RAIs) can further enhance project knowledge management and contribute to more efficient review.
6) Coordinated, consistent reviews of construction permit applications, design certifications and combined license applications contribute to maximizing standardization.
7) Evaluation and Integration of Lessons Learned early in the guidance development will contribute to enhancement of licensing process while mitigating potential for change

Comments/observations to NRC white paper – non-safety related

- Evaluate and implement a formal guidance to separate (bifurcate) safety related from non-safety related scopes and specifically areas (islands) of the facility and plant boundaries with associated guidance for each. This will have a positive impact on construction permit and project execution.
  - NRC charter is public health and safety focus. Primary focus and guidance on safety-related construction will lessen stringent requirements for construction of non-safety related facilities--providing for more efficient project execution, schedule and realized cost savings. Focusing on safety-related construction will result in less impact on FOAK (First of as Kind) execution, thus providing cost and schedule certainty.
  - For example, If turbine or isolated related secondary systems (non safety related) can shut down unexpectedly and not put the public in jeopardy, why is there a need to continue to have the same strict regulations as the primary systems (safety related)?
    - Impacts schedule and cost, productivity, resources and supply chain cost and procedures (Logistics, receipt inspections, etc.)

Comments/observations to NRC white paper – specific disciplines

- For all the specific disciplines listed in the white paper (e.g. Instrumentation & controls, protective coatings, structure system components), separately consider requirements for safety related and non safety characteristics related to scope and materials and components
  - A graded approach by specific attributes and scope.
  - Set guidance to categories each within each discipline.
  - Consider to commercial grade dedication acceptance criteria (e.g. EPRI guidance) and incorporate/align in NRC guidance
  - Review requirements of conditions when fuel declared on site. Provide for acceptance without restricting or impacting construction execution.

Comments/observations to NRC white paper – ITAAC

- ITAAC (Inspections, Test, Analyses, Acceptance Criteria) process needs to be addressed as it is cumbersome as it integrates into many aspects of turnover.

  NRC approves a set of ITAAC at the time of initial licensing, which is intended to provide greater stability and predictability in making the decision whether the plant conformed to the accepted design and could commence operation. (1989 White paper by Steven G Burns, Previous Deputy General Counsel USNRC)

  - Consideration needed for the ITAAC process to provide for a less taxing and less expensive way to validate compliance without slowing the back end of the project.
  - Evaluate streamlining of the ITAAC turnover process
  - Consideration for collaborative planning of how all or most ITAAC could be incorporated into design and work packages and signed off by NRC along the way.

Comments/Response to NRC white paper – Codes

NRC: “Expectation that the application will include consensus design codes and standards (ASME, ANSI, IEEE, etc.) used for the design along with applicability to design of specific SSCs

- Staff consider ASME Section III Division 5 under development would be included in the CP application as appropriate.”

Response:

- Separate Quality Program requirements based upon safety and non-safety components. Bifurcation capability is supported with this approach from construction permitting to project completion.
  - Assume NRC will expect to see design codes in the CP PSAR. This gets to the foundation of how the facility will be constructed with the necessary quality to assure the safety
- Appendix B and NQA-1 Program should be considered for application of this approach as well as acceptance of ISO 9000 series, IAEA, and efficient commercial dedication programs that should become an accepted practice and a part of the NRC requirements and acceptance.
  - This should not be a duplication of regulations/guidance but compliment/alternative to the existing requirements, while taking advantage of benefits to efficiently achieve the same compliance.

Comments/observations to NRC white paper – Digital Twin Utilization

- Evaluate/align/implement and address in the guidance the utilization of Digital Twins modeling platforms and virtual reality systems. These may provide a compliance verification tool from initial permitting to design to construction commissioning and project closeout. Becomes a part of Document Control retention to turnover of basis of maintenance and operations in the future while providing live, “Source of Truth” utilized by NRC for verbatim compliance verification.
    - Will enhance collaboration between the NRC and constructor for pre-planning, design review, execution process and schedule, commissioning and document control, change management, and configuration management and ultimately verbatim compliance with real time processes.
    - Will provide simulation for verification and validation of design compliance while addressing change. Providing for a risk informed Regulator with a potential encompassing “Source of Truth”
    - Need to resolve response time or requirements associated with design changes under Part 52 (e.g. process similar to 50.59 allowing proceed at risk prior to NRC approval). Digital Twin approach can assist in this.

Contacts

Jeffery P. Hawkins

Energy Production & Infrastructure Center (EPIC), University of North Carolina, Charlotte's (UNCC)
Staff Resident Nuclear Industry Expert

Retired, Vice President Fluor's Nuclear business line; Prior: key management roles in Bechtel and Raytheon

JeffHawkins@JHawkconsulting.com

Cyril W. Draffin, Jr.

Senior Fellow, Advanced Nuclear,
U.S. Nuclear Industry Council

Cyril.Draffin@usnic.org

Jeffrey S. Merrifield

Chairman, Advanced Nuclear Working Group, U.S. Nuclear Industry Council

Partner, Pillsbury Winthrop Shaw Pittman LLP

Jeff.Merrifield@pillsburylaw.com

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NRC Staff Draft White Paper Analysis of Applicability of NRC Regulations for Non-Light Water Reactors - Followup

February 2021

Background

- "NRC Staff Draft White Paper - Analysis of Applicability of NRC Regulations for Non-Light Water Reactors", issued in 9/2020 (ML20241A017)

- NEI provided feedback regarding the NRC draft white paper in a letter to the NRC on October 30, 2020 (ML20308A662) and at a stakeholder meeting in 12/10/2020 (ML21006A414)

- NRC proposed changes to the Draft White paper at the 12/2020 stakeholder meeting and issued a Draft Appendix providing examples demonstrating compliance and exemptions on 2/18/21 (ML21049A098)

Purpose

- Share staff feedback on NEI letter and 12/2020 presentation
- Discuss draft Appendix to “NRC Staff Draft White Paper - Analysis of Applicability of NRC Regulations for Non-Light Water Reactors”
- Suggested use of Tables in NRC Staff Draft White Paper

Feedback

- We will determine regulatory applicability from a plain language reading of the rule.
- Regulatory applicability in this context was determined for non-LWRs as a group, rather than on a design-specific basis
- We are taking steps to clarify expectations and minimize unnecessary burden for non-LWR applicants.

10 CFR Part 52

- Seven regulations in 10 CFR Part 52 apply to all power reactors but reference a 10 CFR Part 50 regulation that refers specifically to Light Water Reactors
- The NRC staff will document these exemptions based on design information provided in the application

Expectations for Documentation

- For regulations that are assessed as not applicable (“N”) in the tables of the white paper by the NRC, no further action within the application is necessary for non-LWR applications.
- For regulations that are assessed as applicable in the white paper, applicants will have to demonstrate compliance with the regulation or justify an exemption from the regulation.
- For regulations that are assessed as applicable in the white paper, where the specific design does not meet entry conditions specified in the regulation, no further action is necessary beyond providing information in the application
  - E.g., For regulations related to multi-unit sites, no action to meet the regulation beyond specifying the reactor is a single unit somewhere in the application
- For providing information related to regulatory compliance or drafting an exemption from a regulation, staff has provided high level examples of what might be expected for certain regulations.

Regulatory Compliance

- As a first step, applicants should consider whether the design already complies with existing regulations.

