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SOUTHERN NUCLEAR
A SOUTHERN COMPANY

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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 Request for License Amendment:
Wall 11 Changes (LAR-15-021S1)

Ladies and Gentlemen:

Pursuant to 10 CFR 52.98(c) and in accordance with 10 CFR 50.90, Southern Nuclear Operating Company (SNC) requested 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) by SNC letter ND-15-2263, dated December 22, 2015. The license amendment request proposes to depart from approved AP1000 Design Control Document (DCD) Tier 2 information (text, tables, and figures) and involves Tier 2* information (as incorporated into the Updated Final Safety Analysis Report (UFSAR) as plant-specific DCD information), and also involves a change to a license condition.

Following the December 22, 2015, submittal, the Nuclear Regulatory Commission (NRC) staff identified a set of questions. The questions were discussed with the NRC in two public meetings on January 22 and February 25, 2016.

This supplement to the amendment request provides a voluntary response to the NRC questions discussed in the above mentioned public meetings. For consistency with the changes provided in this supplement, the title of the LAR was revised from “Wall 11 Design Related Changes” to “Wall 11 Changes.”

Enclosure 1 provides the description, technical evaluation, regulatory evaluation (including the Significant Hazards Consideration determination) and environmental considerations for the

proposed changes. Following an initial overall summary description of the requested changes, Enclosure 1 is further subdivided into five parts: 1A, 1B, 1C, 1D, and 1E.

- Part 1A identifies and describes the proposed changes to auxiliary building Wall 11, and provides the technical evaluation of the changes.

- Part 1B identifies and describes the proposed changes to clarify the use and classification of seismic Category II structures providing a protective function for nonseismic events and high energy line break (HELB) events in the nonseismic portion of the turbine building, and provides the technical evaluation of the changes.

- Part 1C identifies and describes the proposed changes to identify the use of turbine building first bay Wall 11.2 as a HELB barrier for postulated breaks in the nonseismic portion of the turbine building, and provides the technical evaluation of the changes.

- Part 1D identifies and describes the proposed changes to identify the use of the turbine building first bay as a protective structure for tornado missiles, and provides the technical evaluation of the changes.

- Part 1E provides the regulatory evaluation and environmental considerations addressing the proposed changes in this license amendment request.

Enclosure 2 provides markups depicting the requested changes to the licensing basis documents. Enclosure 2 is similarly divided to show the changes identified and discussed in the associated part of Enclosure 1.

Enclosures 1 and 2 were updated with changes to address NRC comments as discussed during public meetings on January 22 and February 25, 2016. Enclosure 3 was added to provide a written response to NRC questions and to identify the revisions to the LAR demarcated with revision bars in the updated Enclosure 1 and 2. Enclosure 4 includes the figures discussed in Enclosure 1. The figures contain Security-Related Information (SRI), also referred to as sensitive unclassified non-safeguards information (SUNSI), and are requested to be withheld under the provisions of 10 CFR 2.390(d).

The supplemental information provided in this letter does not impact the scope of the requested amendment, nor the conclusions of the regulatory evaluation. This conclusion was made for the significant hazards consideration and the environmental considerations because the changes implemented in those sections are consistency changes. These changes were made to maintain consistency with other changes discussed with the NRC. The changes are strictly clarifications and do not impact the scope of the requested amendment, nor the conclusions of the regulatory evaluation.

This license amendment is now requested to be issued by September 21, 2016. Delayed approval of this license amendment could result in a delay of construction of Wall 11 for placement of reinforcement bar at and above the 117′ elevation and subsequent dependent construction activities for the auxiliary building wall at column line 11 (Wall 11). 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.

This letter contains no regulatory commitments.

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

Should you have any questions, please contact Mr. Jason P. Redd at (205) 992-6435.

Mr. Brian H. Whitley states that: he is the Regulatory Affairs Director 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.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

B. H. Whitley

Brian H. Whitley

BHW/ERG/ljs

Sworn to and subscribed before me this 9th *day of* May, *2016*

Notary Public: Lisa Myrick Spears

My commission expires: June 18, 2019

Enclosures:

1) Vogtle Electric Generating Plant (VEGP) Units 3 and 4 – Supplement to Request for License Amendment Regarding Wall 11 Changes (LAR-15-021S1)

2) Vogtle Electric Generating Plant (VEGP) Units 3 and 4 – Proposed Changes to Licensing Basis Documents (LAR-15-021S1)

3) Vogtle Electric Generating Plant (VEGP) Units 3 and 4 – Voluntary Response to NRC January 22 and February 25, 2016 Public Meetings Questions on SCANA LAR 14-02 (LAR-15-021S1)

4) Vogtle Electric Generating Plant (VEGP) Units 3 and 4 – Supplement to Request for License Amendment Regarding Wall 11 Changes (LAR-15-021S1) - **Security-Related Information (SUNSI) – Withhold from Public Disclosure Under 10 CFR 2.390(d)**

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Southern Nuclear Operating Company

Vogtle Electric Generating Plant (VEGP) Units 3 and 4

ND-16-0557

Enclosure 1

Supplement to Request for License Amendment Regarding Wall 11 Changes (LAR-15-021S1)

(This Enclosure consists of 71 pages, including this cover page. Supplemental revisions are depicted in red.)

