Southern Nuclear
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SOUTHERN NUCLEAR
A SOUTHERN COMPANY

October 20, 2016

Docket Nos.: 52-025 ND-16-2014
52-026 10 CFR 50.90
10 CFR 52.98

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Southern Nuclear Operating Company
Vogtle Electric Generating Plant Units 3 and 4
Supplement to Revised Request for License Amendment:
Containment Internal Floor Module Connections (LAR-15-012 R1S)

Ladies and Gentlemen:

Pursuant to 10 CFR 52.98(c) and in accordance with 10 CFR 50.90, Southern Nuclear Operating Company (SNC) requests an amendment to the combined licenses (COLs) for Vogtle Electric Generating Plant (VEGP) Units 3 and 4 (License Numbers NPF-91 and NPF-92, respectively). The requested amendment proposes to depart from approved AP1000 Design Control Document (DCD) Tier 2* and associated Tier 2 information in the Updated Final Safety Analysis Report (UFSAR) (which includes the plant-specific DCD Tier 2 information).

SNC originally submitted this request by SNC letter ND-16-0319, dated March 11, 2016 [ML16071A404]. The request was revised to address discussions with the Nuclear Regulatory Commission (NRC) Staff held on March 31, 2016. The submittal was revised by SNC letter ND-16-0831, dated July 12, 2016 [ML16196A099] and was subsequently accepted for review. The NRC Staff provided comments on the revised submittal during a public telephone conference on August 11, 2016. This supplement to Revision 1 addresses the comments from the NRC Staff in Enclosures 3 and 4.

The requested amendment proposes to depart from UFSAR text and figures that describe the connections between floor modules and structural wall modules in the containment internal structures. Enclosures 1 and 2 of Revision 1 are not affected except as noted in Enclosure 3. The revisions identified in Enclosure 3 are minor and do not affect the regulatory evaluation (including the revised Significant Hazards Consideration Determination) and environmental considerations for the proposed changes.

Enclosure 4 provides a figure referenced in Enclosure 3 which contains information identified as security-related, also referred to as sensitive unclassified non-safeguards information (SUNSI). Therefore, Enclosure 4 is requested to be withheld from public disclosure under the provisions of 10 CFR 2.390(d).

This letter contains no regulatory commitments.

A preliminary amendment request (PAR) is also being prepared seeking a no objections finding for work that is expected to be ready to proceed prior to the requested approval date identified below. A "no objection" finding for this PAR is currently expected to be needed by December 7, 2016 to support placing floor modules at approximate design elevation of 105'-2".

SNC requests NRC staff approval of the license amendment by January 11, 2017 to support the first activity affected by this request (following the work which will be the subject of the above mentioned PAR) which is placing concrete at approximate design elevation of 107'-2". Delayed approval of this license amendment could result in a delay of further construction of steel floor modules above the 107'-2" elevation and subsequent dependent construction activities. SNC expects to implement the proposed amendment (through incorporation into the licensing basis documents, e.g., the UFSAR) within 30 days of approval of the requested changes. South Carolina Electric and Gas has recently indicated that the requested approval date for the VC Summer Units 2 and 3 license amendment request for this topic is February 10, 2017.

In accordance with 10 CFR 50.91, SNC is notifying the State of Georgia of this LAR Supplement by transmitting a copy of this letter and enclosures to the designated State Official.

Should you have any questions, please contact Ms. Paige Ridgway at (205) 992-7516.

Mr. Wesley A. Sparkman states that: he is the Regulatory Affairs Licensing Manager, Nuclear Development, of Southern Nuclear Operating Company; he is authorized to execute this oath on behalf of Southern Nuclear Operating Company; and to the best of his knowledge and belief, the facts set forth in this letter are true.