- To provide additional context on how to comply with and what might be expected for regulations, staff has provided examples as part of the draft appendix:
  - 10 CFR 50.46a
  - 10 CFR 50.44
  - 10 CFR 52.79(a)(4)(i)
  - 10 CFR 52.79(a)(6)

Exemptions

- At this time, NRC expects to prepare exemptions for the items in Table 2 of the white paper
- Exemptions will vary both in content and complexity, and the level of effort and length will vary accordingly. All exemptions (provided by an applicant) should contain:
  - A statement identifying the need for NRC approval or need for an exemption.
  - The scope and summary of the requested exemption, including identification of the specific portion(s) of the regulation that the exemption is requested from and the relevant design feature(s);
  - Relevant justification for the exemption, with references to regulatory guidance and/or requirements (as applicable);
  - A technical and regulatory evaluation relative to the regulatory acceptance criteria associated with the request (e.g., Section 50.12); and
  - An evaluation against the applicable exemption criteria.

Exemptions

- Two examples of expected exemptions are provided in the draft Appendix:
  - For emergency response, emergency preparedness, and emergency planning zone regulations (e.g., those in 10 CFR 50.33(g), 50.47(b), 50.47(c)(2), and Appendix E) – applicants can use the proposed rule as part of their justification in conjunction with a technically supported basis that aligns with the proposed rule and regulatory basis
  - For the definition of safety-related as it pertains to part (1), the integrity of the reactor coolant pressure boundary – applicants can either comply and use the process laid out in 10 CFR 50.69 for classification, or request a single exemption from all related regulations. In doing so, a technical and regulatory basis considering the specific design would be required, and applicants should consider how changing the definition affects regulatory requirements that apply to the design.

Using the Draft White Paper

- Start with Table 3 (Part 50) or Table 5 (Part 52)
  - If “N” no action required
  - If “Y” but regulation does not impose a requirement, no action required
  - If “Y” but specific application does not meet entry condition, application should clearly show why it doesn’t meet entry conditions
  - If “Y” with Ref to Table 2, NRC will document these exemptions based on design information provided in the application
  - If “Y” with Ref to Table 1, determine if design needs an exemption in this area
  - If “Y” and design complies with plain language reading of regulation, application should clearly show how this regulation is met
  - If "Y" otherwise, request exemption

Using the Draft White Paper

- Review Table 4 – Three Mile Island Requirements
  - If “Y” but specific design does not meet entry condition, application should clearly show the design doesn’t meet the entry conditions
  - If “Y” but not technically relevant, application should clearly show why this requirement is not technically relevant (as directed in 50.34(f))
  - If “Y” and design complies with plain language reading of regulation, application should clearly show how this regulation is met
  - If "Y" otherwise, request exemption
- Review Table 6 – Other Regulations that may apply
  - These regulations are listed at a higher level than the previous tables, and the table provides general applicability. Regulations designated as "Y" should be considered, as applicable to the specific application.

Questions/Discussion

Example: Applicability of NRC Regulations for Non-LWRs

February 25, 2021

NUCLEAR ENERGY INSTITUTE

Sept. 2020 NRC Staff Draft White Paper Analysis of Applicability… for non-LWRs

NRC Table 2

Topical Area	Regulation	Discussion
Station Blackout (SBO)	10 CFR 52.47(a)(16) 10 CFR 52.79(a)(9) 10 CFR 52.137(a)(16)	These provisions reference 10 CFR 50.63, which is only applicable to LWRs. Therefore, non-LWR applicants will need an exemption from these regulations.

NRC further states, in part:

When a non-LWR design, by virtue of its unique attributes, need not comply with one or more of the requirements of a regulation listed in Table 2, the applicant should request an exemption or exemptions from the specific subsection or subsections of each such regulation.

Applicability determined by underlying safety purpose & technical des. aspects

- Purpose: to ensure that LWRs can withstand a total loss of AC electric power for a specified duration and can maintain core cooling and appropriate containment integrity during that period.
- Technical design: Non-LWR "A" does not need AC electric power for safety functions, including heat removal.

Neither changes based on the use of 10 CFR Part 50 or 10 CFR Part 52

- "plain language" yields an odd and unintended result, because the purpose of the regulation relates to design features that are not present in non-LWR designs

Maybe Station Blackout is a concern for Non-LWR "B"

AC electric power is needed for some safety functions

- 10 CFR 52.79(a)(9) and 10 CFR 50.63 still may not apply or require an exemption (given LWR focus)

Three possible paths to address Station Blackout

1. 10 CFR 52.79(a)(2) and (a)(4) require thorough descriptions and analyses of SSCs, principal design criteria, design bases, etc.
2. 10 CFR 52.79(a)(9) compliance by alternative means ≠ exemption
3. Use "entry conditions" for the applicability of 10 CFR 52.79(a)(9) ≠ exemption

Option 1 for Non-LWR “B”

10 CFR 52.79(a)(2) and (a)(4) will address SBO

These regulations require applications to include, for example:

- “evaluations required to show that safety functions will be accomplished” and
- the design bases and its relation to the principal design criteria

10 CFR 52.79(a)(9) will be listed as not applicable

Because this regulation references 10 CFR 50.63 which is specific to LWRs, non-LWR “B” does not need to address it in their application.

Option 2 for Non-LWR “B”

10 CFR 52.79(a)(9) compliance by alternative means

NRC has noted in previous correspondence to applicants:

- “a novel means to perform a required function or include a required design attribute does not necessarily trigger a need for an exemption”

10 CFR 52.79(a)(9) will be included in application content

Non-LWR “B” would describe how they meet the underlying safety purpose of 10 CFR 50.63 with non-LWR “B” technical design characteristics.

Option 3 using “entry conditions”

Establish “entry conditions” for 10 CFR 52.79(a)(9)

When a regulation cannot unequivocally be determined not applicable:

- Use clear acceptance criteria for new designs to provide adequate protection of public health & safety
- Extend the logic and experience with recent applicants and the development of RG 1.232 (ARDC), e.g., with respect to offsite power

10 CFR 52.79(a)(9) applicability based on technical design

Technology-inclusive, risk-informed, performance-based “entry conditions” would identify applicability:

- Non-LWR “B” does need to address SBO.
- Non-LWR “A” does not need to address SBO.

Desire more efficient path to disposition regulations that are N/A to non-LWRs

Issue

Regulations in Part 50 and Part 52 were established around large LWR technology with prescriptive requirements that are specific to features of these designs.

A timely alternative to the exemption process is prudent.

Preferred alternative should

- Acknowledge technical aspects of non-LWR designs
- Clearly convey safety focus
- Consistently treat non-LWR applicants under Pt 50 and Pt 52 licensing processes

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Break

Meeting/Webinar will resume shortly

Microsoft Teams Meeting
Bridgeline: 301-576-2978
Conference ID: 644 910 374#

Technology Inclusive Content of Application Project (TICAP) Presentations

Steve Nesbit, LMNT Consulting
Ed Wallace, GNBC Associates
Brandon Chisholm, Southern Company

TICAP – Nuclear Regulatory Commission (NRC) Working Meeting
February 25, 2021

Southern Company

Outline of Today's TICAP Presentations

- Introduction and Overview (Steve)
- TICAP / Advanced Reactor Content of Application Project (ARCAP) Integration (Steve)
- Level of Detail (LoD) Task (Ed)
- Tabletop Exercises (Brandon)