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Pursuant to 10 CFR 52.98(c) and in accordance with 10 CFR 50.90, Southern Nuclear Operating Company (SNC), the licensee for Vogtle Electric Generating Plant (VEGP) Units 3 and 4, requests an amendment to Combined License (COL) Numbers NPF-91 and NPF-92, for VEGP Units 3 and 4, respectively.

1. Summary Description

The proposed changes consist of 1) ~~revising the design~~ removal of openings in and modifying the reinforcement detailing of portions of the north wall of the auxiliary building on Column Line 11 (Wall 11) adjacent to the turbine building first bay within the main steam isolation valve (MSIV) compartments, 2) clarifying the use and classification of building structures that provide a protective function during nonseismic events and for high energy line break (HELB) events in the nonseismic portion of the turbine building, 3) crediting the use of the north wall of the turbine building first bay (Wall 11.2) as a HELB barrier protecting Wall 11 from the dynamic effects of HELB events postulated to occur north of Wall 11.2, and 4) crediting the use of the turbine building first bay and associated missile barriers for protection of Wall 11 openings from tornado missiles.

The proposed changes to ~~the~~ Wall 11 ~~design~~ are located in the portions of Wall 11 that form the north walls of Main Steam Isolation Valve (MSIV) Compartment A (Room 12406/12506; the "west" MSIV compartment) and MSIV Compartment B (Room 12404/12504; the "east" MSIV compartment).

The proposed changes include removal of an opening near the top of each of the MSIV compartment north walls, modification of the reinforcement ~~design~~ detailing and development in the vicinity of the main steam line penetrations to meet American Concrete Institute (ACI) code requirements, clarification of the HELB loadings applicable to the MSIV compartments, and identification of the application of ACI code requirements to the shear reinforcement placement tolerances in the vicinity of the main steam line Wall 11 penetrations. The openings proposed to be removed (Wall 11 upper vent openings) were originally intended to accommodate MSIV compartment pressure relief vents to mitigate postulated pipe breaks in the MSIV compartments. However, these relief vents were not credited in the MSIV compartment pressurization analysis, because it was not expected they would be retained in the final ~~detailed~~ Wall 11 design due to changes that increased the relief capacity of the roof vents in each MSIV compartment. Removal of the Wall 11 upper vent openings consists of extension of the surrounding wall reinforcement through the openings, and fill of the openings with concrete during placement.

The proposed changes to the Wall 11 reinforcement ~~design~~ detailing and development in the vicinity of the main steam line Wall 11 penetration include 1) reconfiguration of the reinforcement to satisfy ACI 349-01 and ACI 318-11 detailing and development requirements, 2) modification of the main steam line Wall 11 anchorage sleeve shear lugs and headed studs to provide sufficient clearance to facilitate construction of the reinforcement in the vicinity of the main steam line Wall 11 penetrations, and 3) identification of the application of ACI code requirements to the shear reinforcement placement tolerances in the vicinity of the main steam line Wall 11 penetrations. These modifications are reflected in the proposed changes to Updated Final Safety Analysis Report (UFSAR) Figure 3H.5-5, and to UFSAR subsection 3.8.4.6.3.

Changes are proposed to UFSAR subsection 3H.5.1.4 to clarify the HELB loadings considered in the east MSIV compartment and applied to the design of the critical section, and provide consistency with UFSAR subsection 3.6.1, "Postulated Piping Failures in Fluid Systems Inside and Outside Containment," and UFSAR subsection 3.6.1.2.2, "Main Control Room Habitability."

Changes are proposed to identify that the reinforcement ~~design~~ detailing and development represented in UFSAR Figure 3H.5-5 for the east MSIV compartment (defined as a "critical section") varies from the reinforcement ~~design~~ detailing and development for the west MSIV compartment because the west MSIV compartment Wall 11 section ties into auxiliary building Wall Q.

Changes are proposed to clarify the use and classification of building structures that provide a protective function during nonseismic events. The proposed changes clarify the classification of such structures, and therefore, the quality assurance requirements applicable to the building structures credited for this purpose. These proposed changes support the request to allow use of Wall 11.2 as a protective barrier to mitigate the dynamic effects of pipe ruptures postulated to occur in the nonseismic portion of the turbine building, and use of the turbine building first bay to provide protection of Wall 11 openings from the effects of tornado missiles.

