Vogtle PEmails

From: Haggerty, Neil <X2NHAGGE@SOUTHERNCO.COM>
Sent: Wednesday, April 25, 2018 8:56 PM
To: Habib, Donald
Cc: Patel, Chandu; Hoellman, Jordan; Sparkman, Wesley A.; Redd, Jason P.; Hicks, Thomas E.; Amundson, Theodore Edwin; Aughtman, Amy G.; Haggerty, Neil
Subject: [External_Sender] Draft RAI responses for Thursday, May 3, Public Meeting
Attachments: 2018-05-03_RAI LAR-17-037-2_SEB - DRAFT RAI 9530 response for Public Mtg.pdf; 2018-05-03_RAI LAR-17-037-3_MCB - Draft RAI 9477 response for Public Mtg.pdf

Don,

Attached are draft responses to the following Requests for Additional Information for discussion in the Public Meeting on Thursday, May 3:

- RAI LAR-17-037-2, eRAI 9530, Structural Engineering Branch (SEB) questions regarding "Critical Sections"
- RAI LAR-17-037-3, eRAI 9477, Materials & Chemistry Branch (MCB) questions regarding "Reactor Coolant Pumps"

Please provide these draft responses to the technical staff responsible for your reviews, to allow them sufficient time to familiarize with our responses.

The information provided in these responses do NOT contain Sensitive Unclassified Non-Safeguards Information (SUNSI), and may be released to the Public.

Please contact me or any personnel on cc: for this message if you have any questions regarding this information.

Thank you,
Neil Haggerty

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MESSAGE	1533	4/25/2018 8:56:48 PM
2018-05-03_RAI LAR-17-037-2_SEB - DRAFT RAI 9530 response for Public Mtg.pdf	823875	
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The following is a question provided by the NRC Staff [Request for Additional Information (RAI) LAR 17-037-2] regarding the review of Southern Nuclear Operating Company (SNC) License Amendment Request (LAR) 17-037, which was submitted by SNC letter ND-17-1726 on December 21, 2017 [ADAMS Accession No. ML17355A416].

Question

The final safety analysis report of the Vogtle Electric Generating Plant (VEGP) Units 3 and 4 references the Westinghouse AP1000 certified design. Appendix D to 10 CFR Part 52, "Design Certification Rule for the AP1000 Design," provides the regulatory requirements for the AP1000 design. 10 CFR Part 52, Appendix D, Section VIII.B.6.c provides a list of Tier 2* matters, including a design summary of critical sections, that a licensee who references this appendix may not depart from without NRC approval. Furthermore, SECY-17-0075, "Planned Improvements in Design Certification Tiered Information Designations," described the staff's approach to using the Tier 2* designation for safety significant information. The SECY noted that if Tier 2* were to be eliminated, certain safety-significant information currently in Tier 2* should be included in Tier 1 rather than in Tier 2. The staff considers that a "critical section" has attributes that make it safety significant in maintaining the integrity of the plant structure. The designed capacity of the "critical sections" support the reasonable assurance of safety determination for the AP1000 DCD, Rev.19 design in the staff safety evaluation.

The staff reviewed the LAR and noted that the criteria for screening Tier 2* information pertaining to "critical sections" is not well defined.

In Enclosure 3, "Proposed Changes to Licensing Basis Documents," of the LAR, the licensee proposed to revise its combined license (COL) to include a new license condition to address the Tier 2* change process. The licensee included a new license condition, proposed License Condition 13, "Departures from Plant-Specific DCD Tier 2* Information." The proposed license condition states that the licensee

> . . . is exempt from the requirements of 10 CFR Part 52, Appendix D, Paragraphs II.F and VIII.B.6 that invoke the Tier 2* change process that requires prior NRC approval via a license amendment for departures from Tier 2* information; and Paragraph VIII.B.5.a for Tier 2 information that involves a change to, or departure from, Tier 2* information; except for departures from Tier 2* information that:
>
> 1. Involve design methodology or construction materials that deviate from a code or standard credited in the plant-specific DCD for establishing the criteria for the design or construction of a structure, system, or component (SSC) important to safety."

The proposed license condition is not clear as to how the critical sections associated with the steel-concrete (SC) modular construction would be screened using the above

criteria because information from analysis and tests were used in conjunction with codes and standards for the design of SC modules. As approved in the certified design, linear analysis, nonlinear analysis, and testing of the SC module design were performed and the results were compared to provisions of two different codes in order to validate the use of the codes.