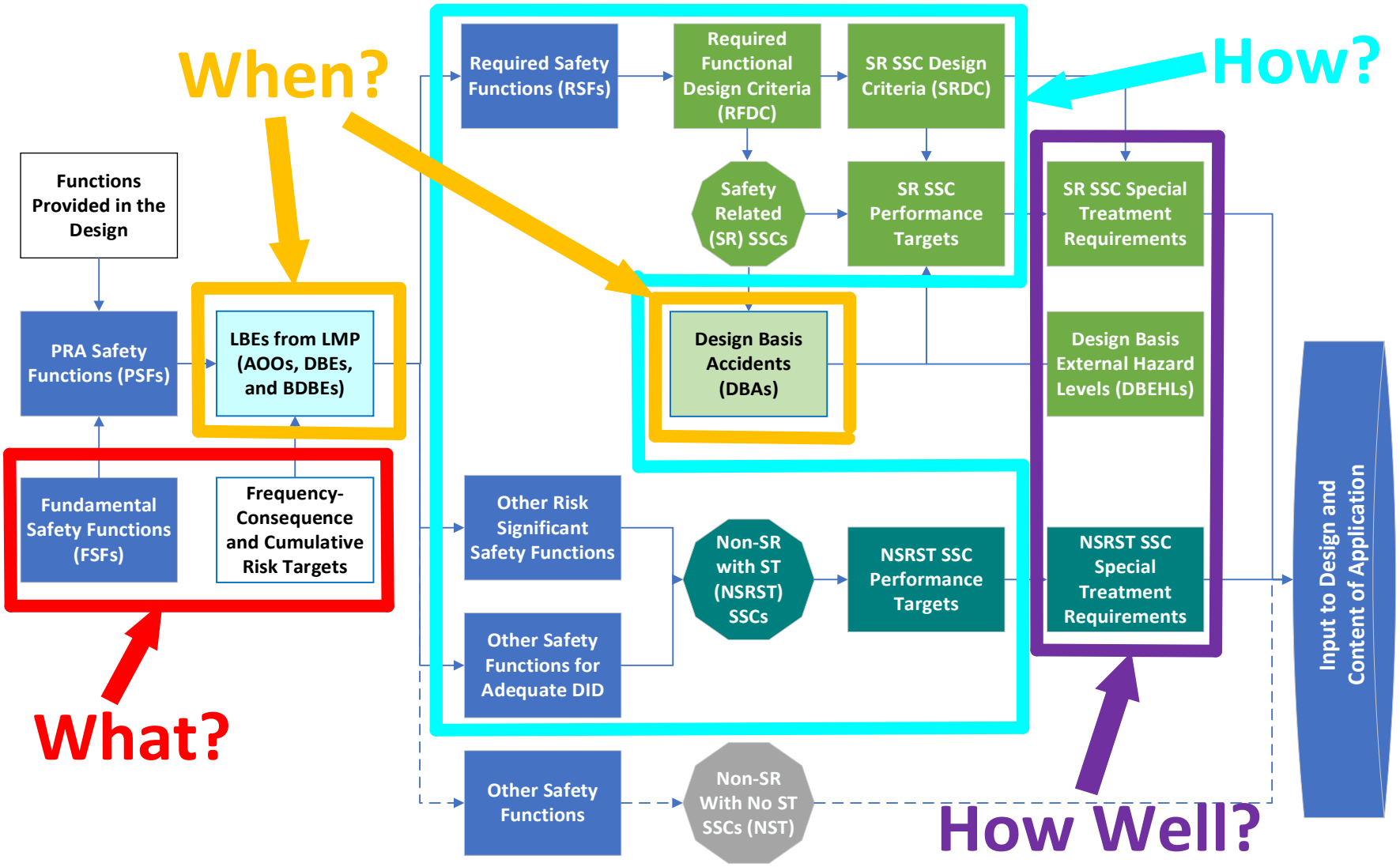
Please note that we will be discussing work in progress, not a finished product. We request your indulgence and welcome your feedback.

Also, we have included a list of acronyms at the end of the presentation.

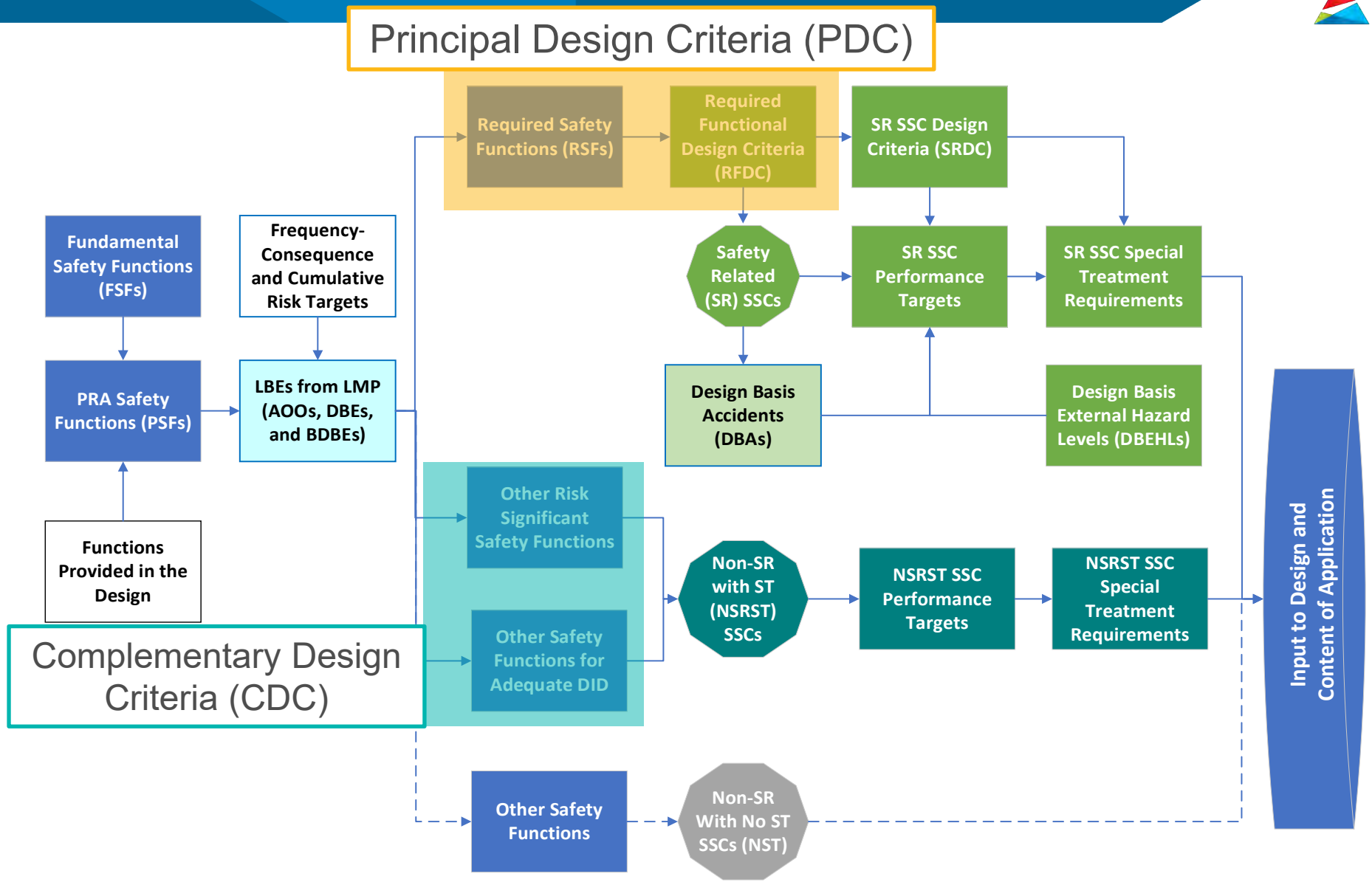
TICAP Overview

- ***Product:*** *Develop an endorsable Guidance Document that proposes an optional formulation of advanced reactor application content that*
  - *Benefits from the insights and knowledge gained through licensing and safely operating the current US-based nuclear fleet for over 40 years to ensure adequacy of proposed content requirements*
  - *Is based on describing a technology-inclusive affirmative safety case that meets the underlying intent of the current requirements*
    - » *To optimize application content (add where additional content is needed and reduce where current content requirements are not commensurate with the contribution to risk)*
    - » *To provide the needed regulatory agility to accommodate review of spectrum of designs that are expected to submit licensing application*
  - *Is risk-informed, performance-based (RIPB) to right size the required information in an application (based on the complexity of the safety case) to increase efficiency of generating and reviewing an application*
  - *Its scope is governed by the Licensing Modernization Project (LMP)-based safety case to facilitate a systematic, technically acceptable, and predictable process for developing a design's affirmative safety case*
  - *Provides similar information as is currently required from a light water reactor (LWR) applicant*

LMP-Based Safety Case Output- Simplified Diagram



PDC and CDC are answers to "How?"