LISA MYRICK SPEARS MY COMMISSION EXPIRES June 18, 2019 NOTARY PUBLIC STATE OF ALABAMA

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

Wesley A. Sparkman

WAS/ERG/ljs

Sworn to and subscribed before me this 20th *day of* October*, 2016*

Notary Public: Lisa Myrick Spears

My commission expires: June 18, 2019

Enclosures:

1) Provided with LAR-15-012 R1

2) Provided with LAR-15-012 R1

3) Supplement to Revised Request for License Amendment: Containment Internal Floor Module Connections, Responses to NRC Staff Comments (Publicly Available Information) (LAR-15-012 R1S)

4) Supplement to Revised Request for License Amendment: Containment Internal Floor Module Connections, Responses to NRC Staff Comments **(Withheld Information)** (LAR-15-012 R1S)

cc:
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Southern Nuclear Operating Company

ND-16-2014

Enclosure 3

Vogtle Electric Generating Plant (VEGP) Units 3 and 4

Supplement to Revised Request for License Amendment:

Containment Internal Floor Module Connections,

Responses to NRC Staff Comments

(Publicly Available Information)

(LAR-15-012 R1S)

(This Enclosure consists of 8 pages, including this cover page.)

Revision 1 of LAR-15-012 (SNC LAR-15-012R1) revises design details for the construction of floor modules and connections between floor modules and structural wall modules in the containment internal structures (CIS). During discussions with the NRC Staff on August 11, 2016, the NRC Staff requested that the licensee provide additional information.

The requested information and the responses are provided below.

Request No. 1

Provide a table to demonstrate the demand to capacity ratio of the connection at various sample locations, including locations where the top of the wall is at the same elevation as the top of the floor.

Response to Request No. 1

The CA37 structural module floor has been selected as representative of SNC LAR 15-012R1 because it is one of the most heavily loaded floors. Two representative connections have been selected: 1) the connection with the CA01 module wall and 2) the connection with the CIS basemat. The latter corresponds to a case in which the top of concrete of the floor coincides with the top of the connecting wall. Supporting information, including the demand-to-capacity ratios, are provided below.

Supporting Information

The CA37 structural module floor has been selected as representative of SNC LAR-15-012R1 because it is one of the most heavily loaded floors.

Figure 1 shows a plan view of the CA37 module floor and its boundaries. Figure 1 was obtained from UFSAR Figure 3.8.3-1 (Sheet 4 of 7) and additional information has been added using red markings.

Two representative connections have been selected: the connection with the CA01 module wall (see Figure 1, Detail 1) and the connection with the CIS basemat (see Figure 1, Detail 2). The latter corresponds to a case in which the top of concrete of the floor coincides with the top of the connecting wall.

This UFSAR figure contains security-related information and is provided in Enclosure 4.

Figure 1: Plan View of CA37 Floor

Example of evaluation for the CA37 module floor-to-CA01 wall connection (Detail 1)

Figure 2 (revised UFSAR Figure 3.8.3-17 (Sheet 1 of 2) as proposed in SNC LAR-15-012R1 and shown below) shows the configuration of the CA37 module floor-to-CA01 wall connection (Area 4 in Containment, top of floor elevation 107'-2"). This connection is composed primarily of encased steel beams that are welded to continuous stiffened angle beam seats. The seats are continuously welded to the CA01 module wall faceplate. Additionally, there are top and bottom dowels that connect the CA37 floor to the CA01 wall. At some locations where the encased beams are heavier to carry heavier loads, such as the Core Makeup Tank, there are heavy beam seats instead of the continuous stiffened angle. These heavy beam seats are referred to as beam pedestals.

