

April 10, 2020

To: Joe Sebrosky, NRC

From: Amir Afzali, Southern Company

Subject: Comments on NRC's "Draft Outline for Licensing Modernization Project  
Advanced Reactor License Applications"

The TICAP team appreciates the opportunity to provide the enclosed comments on the draft outline that NRC discussed at the December 2019 Advanced Reactor Stakeholders Meeting.

As you are aware, Southern Company is working on the Technology Inclusive Content of Application Project (TICAP) which is co-funded by the Department of Energy and administered through the Idaho National Laboratory (INL). TICAP is planning to develop a Nuclear Energy Institute (NEI) guidance document on the content of an advanced reactor application using the NEI 18-04 methodology to develop its safety case. We plan to provide the NRC with a series of white papers over the next year culminating in an NEI guidance document for review and endorsement around September 2021.

TICAP will address the structure of an advanced reactor application in our guidance document. However, that particular work has not yet progressed to draft application outline stage. Therefore, your draft outline is ahead of our activities. You requested feedback on your outline, and we therefore offer the enclosed comments. Please recognize that our comments are preliminary and they do not reflect insights from the work we will be doing over the coming months. Also, because we do not have a fully-formed opinion as to the optimal outline for an application at this time, in some cases we will point out potential concerns with your document without making a specific recommendation to address those concerns.

While our comments are provided in the context of a SAR outline for the existing (Part 50/52) regulatory framework, we cannot help to think about approaches that could be used in a less constrained Part 53 world. Thus our comments should be considered in the Part 53 context as well.

Finally, please recognize that these comments reflect the views of the TICAP project team at the present time, and nothing more. The comments do not reflect a consensus on the part of the nuclear industry. Other entities may offer additional valuable perspectives.

It is essential to establish an improved framework for advanced reactor applications, and we appreciate the NRC's efforts toward that end. We trust these comments will contribute positively to the dialog on how best to accomplish that goal. We look forward to our upcoming discussions with the NRC about the draft SAR outline.

## Enclosure

### **TICAP Comments on NRC's "Draft Outline for Licensing Modernization Project Advanced Reactor License Applications" April 10, 2020**

The Technology Inclusive Content of Application Project (TICAP) is pleased to offer the following comments on the "Draft Outline for Licensing Modernization Project Advanced Reactor License Application" as provided by the Nuclear Regulatory Commission (NRC) in November 2019 and discussed at the December 2019 Advanced Reactor Stakeholder Meeting. As you know, TICAP follows in the footsteps of the Licensing Modernization Project which culminated in the submittal of NEI 18-04 "Risk-Informed Performance-Based Technology Inclusive Guidance for Non-Light Water Reactor Licensing Basis Development." The goal of TICAP is to propose application content guidance that will have the following attributes:

- Technology inclusive to be generically applicable to all non-LWR designs
- Risk-informed and performance-based to:
  - Ensure NRC review is focused on information that impacts the safety case of reactors.
  - Create coherency and consistency in the scope and level of details requirements in the license application for various advanced technologies and designs.
  - Provide for flexibility during construction.
  - Encourage innovation by focusing on the final results as opposed to the pathway taken to achieve the results.

The NRC's proposed draft has a number of attractive attributes. It departs from the standard format and content for conventional large light water nuclear power reactor safety analysis reports (SARs). It begins with general information about a proposed plant, which TICAP believes should be structured to be understandable and useful to both the NRC and to the broader stakeholder community. It has a primary focus on the safety case of the plant, i.e., the demonstration that there is reasonable assurance of adequate protection of public health and safety. Along those lines, TICAP maintains that the SAR should not be encumbered with material that is not directly related to the radiological safety case for public protection.

TICAP has not yet reached the stage of our work of formulating and validating an optimized outline for a SAR, so these comments are necessarily preliminary. Also, because TICAP does not have a fully-formed opinion as to the optimal structure for an application at this time, in some cases the comments note potential concerns without making specific recommendations to address those concerns.

The TICAP comments are provided in the attached table, with general observations at the beginning, followed by specific comments and questions.