TICAP Key Benefits

- Major step towards industry goal of having safety focused reviews which minimize the burden of generating and supplying non-safety significant information
- Helps NRC and “Industry” (developers and utilities) establish a common understanding of how to document reasonable assurance of adequate protection for non-LWRs
- Provides a means for submitting a right-sized Part 50 or Part 52 application
  - Also informs and supports ongoing efforts to develop a risk-informed, performance-based regulation for advanced reactors (Part 53)
  - Addresses important facets of the Nuclear Energy Innovation and Modernization Act
- Reducing regulatory uncertainty by having an endorsed NRC guidance document for evaluating and demonstrating the safety case.

Technology-Inclusive Content of Application Project (TICAP)

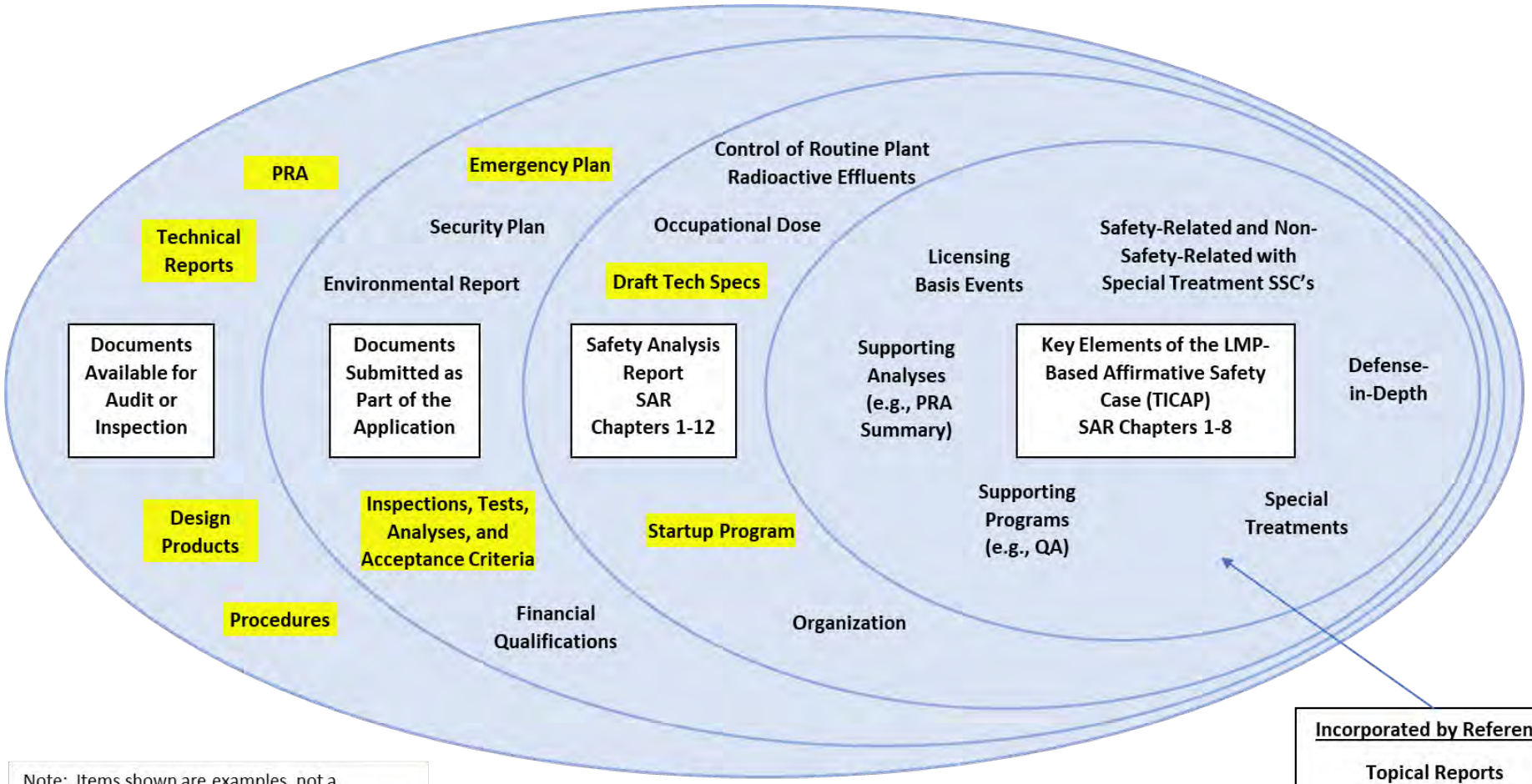
TICAP / ARCAP Integration

Steve Nesbit

TICAP – NRC Working Meeting
February 25, 2020

Southern Company

Visual Depiction of TICAP Guidance in the Context of an Advanced Reactor Application



Note: Items shown are examples, not a complete list. Highlighted items may also support the LMP-Based Affirmative Safety Case even though they are not inside the TICAP area.

* Special treatments include quality assurance, reliability assurance, protection against design basis external events, equipment qualification, in-service inspection, etc., as described in NEI 18-04 Table 4-1.

TICAP Schedule

- Tabletop exercises – ongoing (first NRC-observed exercise 2/3)
- 4/15/21: Draft NEI Guidance Document to NRC
  - Will factor in lessons-learned from tabletop exercises as available
  - Will not include “for information” appendices
- May 2021: Workshops with NRC on draft guidance document
  - To be scheduled
- 6/1/21: Written NRC comments to TICAP team
- 7/28/21: NEI Guidance Document Rev. 0 to NRC
- Fall 2021: NRC/TICAP briefing to the Advisory Committee on Reactor Safeguards
- Dec 2021: NEI Guidance Document Rev. 1 to NRC (if needed)

Technology Inclusive Content of Application Project (TICAP)

SAR Level of Detail

Ed Wallace

TICAP – NRC Working Meeting
February 25, 2021

Southern Company

SAR Level of Detail Objectives

A TICAP objective is to right-size the Level of Detail (LoD) by:

- Using a graded approach, facilitated by the LMP-based safety case
- Using a performance-based approach by stating the performance outcomes and supporting programmatic requirements commensurate with the safety significance of the topic
- The detailed design and programs are part of the design-phase records, available for audit and inspection

Probabilistic Risk Assessment (PRA) Guidance

- The SAR is to include “A description of the design-specific probabilistic risk assessment (PRA) and its results” [10 CFR 52.47(a)(27)]
- Guidance for the PRA description is provided in TICAP Guidance Section 2.1.1
  - Summary description
  - Includes statement of conformance with non-LWR PRA Standard ASME/ANS-RA-S-1.4-2021
  - Supporting PRA detailed calculations, models etc. will be maintained in plant design records and available for inspection and audit like other design records