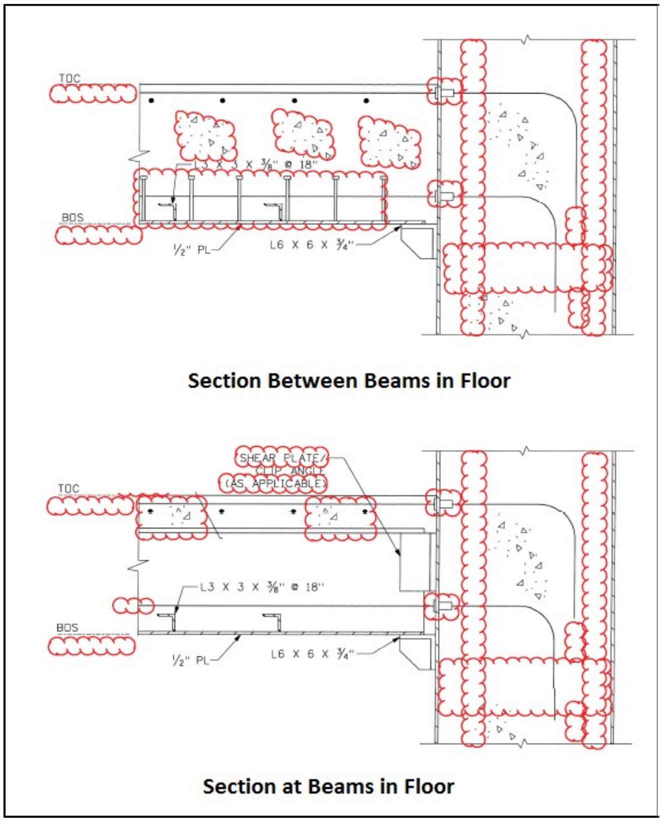

Figure 2: Elevation View of CA37 Floor to CA01 Wall Connection

Table 1 describes the interaction ratios for the CA37 module floor to CA01 module wall connection (Area 4 in Containment, top of floor elevation 107'-2").

Table 1: CA37 Module Floor to CA01 Module Wall Connection Design Interaction Ratios (IR)

Item	Structural Item	Demand	Capacity	IR	Governing failure mode
1	Top dowel	1.32 in^2/ft	2.00 in^2/ft	0.66	Maximum 0.3% concrete compressive strain in bending per ACI 349 requirements.
2	Bottom dowel	1.96 in^2/ft	2.00 in^2/ft	0.98	Maximum 0.3% concrete compressive strain in bending per ACI 349 requirements, determined conservatively neglecting the contribution of the encased beams, the floor bottom plate and the weld to the floor seat.
3	Continuous Stiffened Beam Seat	4.94 kip/in	5.57 kip/in	0.89	Weld connecting floor bottom plate to continuous angle seat, determined conservatively neglecting the contribution of the bottom dowels.
4	Beam Pedestals	12.6 kip/in	50.4 kip/in	0.25	Weld connecting beam to beam pedestal.

Table 1 displays the reinforcement required (see items 1 & 2 in the table) in square inches per linear foot to withstand the demand forces due to axial, bending, & twisting loads from the ANSYS finite element analysis model while neglecting the contribution of the beam seats. The capacity is presented as the available square inches of steel per linear foot.

Table 1 also displays the continuous stiffened angle floor seat (see item 3 in the table) “demand” due to tension (axial, bending, & twisting moment), in-plane shear, and out-of-plane shear loads from the ANSYS finite element analysis model, along with locked-in stress imparted to the seats during concrete placement. The forces applied at the stiffened seat for the evaluation are conservatively based on the largest demand obtained from the analysis model at the CA37 floor to wall connection, while neglecting the contribution of the bottom dowels. The continuous stiffened beam seats are demonstrated to meet the design requirements.

Finally, Table 1 also displays the beam pedestal (see item 4 in the table) “demand” due to in-plane shear and out-of-plane shear loads from the ANSYS finite element analysis model. The beam pedestals are analyzed in a similar fashion as the continuous stiffened angle beam seats with the exception that they see larger loads due to the Core Makeup Tank being supported on this area of the floor.