The staff considers that the critical sections have safety significance in assuring the integrity of the building which house safety related systems and components. The proposed Criterion 1 relies on code compliance in the design and detailing of the critical sections to screen out details that are code controlled. The application of this criteria may lead the applicant to conclude that the parameters of the critical sections can be modified in the field using available NRC change processes without resorting to the license amendment process. The staff finds instances where the application of this criterion will not yield the desired results. The staff has identified the following cases as exceptions to the Criterion 1:

- Critical sections using steel concrete sandwich construction, and
- the capacity aspects such as area of steel provided or the demand to capacity ratio of critical sections using reinforced concrete

In both cases, the staff has determined that neither the design nor the cited attributes of the critical sections are code defined, making Criterion 1 in-applicable in these instances. The staff requests the applicant to revise the Criterion 1 such that the conditions identified above are screened in and a license amendment process followed for any changes to these cases, or that the applicant provide additional explanation as to why the proposed criteria would not need to be revised in order to maintain a reasonable assurance of safety.

SNC Response to RAI Question 1

Tier 2* information is intended to have substantial safety significance, commensurate with information designated as Tier 1. As noted in SECY-17-0075, "Planned Improvements in Design Certification Tiered Information Designations," [ADAMS Accession Number ML16196A321], the Tier 2* scope identified in previous design certifications, such as AP1000, may be broader than necessary, and includes information more appropriately designated as Tier 2. SNC proposes to invoke a process whereby VEGP 3 and 4 Tier 2* departures would be submitted to the NRC for prior approval when the safety level rose to that which is commensurate with the safety level of Tier 1 information.

While Updated Final Safety Analysis Report (UFSAR) Appendix 3H, *Auxiliary and Shield Building Critical Sections*, contains significant critical section detailed design, including detailed figures of critical sections, the majority of the AP1000 structural design requirements are derived from applicable codes. SNC acknowledges that for the shield building design nonlinear analysis and testing were performed to validate the use of applicable codes. The performance of these activities, however, does not invalidate SNC's position that the design of the shield building and other critical sections is based in large part on meeting applicable industry codes. Hence, the

proposed evaluation Criterion 1, which requires prior NRC approval for any Tier 2* text, table and figure change that deviates from these codes, combined with the 10 CFR Part 52, Appendix D, Section VIII.B.5.b evaluation criteria, does provide a reasonable assurance of safety.

Nevertheless, SNC has identified enhancements to Criterion 1 that expand the scope of this Criterion to include requirements described in the UFSAR that supplement code requirements for critical sections (discussed below).

In addressing the staff's question, this response is divided into three areas: reinforced concreted (RC) design; concrete-filled steel plate construction (SC) module design; and shield building design.

RC Design

Design requirements for RC structures are governed by accepted industry codes as described in the following UFSAR subsections:

- UFSAR Subsection 3H.3.1, *Governing Codes and Standards*, describes the primary codes and standards used in the design of the auxiliary and shield buildings: American Concrete Institute (ACI) standard ACI 349-01, "Code Requirements for Nuclear Safety Related Concrete Structures" (and Subsection 3.8.4.5 for supplementary requirements and Subsection 3.8.4.4.1 for alternative requirements); American National Standards Institute (ANSI) / American Institute of Steel Construction (AISC) standard ANSI/AISC N690-1994, "Specification for the Design, Fabrication and Erection of Safety-Related Steel Structures for Nuclear Facilities" (and Subsection 3.8.4.5 for supplemental requirements); American Welding Society (AWS), Structural Welding Code - Steel, AWS D1.1-2000 (provides an acceptable alternative for AISC N690 weld requirements as described in Subsections 3.8.3.2 and 3.8.4.2).
- UFSAR Subsection 3H.5.1, *Shear Walls*, states that the wall sections are designed in accordance with the requirements of ACI 349-01.
- UFSAR Subsection 3H.5.2, *Composite Structures (Floors and Roof)*, states that the designs of the floors are in conformance with AISC N690 and ACI 349. This section also requires that the reinforcement size and spacing are based on loads and spans for this type of floor and are determined at each location based on the requirements in ACI 349 and ACI 318-11. The slab concrete and the reinforcement is designed to meet the requirements of ACI 349-01.
- UFSAR Subsection 3H.5.3, *Reinforced Concrete Slabs*, states that the design of these floors is in conformance with AISC N690 and ACI 349. The reinforcement size and spacing are determined for each location, based on specific loads and spans, and satisfy the requirements in ACI 349 and ACI 318-11. The precast panels are connected to the concrete placed above them by shear reinforcement which satisfies the requirements of ACI 349.
- UFSAR Subsection 3H.5.4, *Concrete Finned Floors*, states that the finned floors are designed as reinforced concrete slabs in accordance with ACI 349. Composite section properties, based on an all steel-transformed section, as detailed in Section Q1.11 of ANSI/AISC N690-94 are used to design the weld strength between stiffener and the steel plate and the spacing of the shear studs for the composite action. The plate is designed against the criteria for bending and shear, specified in ANSI/AISC N690-94.