PRA Results

- Compared to recent LWR applications, PRA plays a more central role in the LMP-based safety case
- As a result, the outcomes and products derived from the PRA are used in a number of ways to define, describe and manage an affirmative safety case
  - Radionuclide hazards
  - Quantification of essential input parameters and assumptions
  - Identification of PRA Safety Functions and Required Safety Functions
  - Quantification of LBE results represented on F-C Target
  - Quantification of cumulative risk evaluation
  - Identification of risk-significant uncertainties
- TICAP Guidance Section 2.1.2 points to specific PRA results in:
  - Ch 3 Licensing Basis Events
  - Ch 4 Defense in Depth

PRA Level of Detail

- PRA LoD is an active topic in tabletop exercises
- LoD guidance is intended to satisfy initial licensing needs and provide only that information needed for life of plant change control
- Continuing discussions on:
  - LoD for LMP products derived from PRA results that are expected to change throughout lifetime
  - Addressing LBEs with low safety-significance or DID relevance
  - Intent is to convey SAR content without unduly restricting flexibility needed for technology-inclusive guidance

LoD for Reliability / Capability Requirements

- Choosing the appropriate level of performance targets that reflects the right mix of effectiveness and flexibility and reduces overall burden is the TICAP intention
- The LoD for addressing safety significant SSC reliability and capability targets needs to be established
  - Performance-based statements should be sufficient for performance monitoring and regulatory control and provide some operational flexibility during operational phases

Technology Inclusive Content of Application Project (TICAP)

Tabletop Exercises – Update and Status

Brandon Chisholm

TICAP – NRC Working Meeting
February 25, 2021

Southern Company

Tabletop Exercises Refresher

- Objectives of Tabletop Exercises:
  - Technically improve TICAP guidance by obtaining input
  - Maximize the usefulness of the guidance by providing examples
  - Improve the endorsability of the Guidance Document
- Exercises include meetings between developers and the TICAP team supporting the development of example SAR content by developers
- NRC/Idaho National Laboratory (INL) observation of some meetings to provide an opportunity to look at example SAR content developed using TICAP approach
- TICAP team will document the Tabletop Exercises in reports (i.e., final deliverables) that will be publicly available

Summary of Tabletop Exercises

Developer/ Design	Portions of TICAP Guidance Explored	Exercise Focuses	NRC-Observed Tabletop Meeting
X-energy – Xe-100 [HTGR, moving fuel]	• Chapter 2 (Generic Analyses) • Chapter 8 (Plant Programs)	• PRA and Risk Insights • Special Treatments and Plant Programs	Held on Feb 3, 2021
GE Hitachi – VTR (w/ INL) [solid fueled SFR, pool-type]	• Section 4.2 (DID) • Chapter 5 (Safety Functions, PDC, and SSC Categorization) • Chapter 6 (SR SSC Criteria and Capabilities) • Chapter 7 (NSRST SSC Criteria and Capabilities)	• Defense in Depth • External Hazards	Scheduled for March 5, 2021
Westinghouse – eVinci [micro reactor]	• Chapter 5 (Safety Functions, PDC, and SSC Categorization) • Section 5.1 (RIPB PDC vs. ARDC)	• Design Criteria (PDC/CDC)	Mid March 2021
TerraPower – MCRE [liquid fueled MSR, pool-type]	• Chapter 3 (LBEs) • Chapter 5 (Safety Functions, PDC, and SSC Categorization)	• LBE Narrative(s) • Design Criteria (PDC/CDC)	March 2021

Early Lessons Learned

- Tabletop exercise work to date has given valuable feedback to TICAP guidance development team
- Some key concepts requiring clear guidance have been highlighted by multiple developers, for example:
  - Identification of PDC (and CDC)
  - How PDC developed using a RIPB approach differ from PDC identified using a pre-selected approach
  - Level of detail for discussion(s) of PRA and reliability/capability requirements

Acronyms

Acronym	Definition
ANS	American Nuclear Society
AOO	Anticipated Operational Occurrence
ARCAP	Advanced Reactor Content of Application Project
ARDC	Advanced Reactor Design Criteria
ASME	American Society of Mechanical Engineers
BDBE	Beyond Design Basis Event
CDC	Complementary Design Criteria
CFR	Code of Federal Regulations
DBA	Design Basis Accident
DBE	Design Basis Event
DBEHL	Design Basis External Hazard Level

Acronyms (cont.)

Acronym	Definition
DID	Defense in Depth
F-C	Frequency - Consequence
FSF	Fundamental Safety Function
HTGR	High Temperature Gas Reactor
INL	Idaho National Laboratory
LBE	Licensing Basis Event
LMP	Licensing Modernization Project
LoD	Level of Detail
LWR	Light Water Reactor
MCRE	Molten Chloride Reactor Experiment
MSR	Molten Salt Reactor

Acronyms (cont.)

Acronym	Definition
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
NSRST	Non-Safety-Related with Special Treatment
PDC	Principal Design Criteria
PRA	Probabilistic Risk Assessment
PSF	PRA Safety Function
QA	Quality Assurance
RFDC	Required Functional Design Criteria
RIPB	Risk-Informed, Performance-Based
RSF	Required Safety Function
SAR	Safety Analysis Report

Acronyms (cont.)

Acronym	Definition
SFR	Sodium Fast Reactor
SR	Safety-Related
SRDC	Safety-Related Design Criteria
SSC	Structure, System, or Component
ST	Special Treatment
TICAP	Technology-Inclusive Content of Application Project
VTR	Versatile Test Reactor

Status of Technology Inclusive Content of Application Project (TICAP) and Advanced Reactor Content of Application Project (ARCAP)

Background

- High-level ARCAP proposal discussed during August 2020 and October 2020 TICAP/ARCAP public meetings. Proposal included:
  - ARCAP proposed guidance document would provide a roadmap for developing an application
  - Roadmap leverages existing guidance or guidance that is under development
  - Examples include:
    - TICAP developing guidance for portions of application using LMP process
    - Emergency planning and security rulemaking will provide insights to this portion of the application
  - Roadmap also identifies areas where additional guidance is needed (Technical Specifications).
  - ARCAP guidance document **not intended to replicate** NUREG-0800, Standard Review Plan for LWRs

Status of TICAP and ARCAP Guidance Documents

- Industry-led TICAP guidance document continues to be developed and refined
  - Series of tabletops exercises scheduled to provide feedback for TICAP guidance document development effort.
    - February 3, 2021 - First TICAP tabletop exercise (X-Energy) observed by NRC
    - Additional TICAP tabletop exercises – three more being scheduled (see December 10, 2020, public meeting slides for details regarding tabletop exercise scope and purpose at ADAMS Accession No. ML20344A057)
  - Per recent discussions with Southern, the TICAP guidance document schedule has been revised to reflect:
    - Interim Southern-developed TICAP documents that will be provided
    - NEI proposed plans for providing industry TICAP guidance document, Revision 0

Status of TICAP and ARCAP Guidance Documents

- Plans for staff-developed ARCAP guidance documents continue to evolve
  - Staff-developed ARCAP sections to be discussed during this meeting:
    - ARCAP Roadmap interim staff guidance (ISG) (to be discussed later)
    - ARCAP Chapter 11, “Organization”
    - ARCAP Chapter 12, “Initial Startup Program”
  - Previous ARCAP Sections that have been developed include:
    - ARCAP Chapter 2, “”Site Information”
    - ARCAP Chapter 9, “Control of Routine Plant Radioactive Effluents, Plant Contamination, and Solid Waste
    - ARCAP Chapter 10, “Control of Occupational Dose”