Example of an evaluation for a CA37 module floor to CIS Basemat connection (Detail 2)

The location of the CA37 module floor to CIS basemat connection is marked as Detail 2 in Figure 1. This corresponds to a case in which the top of concrete of the floor coincides with the top of the connecting wall. This connection is composed of encased steel beams in the CA37 floor that are welded to embedment plates that transmit loads into the CIS basemat in combination with top and bottom dowels that connect the CA37 floor to the CIS basemat.

Table 2 shows the interaction ratios for the CA37 module floor to CIS basemat connection (Area 4 in Containment, top of floor elevation 107'-2").

Table 2: CA37 Module Floor to CIS Basemat Connection Design Interaction Ratios (IR)

Item	Structural Item	Demand	Capacity	IR	Governing failure mode
1	Top dowel	0.92 in^2/ft	1.56 in^2/ft	0.59	Maximum 0.3% concrete compressive strain in bending per ACI 349 requirements.
2	Bottom dowel	1.50 in^2/ft	1.56 in^2/ft	0.96	Maximum 0.3% concrete compressive strain in bending per ACI 349 requirements, determined conservatively neglecting the contribution of the encased beams, the floor bottom plate and the weld to the embedment plates.
3	Shear friction at floor to wall boundary	2.16 in^2/ft	2.77 in^2/ft	0.78	Shear friction failure mode per ACI 349 requirements, determined conservatively assuming a shear friction failure plane at the floor to wall boundary, even though there are no construction joints, it is a monolithic concrete placement.
4	Embedment plate	265 kip	270 kip	0.98	Embedment shear failure, determined conservatively using the shear capacity of the beam as demand.

Table 2 displays the reinforcement demand (see items 1, 2 & 3 in the table) in square inches per linear foot for demand forces due to axial, bending, & twisting loads from the ANSYS finite element analysis model. The capacity is taken as the available square inches of steel per linear foot. The reinforcement at the module floor to CIS basemat connection is also conservatively qualified to accept the in-plane and out-of-plane shear forces through shear friction, while neglecting the contribution of the encased beams.

Table 2 also displays the controlling design ratio for the connection of the encased steel beams, which are welded to embedment plates to transmit their load into the CIS basemat (see item 4 in the table). The encased beams, the embedment plates, and the welds at the module floor-to-CIS basemat connection are conservatively qualified to the full demand while neglecting the contribution of the dowels.

Request No. 2

Provide an engineering representation of “direct load path” (the format of the representation can be descriptive wording or a figure or combination of text and illustration).

Response to Request No. 2

The direct load path at the floor-to-module wall connections is achieved through the following structural features: the floor bottom plate is welded to the continuous floor seat, clip angles and shear plates connect the webs of the encased beams to the module wall faceplate, and the top and bottom dowels are anchored into the wall and into the floor.

Request No. 3

Provide a brief description of the methodology of "fully fixed" connection design.

Response to Request No. 3

The floors are evaluated as “fully fixed” because the connection has the capability to resist negative bending moments, in which the top reinforcement is in tension and the concrete in the lower portion of the section is in compression. In addition, the encased beams are evaluated as simply supported for downward loading assuming composite action and for upward loading considering only the steel while ignoring the contribution of the concrete.

Request No. 4

Provide a brief description of the types of mechanical couplers being used and the requirements for these mechanical couplers.

Response to Request No. 4

A brief description of the types of mechanical couplers being used and the requirements for these mechanical couplers is provided below:

> A typical mechanical connection between two reinforcing bars to create a tension splice is made with a taper-threaded coupler (e.g., as described in ACI 439.3R-05 Section 3.3.13). These are often referred to as “form savers” at the mechanical connection of reinforcing bars at a floor-to-wall connection as they eliminate protruding dowel bars at the construction joint. Mechanical connectors are used to splice ASTM A706 and A615 reinforcing bar. The mechanical connectors used are mechanical splices that develop at least 125 percent of the specified yield strength of the spliced bar.

Request No. 5

Provide a corrected Note 4 for UFSAR Figure 3.8.3-3. Note 4 is currently showing an extra period (AWS D.1.1 vs AWS D1.1) in the code listing.