These codes provide requirements for, in part, capacity aspects such as the demand-to-capacity ratio of walls and floors using reinforced concrete. Hence, no new evaluation Criterion is considered necessary to address demand-to-capacity ratios for RC structures. However, SNC acknowledges that the UFSAR describes requirements for the design of critical sections that supplement the code requirements in some areas, as follows:

- UFSAR Subsection 3.8.4.5.1, provides supplemental requirements for concrete structures beyond ACI 349.

Therefore, proposed evaluation Criterion 1 will be revised to add a requirement that prior NRC staff review is needed to deviate from these supplemental requirements in addition to the existing Criterion 1 topic of code provisions.

SC (Sandwich) Design

Design requirements for SC module design are primarily governed by accepted industry codes as described in the following UFSAR subsections:

- UFSAR Subsection 3.8.3.5.3, *Structural Wall Modules*, states that structural modules without concrete fill, such as the west wall of the in-containment refueling water storage tank, are designed as steel structures, according to the requirements of AISC N690. Concrete-filled structural wall modules are designed as reinforced concrete structures in accordance with the requirements of ACI 349 and other code requirements as detailed in this UFSAR subsection. The reinforcing steel used to anchor the modules to the concrete has a development that satisfies the requirements of ACI 349.
- UFSAR Subsection 3H.3.1, Governing Codes and Standards, describes the primary codes and standards used in the design of the auxiliary and shield buildings: ACI 349-01, "Code Requirements for Nuclear Safety Related Concrete Structures" (and Subsection 3.8.4.5 for supplementary requirements and Subsection 3.8.4.4.1 for alternative requirements); ANSI/AISC N690-1994, "Specification for the Design, Fabrication and Erection of Safety-Related Steel Structures for Nuclear Facilities" (and Subsection 3.8.4.5 for supplemental requirements); American Welding Society (AWS), Structural Welding Code - Steel, AWS D1.1-2000 (provides an acceptable alternative for AISC N690 weld requirements as described in Subsections 3.8.3.2 and 3.8.4.2).
- UFSAR Subsection 3H.5.5, *Structural Modules*, states that the design methodology of these modules in the auxiliary building is similar to the design of the structural modules in the containment internal structures described in Subsection 3.8.3.5.3. These modules include the spent fuel pool, fuel transfer canal, and cask loading and cask washdown pits.
    - UFSAR Subsection 3H.5.5.1, *West Wall of Spent Fuel Pool*, states that the concrete filled structural wall modules are designed as reinforced concrete structures in accordance with the requirements of ACI 349. The face plates are treated as reinforcing steel.

These codes provide a comprehensive set of requirements for SC structures. However, SNC acknowledges that the UFSAR describes requirements for the design of SC modules that supplement the code requirements in some areas, as follows:

- UFSAR Subsection 3.8.4.5.2, provides supplemental requirements for steel structures beyond AISC N690.

- UFSAR Subsection 3H.3.4, provides supplemental requirements to AISC N690 for load combinations and stress limit coefficients.

Therefore, proposed evaluation Criterion 1 will be revised to add a requirement that prior NRC staff review is needed to deviate from these supplemental requirements in addition to the existing Criterion 1 topic of code provisions.