Status of TICAP and ARCAP Guidance Documents

- Timeline from October 22, 2020, public meeting updated to reflect status of ARCAP/TICAP guidance documents
  - Changes include timing of industry-developed TICAP guidance documents
  - Integration of TICAP and ARCAP guidance documents
  - Overall impact is a slip of approximately 3 months for issuance of TICAP and ARCAP guidance documents

Status of TICAP and ARCAP Guidance Documents

- Assumptions/Discussion Topics
  - Industry-developed TICAP guidance document will not include guidance for the specific-portions of the first 8 SAR chapters that are outside the scope of the licensing modernization project (LMP)
    - Examples where guidance is being developed outside the scope of LMP that could affect the first 8 chapters of a SAR are:
      - Site information – ARCAP chapter 2
      - ASME Section III, Division 5 high temperature design guidance
      - Fuel qualification guidance

Outline (FSAR)

1. General Plant Information, Site Description, and Overview of the Safety Case
2. Generic Analyses
3. Licensing Basis Event (LBE) Analysis
4. Integrated Plant Analysis
5. Safety Functions, Design Criteria, and SSC Categorization
6. Safety Related SSC Criteria and Capabilities
7. Non-safety related with special treatment SSC Criteria and Capabilities
8. Plant Programs
9. Control of Routine Plant Radioactive Effluents, Plant Contamination, and Solid Waste
10. Control of Occupational Doses
11. Organization
12. Initial Startup Programs

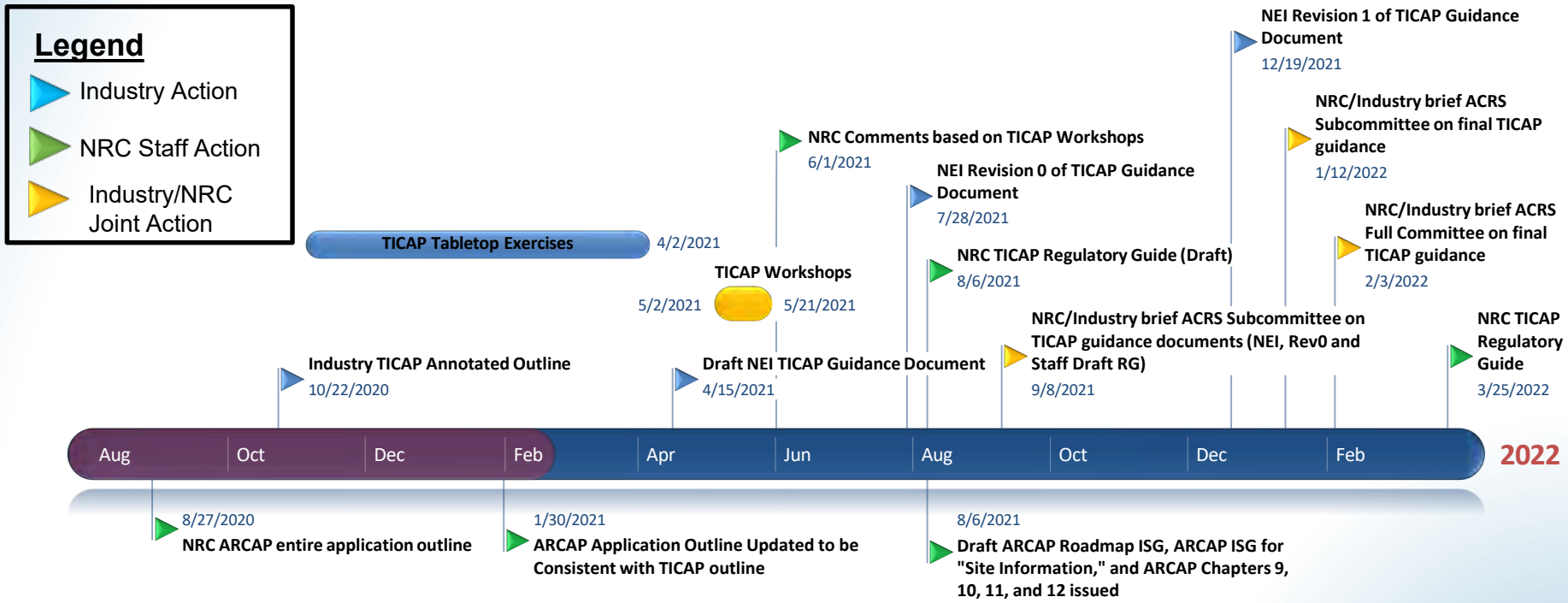
Status of TICAP and ARCAP Guidance Documents

- Questions
  - How will NRC TICAP RG acknowledge the guidance that is being developed to supplement the industry-led TICAP guidance for the first 8 chapters of the SAR?
    - Preliminary thinking is to limit NRC TICAP RG scope to SAR Chapters 1 through 8 associated with the LMP. For areas outside of the LMP for the first 8 chapters the NRC RG would provide supplemental guidance (e.g., ASME Section III, Fuel Qualification).
    - ARCAP guidance will include guidance for application areas outside of the first 8 chapters of the SAR that are non-LMP based.
  - NRC TICAP RG acknowledges approaches for an applicant not using the LMP. How best to update this guidance as Part 53 addresses this issue?
  - How will the NRC issue ARCAP guidance that references guidance still under development that has long lead times (e.g., security and EP rulemaking)?
    - Preliminary thinking is that ARCAP roadmap ISG will stay in draft form until guidance under development is finalized

Timeline for Technology Inclusive Content of Application Project (TICAP) Guidance and Advanced Reactor Content of Application Project (ARCAP) Guidance (rev 2/23/2021)

Notes:

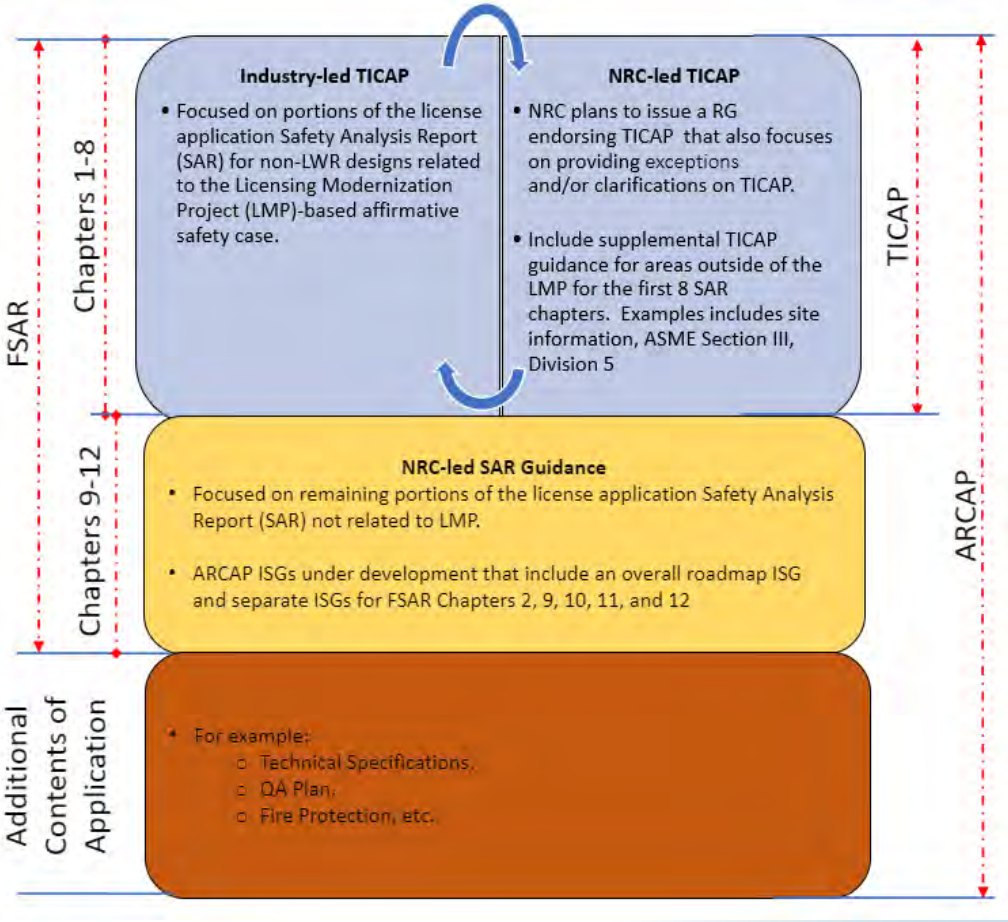
- TICAP portion of the application based on applying licensing modernization project process to appropriate portions of an application. TICAP milestones shown above the timeline
- ARCAP broader than TICAP. Provides roadmap for all portions of an application and encompasses TICAP
- Timeline does not reflect TICAP and ARCAP efforts that started in December of 2019. These early efforts led to the development of the industry-led TICAP Annotated Outline discussed in an October 22, 2020, public meeting and the NRC-led ARCAP outline plan discussed in an August 27, 2020, public meeting