**TICAP Comments on the NRC’s “Draft Outline for Licensing Modernization Project Advanced Reactor License Applications”**

No.	Location	Comment
1.	General	The NRC draft contains the major elements of the Licensing Modernization Project (LMP) risk-informed, performance-based process for selection of Licensing Basis Events (LBEs); safety classification of structures, systems, and components (SSCs) and associated risk-informed special treatments; and determination of Defense-in-Depth (DID) adequacy for non-LWRs. Moreover, the proposed outline puts the chapters describing the application of the NEI 18-04 methodology at the front of the SAR (Chapters 3-7). We endorse the incorporation of LMP and the “safety case first” approach. With that being said, the use of LMP is an option, not a requirement, and some advanced reactor license applicants may choose to employ a different approach. For them, the NRC draft outline would not be a useful tool without some modification.
2.	General	Please provide clarification with respect to the kind of Safety Analysis Report (SAR) to which this outline will be applied (e.g., Part 50 construction permit, Part 50 operating license, Part 52 combined construction and operating license – with or without design certification, etc.). While the nominal organization and content of an application may be similar for different cases, the level of detail and the timing at which such detail is required will vary.
3.	General	Is there a cross-walk available between the sections of the outline and NRC regulations or guidance?
4.	General	Editorial comment: Capitalization should be done consistently and should be standardized. For example, “characteristics” is not capitalized in 2.1 but “Demography” is capitalized in 2.2.
5.	General	In some cases it is challenging to infer the intended content of the sections and subsections simply from the title. It is understood the NRC intends to provide additional detail and explanation.
6.	Chapter 1 General Information	Starting with a general description of the entire plant is a good approach. It should be a high-level description that is “user-friendly” for stakeholders and the public, including aspects that go beyond the safety case. It should be “for information” and not subject to increased administrative controls such as Tier 1 or Tier 2* designation.
7.	1.1 and 1.2	Consider combining these two sections (“General plant description” and “Other important plant features”). There doesn’t seem to be a good reason for setting them apart.
8.	1.1.3 General Arrangement	Consider replacing this section with two others. The first would be “Plant systems” and would be a brief description of key plant systems and their functions. The second would be “General arrangement” and would describe the plant configuration at a high level, with appropriate figures and diagrams.
9.	Section 1.2 Other Important Plant Features	The important features may vary from design to design, so there needs to be flexibility in the sub-headings. As one example, fast spectrum designs will not have a moderator.

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10.	1.2.1 Materials	A separate section on materials may not be warranted. Materials could apply to anything in the plant. To the extent necessary, materials should be discussed in the context of the system for which information is being provided.
11.	1.2.4 and 1.2.6	These two sections (“Neutron energy spectrum” and “Fuel system design”) could be combined into “reactor and fuel system.” Also, it would seem to make sense for fuel to come before moderator (1.2.2) and coolant (1.2.3).
12.	1.2.5 Thermodynamic cycle ...	Consider renaming this section “power conversion and application.” The discussion should make clear the intended use of the energy that is produced, which may not be entirely electricity generation.
13.	1.3 General site description	It is important that this section be confined to general, high-level overview information. To the extent details are required, they should be in Chapter 2. The distinction between 1.3 and Chapter 2 is an area that may warrant additional guidance.
14.	1.4 Overview of process used to develop safety analysis	The material in 1.4 appears to be redundant to later sections of the SAR. For example, 1.4.2 (PRA) is redundant to Chapter 12, 1.4.3 (SSCs) is redundant to Chapter 4, 1.4.4 (DID) is redundant to Chapter 7. This is not descriptive material such as 1.1 through 1.3, so it is considered preferable to cover it once, later in the SAR (e.g., at the beginning of Chapter 3, or a separate chapter before Chapter 3). Also, it is anticipated that this section will primarily be a reference to NEI 18-04.
15.	1.4.5 Role of the Integrated Design Panel (IDP) or Expert Review Panel	Terminology comment: Within the NEI 18-04 framework, as reflected in the Glossary, the expert panel body is known as the “Integrated Decision-making Process Panel” (IDPP) and the structured process for making decisions is known as the “Integrated Decision-making Process” (IDP).
16.	1.5 through 1.11	Consistent with Comment 6, we would like Chapter 1 to be confined to a high level descriptive summary. To the extent Sections 1.5 through 1.11 are necessary, consider moving them to other sections of the SAR.
17.	1.5 Identification and bases for the principal design criteria (PDC) of the facility	The PDCs form a key piece of the safety case for an advanced reactor and the function design criteria derive from them. It seems out of place in Chapter 1 which should be focused on overview, general interest material.
18.	1.6 Overview of analytical codes and methods verification and validation (V&V)	Consider deleting this section. Codes and methods are certainly important and will be used for a variety of purposes. To the extent necessary, codes and methods should be discussed in conjunction with the application or analysis, not all together up front. V&V is carried out consistent with the quality assurance program and additional programmatic detail on V&V in the SAR seems unnecessary.
19.	1.7 Referenced materials	Consider deleting this section. To the extent materials are referenced, that should be done in the pertinent section of the SAR.