Shield Building Design

The shield building uses SC as well as RC construction. As described in the UFSAR, Subsection 3.8.4.1.1, *Shield Building*, and Appendix 3H the design of much of the shield building is based on compliance to codes. This point is stated in NUREG-1793, *Final Safety Evaluation Related to Certification of the AP1000 Standard Design," Supplement 2*, Subsection 3.8.4.1.1.3.1, *Design Methodology and Process for Shield Building Design*, [ADAMS Accession No. ML112061231] which states:

> "…the concrete design of the following areas of the AP1000 shield building falls directly within the scope of ACI 349:
>
> - shield building roof
> - knuckle region of the roof near the PCCWST wall
> - compression ring
> - PCCWST
>
> The applicant designed these areas in accordance with the provisions in the established design codes by using linear elastic analysis methods. Specifically, the design for the sections in these areas is based on compliance with the ACI 349 Code, as supplemented with guidance in NRC Regulatory Guide (RG) 1.142 for concrete structures. The design of the sections in these areas, which uses established design codes and analysis methods listed in Section 3.8.4 of NUREG-0800, satisfies the regulatory basis listed above and is, therefore, acceptable to the staff….
>
> …The applicant's integrated design process also makes use of the design process for structural steel components in certain areas of the shield building. Specifically, it uses ANSI/AISC N690 in designing structural steel components of seismic Category I structures. The applicant used ANSI/AISC N690 in designing the following areas of the shield building:
>
> - the steel roof that supports the concrete roof slab
> - tension ring
> - SC/RC connection
>
> The design process uses provisions from two different design codes: ACI 349 Code for RC components, which uses an ultimate strength design approach and ANSI/AISC N690 Standard for steel and composite components, which uses an allowable stress design approach."

The proposed evaluation Criterion 1, which addresses deviations from codes, does provide sufficient restrictions (i.e., obtain prior NRC staff approval) on shield building design changes involving these above areas when the change deviates from these codes.

However, SNC acknowledges that ACI 349 and ANSI/AISC N690 are not exclusively applicable to the shield building SC wall modules, including connections to RC. For example, there is significant design requirement information beyond code requirements in UFSAR Subsection 3.8.7, Reference 57, *APP-GW-GLR-602, Revision 5 (Proprietary) and APP-GW-GLR-603, Revision 5 (Non-Proprietary), "AP1000 Shield Building Design Details for Select Wall and RC/SC Connections*" [ADAMS Accession No. ML110910541]. Furthermore, there are additional UFSAR sections that provide supplemental design requirements beyond code requirements that SNC acknowledges are important to the design of the shield building. For example, UFSAR Subsection 3.8.4.5.5, *Shield Building Structural Wall Modules*, states that design requirements for shield building concrete-filled structural wall modules are addressed in UFSAR referenced codes and supplemental requirements not addressed in codes:

> "*[Concrete-filled structural wall modules are designed as reinforced concrete structures in accordance with the requirements of ACI 349, and supplemented with additional requirements discussed in subsection 3.8.3.5.3 and below…]**

[Note that UFSAR Subsection 3.8.3.5.3 is Tier 2 text.] Within UFSAR Subsection 3.8.4.5.5, supplemental Tier 2* design requirements for the shield building are addressed in Subsection 3.8.4.5.5.5, *Design of Shear Studs and Tie Bars*.

By including these additional shield building requirements within the scope of proposed evaluation Criterion 1, combined with the 10 CFR Part 52, Appendix D, Section VIII.B.5.b evaluation criteria, the new evaluation process will provide a reasonable assurance of safety.

Proposed Change to New Evaluation Criterion 1

To address the concerns addressed by the NRC staff in the question, SNC agrees to broaden the scope of proposed evaluation Criterion 1 to address additional requirements. Proposed Criterion 1 is revised to address RC design, SC module design, and shield building design as follows:

1. Involve design methodology or construction materials that deviate from a code or standard credited in the plant-specific DCD for establishing the criteria for the design or construction of a structure, system, or component (SSC) important to safety, deviate from the design methodology described in UFSAR Subsection 3.8.7, Reference 57, or deviate from the supplemental design requirements described in UFSAR Subsections 3.8.4.5.1, 3.8.4.5.2, 3.8.4.5.5.5, or 3H.3.4.

Request for Additional Information LAR 17-037-3

Issue Date: 04/12/2018
Application Title: Vogtle Nuclear Site, Units 3 and 4, LAR 17-037
Operating Company: Southern Nuclear Operating Co.
Docket No. 52-0025 and 52-0026
Review/Application Section: Not Applicable

By letter dated December 21, 2017, Southern Nuclear Operating Company, Inc. (SNC), submitted License Amendment Request (LAR) No. 17-037 to the U. S. Nuclear Regulatory Commission (NRC) for Vogtle Electric Generating Plant Units 3 and 4, Combined License Nos. NPF-91 and NPF-92 (ADAMS Accession No. ML17355A416). The LAR requests NRC approval of a proposed license condition that would allow departures from Tier 2* information without a license amendment by allowing the licensee to evaluate a prospective departure against criteria stated in the proposed license condition.