Advanced Reactor Content of Application Project (ARCAP) Draft Roadmap Interim Staff Guidance (ISG) Considerations

Draft ARCAP Roadmap ISG Considerations

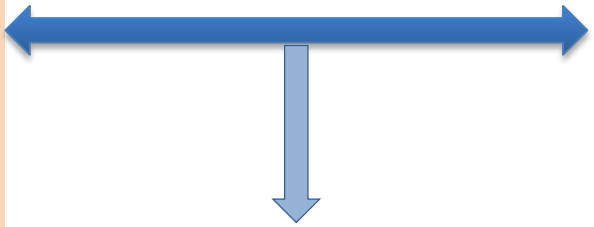
- Developed based on ARCAP plan discussed in past public meetings
  - Updated ARCAP spreadsheet available at ADAMS Accession No. ML21049A277
- Spreadsheet provides pointers to various guidance being considered or under development including:
  - Pointers to Industry-developed TICAP guidance document (safety analysis report (SAR) Chapters 1 through 8)
    - As needed, Staff-developed TICAP Reg Guide provides supplemental guidance for these chapters (e.g., site information, ASME Section III, Division 5, etc.)
  - SAR Chapters outside of TICAP scope including:
    - ARCAP chapters 9, 10, 11, and 12
  - Portions of the application outside the SAR



Draft Roadmap ARCAP Roadmap ISG with Performance Based Approach

Outline (FSAR)

1. General Plant Information, Site Description, and Overview of the Safety Case
2. Generic Analyses
3. Licensing Basis Event (LBE) Analysis
4. Integrated Plant Analysis
5. Safety Functions, Design Criteria, and SSC Categorization
6. Safety Related SSC Criteria and Capabilities
7. Non-safety related with special treatment SSC Criteria and Capabilities
8. Plant Programs
9. Control of Routine Plant Radioactive Effluents, Plant Contamination, and Solid Waste
10. Control of Occupational Doses
11. Organization
12. Initial Startup Programs



Audit/inspection of Applicant Records

- Calculations
- Analyses
- P&IDs
- System Descriptions
- Design Drawings
- Design Specs
- Procurement Specs

Additional Portions of Application

- Technical Specifications
- Technical Requirements Manual*
- Quality Assurance Plan (design)
- Fire Protection Program (design)
- PRA*
- Quality Assurance Plan (construction and operations)
- Emergency Plan
- Physical Security Plan
- SNM physical protection program
- SNM material control and accounting plan
- Cyber Security Plan
- Fire Protection Program (operational)
- Radiation Protection Program
- Offsite Dose Calculation Manual
- Inservice inspection/Inservice testing (ISI/IST) Program
- Environmental Report
- Site Redress Plan
- Exemptions, Departures, and Variances
- Facility Safety Program (under consideration for Part 53 applications)

Exemptions, departures and variations, new fuel shipping plan, and site redress plan not in ARCAP roadmap ISG at this time. May need to be considered for future applications

* Denotes that expectations regarding the availability of the probabilistic risk assessment and the technical requirements manual as part of the application are a topic of future interactions.

Draft ARCAP Roadmap ISG Considerations

- Highlights/Topics of Discussion
  - ARCAP structure for SAR informed by:
    - industry led TICAP annotated outline discussed in October 2020, public meeting (see ADAMS Accession No. ML20294A382) and
    - Staff developed annotated outline discussed in an April 2020, public meeting (see ADAMS Accession No. ML20107J565)
  - First 8 chapters of Staff-developed TICAP Reg Guide structure:
    - Provides pointers to industry-developed TICAP guidance document
    - Will describe any additional clarifications/exceptions to TICAP document
    - Basis for additional reference section could consider guidance that is referenced in April 2020 annotated outline and fact of life changes since that time
      - » As indicated in above slides, industry-led TICAP guidance limited to LMP portions of application found in first 8 chapters of the SAR

Draft ARCAP Roadmap ISG Considerations

- Highlights/Topics of Discussion
  - ARCAP SAR Chapters 9, 10, 11, and 12, are under development and have been discussed in public meetings
    - ARCAP Chapters 11 and 12 to be discussed later in this meeting
  - ARCAP ISG related to “Site Information” could be included in SAR Chapter 2
    - Unsure if this will be part of Staff-developed TICAP guidance or Staff-developed ARCAP guidance
  - Placeholders for guidance outside of the SAR (e.g., technical specifications)

Draft ARCAP Roadmap ISG Considerations

- Next Steps
  - As discussed in previous presentation on TICAP/ARCAP schedule there is a need to determine what will be within the scope of NRC RG associated with TICAP and what will be in ARCAP scope
    - That is, how will supplemental guidance for SAR Chapters 1 through 8 be captured
  - Determine the structure of the ARCAP guidance
    - If proposed structure is not workable, then alternate approach/structure needs to be developed
  - Need to determine if there are gaps in the TICAP/ARCAP SAR guidance under development
  - Need to consider feedback on advanced reactor construction permit guidance and impact it might have on TICAP or ARCAP guidance

Draft ARCAP Roadmap ISG Considerations

- Next Steps
  - ARCAP guidance for portions of application outside of the SAR
    - Staff believes that there is a near-term need to develop risk-informed, technology inclusive and performance-based guidance for technical specifications and risk-informed inservice inspection and inservice testing programs
      - » Staff would like to understand if industry plans to develop guidance for these items
    - Need to determine if there are gaps in guidance for portions of an application outside of the SAR
      - » For example, facility safety program being considered for Part 53 is a known gap
    - The scope of ARCAP needs to be determined
      - » Staff considering whether it is appropriate to have an ARCAP roadmap ISG to support near-term Part 50/52 applications, and a separate ARCAP roadmap ISG for Part 53 applications

Advanced Reactor Content of Application Project (ARCAP) Chapter 11, “Organization,” and Chapter 12, “Initial Startup Program.”