Response to Request No. 5

Note 4 for revised UFSAR Figure 3.8.3-3 is revised to correct the identified reference to the AWS code as shown in the markups below (see page 8 of 8).

Request No. 6

Provide references to identify where shear stud information for internal containment floors is specified in the UFSAR. If it is not defined in the UFSAR, consider whether it is necessary to add one.

Response to Request No. 6

Shear stud information for internal containment floors is currently not specified in the UFSAR.

In the internal containment module floors, the encased beams provide the primary composite action mechanism. The shear studs welded on the top of the floor bottom plate supplement the natural bottom plate-to-concrete bond capability, but are not necessary and are not credited to demonstrate composite action. The shear stud size and spacing is determined based on the stud size and spacing methodology used in the module wall. Also, the capacity of studs required for a local effect, such as loading from an attachment, is determined in accordance with ACI 349.

UFSAR Subsection 3.8.3.1.4 and Subsection 3.8.3.5.4 are proposed to be revised to include shear studs information as identified below and shown in the markups below (see page 8 of 8).

Proposed Revisions to the Licensing Basis Proposed Changes

REVISED
UFSAR Subsection 3.8.3.1.4, Structural Floor Modules - Revise information in the first paragraph to include additional information in the location shown below.

… The ~~107′-2″~~ floor~~s~~ modules consist of shear studs, steel tee, ~~and~~ wide flange, and channel sections, welded to horizontal steel bottom plates stiffened by transverse stiffeners. Shear studs are welded on the top of the floor bottom plate. After erection, concrete is placed….

NEW
UFSAR Subsection 3.8.3.5.4, Structural Floor Modules - Revise information in the first and second paragraphs to include additional information in the location shown below.

Figure 3.8.3-3 shows the design details for a representative example of the floor modules. The details shown in Figure 3.8.3-3 are the representative design for a specific portion of the operating deck floor in containment. The size, material, and configuration of the structural shapes and plates, the amount and arrangement of the reinforcement, the location of the shear studs welded on the top of the floor bottom plate, and the type and size of the welds may vary in the final design of floor modules in this and other locations. The operating floor is designed for dead, live, thermal, safe shutdown earthquake, and pressure due to automatic depressurization system operation or due to postulated pipe break loads. The operating floor region above the in-containment refueling water storage tank is a series of structural modules. The remaining floor is designed as a composite structure of concrete slab and steel beams in accordance with AISC-N690.

For vertical downward loads, the floor modules are designed as a composite section, according to the requirements of Section Q1.11 of AISC-N690. Composite action of the steel section and concrete fill is assumed based on meeting the intent of Section Q1.11.1 for beams totally encased in concrete. Although the bottom flange of the steel section is not encased within concrete, the design configuration of the floor module provides complete concrete confinement to prevent spalling. It also provides a better natural bonding than the code-required configuration. The shear studs welded on the top of the floor bottom plate supplement the natural bottom plate-to-concrete bond capability. The shear stud size and spacing is not directly credited in the composite section design. The capacity of the studs whenever required is determined based in accordance with ACI 349.

REVISED
UFSAR Section 3.8, Figure 3.8.3-3, Structural Floor Module - Revise the Note 4 information for the structural floor module as shown below (The rest of the figure is as shown in LAR 2015-012 R1).

4. THE WELD SIZE AND CONFIGURATION SATISFY THE REQUIREMENTS OF AWS D1.1.

Southern Nuclear Operating Company

ND-16-2014

Enclosure 4

Vogtle Electric Generating Plant (VEGP) Units 3 and 4

Supplement to Revised Request for License Amendment:

Containment Internal Floor Module Connections,

Responses to NRC Staff Comments

(Withheld Information)

(LAR-15-012 R1S)

This Enclosure contains security-related information that is requested to be withheld from public disclosure under 10 CFR 2.390(d).

(This Enclosure consists of 2 pages, including this cover page.)