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20.	1.8 Drawings and other detailed information	Consider deleting this section. To the extent drawings and other detailed information is necessary, they should be included in the pertinent section of the SAR.
21.	1.10 Conformance with Regulatory Guides	Consider deleting this section. It is expected that few reg guides will actually be useful for advanced reactor designs. Reg guides that are used should be cited in the sections where used (similar to references per Comment 19). Requiring a conformance matrix for all reg guides would be an unnecessary burden and would simply confirm what is already known – most do not apply.
22.	Chapter 2 Site Information	The level of detail in this chapter is an important consideration. Only the information needed to inform the NRC Safety Evaluation needs to be included. Detailed population and demographics information should not be provided outside of the proposed Emergency Planning Zone. Content in the applicant-produced Environmental Report should not be duplicated in the SAR. Geotechnical, geological, and seismic information should be provided only in the detail needed to support the safety case.
23.	Chapter 3 LBE Analysis	There are a number of issues arising from the approach taken on LBE and DBA analyses. The TICAP team will be working on an optimal approach for the presentation of this information. It’s not clear that splitting the LBE and DBA discussion in two different chapters is the best approach. It’s also not clear that the breakdown among the sections in Chapter 3 (AOOs, DBEs, and BDBEs in turn) is best for LMP.
24.	3.2 Mechanistic Source Term	Please explain what is intended by this stand-alone section for source term. Is this intended to cover both the calculation of radionuclide inventories and the transport of the radionuclides to the accessible environment during LBEs? “Mechanistic” would seem to imply that it is dependent on the phenomena of the event, but this appears to be a “one size fits all” section.
25.	3.3 Frequency-Consequence Criteria	Please explain what is intended here. NEI 18-04 spells out the technology independent F-C criteria associated with LMP.
26.	3.4 Anticipated Operational Occurrences (AOOs)	Editorial comment: It appears that a Section 3.4.6 “Adequacy of plant response to AOOs” may have inadvertently been omitted from the NRC outline.
27.	3.7 Risk Significant Evaluations	Please clarify the expectations for this section. Perhaps it would better belong with the discussion of SSCs (Chapter 4).
28.	3.8 Aircraft Impact Analysis	It is not clear why there is a section for Aircraft Impacts – this is not called out as a special case under LMP. Inadvertent impacts would be addressed as part of the PRA. Is this intended to address 10 CFR 50.150? If so, it might best be addressed in another section.

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29.	Chapter 4 Description and Classification of SSCs	There are different ways that this material can be organized. The approach in the outline is a bit difficult to follow. An alternative approach would be for the initial part of this chapter to describe the classification processes. This chapter could then include a table of classification results using the process. The later parts of this chapter could then include descriptions of SSCs that meet the categories. Rather than organize the SSC description content by classification category, it might be easier to follow to organize by SSC with an emphasis on which SSCs in the system are safety-related (SR), which are non-safety-related with special treatment (NSRST), and what special treatments are established.
30.	4.2 Overview of Primary Safety Functions	Terminology comment: NRC appears to have introduced a new term “primary safety functions” for the “Fundamental Safety Functions” (FSFs) as used in LMP (NEI 18-04 and DG-1353). TICAP would prefer to stick with the FSF terminology.
31.	4.2 Overview of Primary Safety Functions	Discussion of the FSFs at this point does not appear to be optimal. The FSFs are technology- and design-independent and should come first. Other functions (PRA Safety Functions, Required Safety Functions and Safety Significant Functions) derive from the FSFs but are currently introduced earlier, in Chapter 3.
32.	4.3 and 4.4	At what level of detail does NRC anticipate getting information on SR SSCs and NSRST SSCs in the SAR? This could become overwhelming.
33.	4.3.5 Required supporting functions	“Required supporting functions” does not have a defined meaning in 18-04. If the function is necessary for the LBE, it will have the same safety-significance as the front-line functions and will be addressed by the safety case. It is not clear there is value in attempting to identify design-specific supporting functions and addressing them in SAR subsections.
34.	4.5 Non-Safety-Related SSCs with No Special Treatment	We suggest that Section 4.5 is not necessary - systems that have or serve no SR or NSRST functions need not be addressed.
35.	Chapter 5 Design Basis Accidents Analysis (10 CFR 50.34)	Please clarify why 10 CFR 50.34 is in the title of this section.
36.	5.2.2 Event Evaluation	The subsections (5.2.2.1, 5.2.2.2, etc.) may be unnecessarily prescriptive. It might be better to optimize them for the technology and event being addressed.
37.	Chapter 6 Integrated Plant Analysis	As it stands, Chapter 6 is composed of two disparate parts – Quantitative Health Objectives (QHOs) and 10 CFR Part 20. A number of alternatives could be posited. QHOs and risk could be addressed in Chapter 12 (PRA). Defense in depth (Chapter 7) could be discussed in the context of Integrated Plant Analysis, as could aircraft impact. Part 20 cumulative dose could be its own chapter (albeit a small one) or lumped with occupational dose (Chapter 9).