ARCAP ISG
Chapter 11, Organization

- Draft document available in ADAMS at Accession No. ML21049A277

- **APPLICABILITY**
  - The following Part 50/52 applications for light water reactors (LWRs), non-LWRs, stationary micro reactors and small modular LWRs:
    - A construction permit (CP) or operating license (OL) under 10 CFR Part 50
    - A combined license (COL), a design certification (DC), or a standard design approval (SDA) under 10 CFR Part 52

  - Applications for a power reactor construction permit and operating license under 10 CFR Part 53.
    - As the 10 CFR Part 53 requirements are finalized this ISG guidance will be supplemented, as necessary, to provide guidance in the organizational and training areas to reflect any differences in requirements between Part 50/52 and Part 53

ARCAP ISG
Chapter 11, Organization (cont.)

- **Guidance –**
  Design, Construction, Operating Organization – Key Management Positions
  - For a CP/OL or COL applicant provide, in part:
    - Organizational charts of the applicant's corporate-level management, technical support, and operations organizations, including organizational and management structure responsible for direction and support of design and construction of the proposed plant
    - A general staffing plan for construction, startup testing
    - Plans (preliminary for CP applicants) for the applicant's operations organization, including a general staffing plan for operations (OL and COL)

ARCAP ISG
Chapter 11, Organization (cont.)

- **Guidance –**
  Design, Construction, Operating Organization – Key Management Positions (continued)
  - For the design, construction and preoperational period (DC, SDA, CP/OL or COL), describe key management responsibilities in the following areas:
    - Principal site-related engineering studies
    - Design of safety-significant (i.e., safety-related and non-safety-related with special treatment) SSCs, including SSC design features
    - Development of probabilistic risk assessment (PRA), defense-in-depth, and license basis event analysis
    - Material and component specification review and approval
    - Procurement of materials and equipment
    - Management of construction activities
    - Quality assurance activities for design and construction

ARCAP ISG
Chapter 11, Organization (cont.)

- **Guidance –**
  Design, Construction, Operating Organization – Key Management Positions (continued)
  - For the operational period (OL or COL), key management responsibilities in the following areas should be described:
    - Nuclear, PRA, mechanical, structural, electrical, thermal-hydraulic, metallurgy and materials, and instrumentation and controls engineering (design and technical support)
    - Plant chemistry and health physics
    - Fueling and refueling operations support
    - Maintenance support
    - Operations support
    - Fire protection
    - Quality assurance
    - Training
    - Safety review
    - Startup testing
    - Emergency planning
    - Security

ARCAP ISG
Chapter 11, Organization (cont.)

- **Guidance –**
  Educational and Experience Requirements for Key Management Personnel
  - The application should describe the educational and experience requirements for each key management position described on previous slides
  - For a CP or COL application, the information should describe the applicant's past experience in the design and construction of nuclear power plants
  - The CP or COL applications should include information that demonstrates the ability of the technical staff to support or perform the safety-related activities specified in the application, as applicable, including the level of risk analysis experience available to perform necessary probabilistic risk assessments

ARCAP ISG
Chapter 11, Organization (cont.)

- **Guidance –**
  Training for Plant Staff
  - Licensed Operator Training
    - OL and COL application should provide a description and schedule of the training programs for reactor operators and senior reactor operators including the use of a simulator
  - Non-licensed Personnel Training
    - For OL and COL applicants, describe the training program for non-licensed nuclear plant personnel that meets the requirements of 10 CFR 50.120(b)(2) and (b)(3)
  - An applicant may provide a commitment to meet the guidelines of Nuclear Energy Institute (NEI) 06-13A, "Template for an Industry Training Program Description," for its licensed operator and non-licensed personnel training programs
  - CP applicants should provide commitments to provide the information requested for the OL application

ARCAP ISG
Chapter 11, Organization (cont.)

- **Guidance –**
  Basis/number of operating shift crews, their staffing and responsibilities
  - Describe the functions, responsibilities, and authorities of the following plant positions (OL or COL):
    - operations supervisors
    - operating shift supervisors/managers
    - shift technical advisors
    - reactor operators and senior operators
    - non-licensed operators
  - The application should describe the shift position titles, applicable operator licensing requirements for each, and the minimum numbers of personnel planned for each shift for all combinations of modules/units proposed to be at the station in either operating or safe shutdown mode

ARCAP ISG
Chapter 11, Organization (cont.)

- **Guidance –**
  Basis/number of operating shift crews, their staffing and responsibilities (continued)
  - If an exemption is necessary from the licensed operator staffing requirements described in 10 CFR 50.54(m), the applicant should provide a basis for this exemption utilizing the guidance contained in NUREG-1791, “Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)”
  - For CP applicants, these plans are not required to be fully developed, provided that the applicant makes commitments to ensure that the staffing plans are included in the OL application

ARCAP ISG-Chapter 12

- Applicability:
  - ISG-12 (see ADAMS Accession No. ML21049A277) provides guidance for the Initial Startup Program (ISP) for CP, OL, COL, DC, SDA and ML applications.
  - ISG-12 has been developed as part of ARCAP, since TICAP does not address this area.
  - ISG-12 is written to describe what the NRC reviewer is expected to look for in the review.
  - ISG-12 is subject to future revision to be compatible with Part 53.

ARCAP ISG-Chapter 12

- Guidance:
  - The purpose of the ISP is to demonstrate, to the extent possible, that the safety-related and safety-significant SSCs operate in accordance with the design and as described in the safety analysis report (SAR).
  - ISG-12 allows all, or part, of the ISP to be documented in a report separate from the SAR, provided the document is referenced and summarized in the SAR.

ISG-12: Scope

- Guidance (continued):
  - Testing and analysis should be sufficient to demonstrate SSC performance over the full range of operating conditions.
  - Risk insights should be used to help focus the testing on the most safety significant conditions.
  - Retesting should be done if plant modifications are made.
  - Parallels the scope contained in RG 1.68, “Initial Test Programs for Water-Cooled Nuclear Power Plants”, but expressed in technology inclusive terms in a less prescriptive fashion.

ARCAP ISG-Chapter 12

- Guidance (continued):
  - The ISP is organized into two phases:
    - Phase 1 – Preoperational Testing (prior to fuel load)
    - Phase 2 – Initial Startup (fuel load to power ascension)
  - Phase 1 is applicable to all applications.
  - Phase 2 is not applicable to CP applications.
  - Programmatic items (applicable to all applications) include:
    - Test descriptions
    - Responsibilities and conduct of the ISP
    - Test sequencing, prerequisites and schedule
    - Use of procedures and qualified personnel
    - Use of plant procedures and Tech Specs
    - ITAAC, if applicable

ARCAP ISG-Chapter 12

- Phase 1 Testing:
  - Reactivity control features.
  - Heat removal system operation and integrity.
  - Integrity and operation of functional containment.
  - Radioactive waste handling, processing and storage systems
  - Radiation and criticality monitoring systems
  - Testing required by Codes and Standards.
  - Flow induced vibration and thermal expansion.
  - I & C and electrical systems.
  - Fuel handling and storage systems.
  - Support systems.

ARCAP ISG-Chapter 12

- Phase 2 Testing:
  - Initial fuel loading and reactor physics tests.
  - Low power testing.
  - Power ascension testing.
  - Residual heat removal system testing.
  - Gaseous and liquid waste system testing.
  - Flow induced vibration and thermal expansion.
  - First-of-a-kind, inherent and passive safety feature testing.

Next Steps – Future Meeting Planning and Open Discussion - Tentative

Near-Term Advanced Reactor Public Stakeholder Meetings
March 4, 2021 (Part 53)
April 8, 2021 (Part 53)
April 15, 2021 (Periodic)
April 22, 2021 (Part 53 – ACRS Subcommittee)
May 6, 2021 (Part 53)
Next TICAP/ARCAP Meeting?