Enclosure (5) of the referenced LAR provides a summary of an analysis of Tier 2* matters using the proposed license condition (screening criteria) presented in enclosure (3) of your letter dated December 21, 2017. For "Section VIII.B.6.b (Tier 2* Matters that Do Not Expire at Full Power)," Item 5, the enclosure states that the reactor coolant pump type is adequately addressed in Tier 1, and therefore no additional screening criteria is required. Also, note that since the enclosure only states that it is adequately addressed by Tier 1, paragraph VIII.B.5 would not be needed since a change in Tier 1 information requires NRC approval. Therefore, per the enclosure, no additional screening criteria is needed since the information is in Tier 1. The NRC staff notes that the analysis provided in Enclosure (5) of the SNC submittal is not correct, since Tier 1 does not specify the type of RCP; but only specifies "sealless reactor coolant pumps." "Sealless reactor coolant pumps" is a generic term that only states that the pump does not have seals, which makes seal failure not a concern. Using the proposed license condition, a different sealless pump type could be used because the pump still meets the "sealless" (shaft seal failure) requirement that is specified as Tier 1. The Tier 2* information is "canned motor type RCP," which is not addressed in Tier 1. Therefore, Enclosure (5) is not correct since Tier 1 does not adequately address all the essential attributes of the type of pump (i.e., canned motor, wet winding, etc.). However, the essential attributes of the type of pump are included as Tier 2* information which states "centrifugal sealless pump of canned motor design".

Therefore, since all of the essential attributes of the RCP (i.e., that it be of a canned motor design) are not addressed in Tier 1, the staff requests that the licensee revise the proposed License Condition 2.d (13)(a) in Enclosure (3) to address this essential attribute by adding the following, or explain why it is not necessary:

"5. Results in a change to the RCP type (canned motor design)."

SNC Response to RAI Question LAR 17-037-3

As discussed in Section 3 of Enclosure 1 of this LAR, SNC evaluated existing Tier 2* material for safety significance. Tier 2* material that was deemed to be of safety significance not warranted to be included in Tier 1 was not selected for development of a non-qualifying criteria. With regard to Reactor Coolant Pumps (RCPs), SNC reviewed relative information regarding the safety significant attributes of the RCP design. Information reviewed included Vogtle Electric Generating Plant (VEGP) licensing documents including the VEGP 3 and 4 Tier 1 Plant-Specific Design Control Document and the VEGP 3 and 4

Updated Final Safety Analysis Report (UFSAR) which contains the plant-specific Tier 2 Design Control Document (DCD). Also reviewed were Final Safety Evaluation Reports for the AP1000 and VEGP 3 and 4. Finally, transcripts and letters from the Advisory Committee on Reactor Safeguards (ACRS) were reviewed. Based on these reviews, SNC determined that the principal safety feature of the RCP design is the sealless feature. As a result, this design feature is captured in Tier 1 information. In addition, Tier 1 information identifies RCP safety-related safety functions as 1) rotating inertia to provide Reactor Coolant System (RCS) flow coastdown on loss of power to the pumps and 2) that each RCP flywheel assembly can withstand a design overspeed condition. Details of these key safety design features including the flywheel, the flywheel retaining ring, and the flywheel enclosure which acts as a missile barrier, are described in Tier 2 information of the UFSAR. The SNC review did not identify the canned motor design feature as being a principal safety design feature. Thus, the existing Tier 2* material regarding the canned motor feature was not selected for the development of a non-qualifying criterion.

SNC also reviewed what the impact of a potential change to Tier 2* information would be with regard to existing change processes and regulations. Should a fundamental change in the RCP be proposed that would involve the change from a canned motor design, the change would be evaluated against the criteria of 10 CFR Part 52, Appendix D, paragraph VIII.B.5. This evaluation would address impacts to the Chapter 15 safety analyses. SNC concluded that a postulated change to use a RCP other than a canned motor design would most likely result in a conclusion that prior NRC approval would be required for the change.

Therefore, SNC concludes that no new evaluation Criterion for License Condition 2.d (13)(a) is necessary to address the canned-motor feature of the RCP.

Based on the above discussion, change the RCP entry for Enclosure 5 of the original LAR-17-037to read:

5	Reactor coolant pump type.	No	Adequately addressed in Tier 1 and paragraph VIII.B.5	N/A