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38.	Chapter 7 Defense-in-Depth	Defense-in-depth (DID) discussion should be focused on processes used to implement DID over the complete lifecycle of the plant. DID is a living program that will evolve through design and operation. Including individual, discrete values for specific SSCs could impose an ongoing, low-value burden on the licensee.
39.	Chapter 7 Defense-in-Depth	It's not clear the SAR is best served by having a stand-alone section on defense-in-depth (DID). It is intimately related to LBEs and SSCs (currently Chapters 3 and 4) and there is the risk of having either a very disjointed discussion or duplication of material, neither of which is desirable.
40.	7.2 Programmatic Defense-in-Depth	Programmatic DID might best be addressed as part of the Reliability Assurance Program (currently 13.4).
41.	7.2.5 Technical Specifications to bound uncertainties	Discussion is needed with the NRC staff to understand the inclusion of this element.
42.	7.2.6 Capabilities for emergency plan protective actions	Such information would more appropriately be included in the Emergency Plan.
43.	Chapter 9 Control of Occupational Dose	Ideally, we would like to see the SAR focused on public health and safety. Occupational dose is not related to public health and safety, and it would be preferable to put such information elsewhere.
44.	Chapter 10 Human Factors Analysis	The need for a separate chapter on human factors is not clear. For some advanced reactor designs human factors may not be a significant part of the safety case. To the extent necessary, human factors can be discussed as part of programmatic DID.
45.	Chapter 11 Physical Security	Physical security should not be addressed in the SAR. It is better addressed in the Physical Security Plan, a separate, non-public document.

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46.	Chapter 12 Overview of the PRA	<p>The PRA is an integral part of the NEI 18-04 methodology. The NRC outline would provide an overview of the PRA toward the end of the SAR for an application using NEI 18-04. Consideration should be given to putting the PRA summary up front in the document, prior to the LBE discussion, rather than at the end.</p> <p>We anticipate that the NRC’s thorough review of the PRA will occur in another context such as a regulatory audit, not through the SAR itself.</p> <p>The PRA section of the SAR should address the technical adequacy of the PRA through conformance to standards. It may be desirable to address QHO risk in this chapter (see Comment 37). The PRA will evolve over the life of the plant as data and operating experience are gathered and the plant configuration changes. It is important to restrict the level of detail provided in the SAR so as not to unnecessarily encumber the change control process.</p>
47.	Chapter 13 Administrative Control Programs	<p>Detail need only be provided for those programs with a nexus to public health and safety, as identified through application of the NEI 18-04 methodology. Moreover, not all elements of every program are appropriate for inclusion in the SAR (e.g., maintenance and training have significant components unrelated to public health and safety).</p>
48.	13.4 Reliability Assurance Program	<p>The Reliability Assurance Program is an essential part of the NEI 18-04 process. It provides the reasonable assurance, through programmatic controls, that key SSCs, operator actions, etc. are maintained with reliability and availability that are consistent with the values used to support the PRA.</p>
49.	13.5 Maintenance Program	<p>Given the requirement in 10 CFR 50.65, it is not clear why this element would be addressed by a combined license applicant only.</p>
50.	13.6 Change control process	<p>The intent of this section is not clear. Would 10 CFR 50.59 not cover change control?</p>
51.	Separate Licensing Documents	<p>Does the NRC consider the list of Separate Licensing Documents a requirement for every application, or a set of examples?</p>
52.	Separate Licensing Documents	<p>Does the NRC intend to flesh out the intent and rationale for all of the documents? Some are fairly straightforward (e.g., Quality Assurance Plan). Others do not have an established precedent or regulatory rationale (e.g., Fuel qualification report).</p>
53.	Technical Requirements Manual	<p>It is not clear this document should be required. The Technical Requirements Manual was created to address Tech Specs relocated as a result of changes to the Tech Spec rule and processes for operating fleets.</p>



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54.	Exemptions, Departures and Variances	Discussion of Departures and Variances is not needed for all combined licenses (COLs). Departures are unique to a Part 52 application that references a Design Certification or standard language of a previously constructed COL. Variances apply only to the situation when an applicant is referencing an ESP and differences need to be evaluated. It is presumed that the NRC intends these to be "as needed."