A change is proposed to credit turbine building first bay Wall 11.2 as a high energy line break barrier to protect Wall 11 from the dynamic effects of HELB events postulated to occur north of Wall 11.2. This change involves analysis to demonstrate that the seismic Category II structure is sufficiently robust in design to withstand postulated HELB loadings in accordance with the load combinations specified in UFSAR 3.8.4.3 and the acceptance criteria in ACI 349-01 for concrete structures and AISC N690-1994 for steel structures.

A change is proposed to identify the use of the seismic Category II turbine building first bay structure and associated missile barriers for protection of Wall 11 openings from tornado missiles. This change involves 1) consideration of the effects of tornado missile strikes on the turbine building first bay structure and associated missile barriers, and demonstration of acceptable missile barrier performance using the procedures defined in UFSAR subsection 3.5.3, "Barrier Design Procedures," and 2) demonstration of turbine building first bay structural adequacy in accordance with the load combinations specified in UFSAR 3.8.4.3 and the acceptance criteria in ACI 349-01 for concrete structures and AISC N690-1994 for steel structures. As part of these evaluations, an assessment of potential missile paths was performed to identify credible missile paths through turbine building first bay openings to Wall 11 openings and penetrations. Where required, additional protection is being provided for Wall 11 openings and penetrations. This proposed change adds information to the UFSAR to describe the missile protection evaluation performed for the Wall 11 openings, and identify the missile barriers credited to protect Wall 11 openings from tornado missiles.

The changes associated with 1) clarifying the use and classification of building structures that provide a protective function for nonseismic events, 2) crediting turbine building first bay Wall 11.2 as a HELB barrier protecting Wall 11 from the dynamic effects of HELB events postulated to occur north of Wall 11.2, and 3) crediting the turbine building first bay and associated missile barriers as a tornado missile barrier protecting Wall 11 openings and penetrations impact Tier 2 information that involves the changes to the Tier 2* information associated with the Wall 11 changes. These Tier 2 changes, identified in Parts 1B, 1C, and 1D were determined to involve the Tier 2* information being revised to reflect changes ~~in the design of~~ to auxiliary building Wall 11 identified in Part 1A, since credit of the seismic Category II

turbine building first bay, or portions thereof, for ~~these protective functions~~ the protection of Wall 11 and/or its openings affects the finalization of the Wall 11 design ~~loads applied to Wall 11~~.

The requested amendment changes the UFSAR in the form of departures from the incorporated plant-specific Design Control Document (PS-DCD) Tier 2 information as identified in Parts 1B, 1C, and 1D, and involves Tier 2* information. Regulations in 10 CFR Part 52, Appendix D, Section VIII.B.5.a require prior NRC approval for Tier 2 departures that involve changes to Tier 1, Tier 2* information or the Technical Specifications. The proposed changes to ~~the~~ Wall 11 ~~design~~ affect Tier 2* information contained in UFSAR subsection 3H.5.1.4 and Figure 3H.5-5, and thus require prior NRC approval.

In addition, the license includes a condition directing compliance with the pipe rupture hazards analysis criteria contained in the AP1000 DCD, Revision 19, subsection 3.6.1.3.2. Since subsection 3.6.1.3.2 is being revised as part of this license amendment request, a change is proposed to license condition 2.D(12) to reference the AP1000 DCD, Revision 19, subsection 3.6.1.3.2, as revised by the Amendment approving this license amendment request.

Part 1A of this enclosure identifies and describes the proposed changes to the auxiliary building Wall 11 ~~design~~, and provides the technical evaluation of the changes.

Part 1B of this enclosure identifies and describes the proposed changes to clarify the use and classification of seismic Category II structures providing a protective function for nonseismic events and for high energy line break (HELB) events in the nonseismic portion of the turbine building, and provides the technical evaluation of the changes. The changes to clarify the use and classification of seismic Category II structures for these protective functions support the proposed changes to use seismic Category II structures for HELB and tornado missile protection as discussed in Parts 1C and 1D discussed below.

Part 1C of this enclosure identifies and describes the proposed design change~~s~~ to identify the use of turbine building first bay Wall 11.2 as a HELB barrier ~~for~~ to protect Wall 11 from the dynamic effects of postulated breaks in the nonseismic portion of the turbine building, and provides the technical evaluation of the changes.

Part 1D of this enclosure identifies and describes the proposed design change~~s~~ to identify the use of the turbine building first bay as a protective structure ~~for~~ to protect Wall 11 from tornado missiles, and provides the technical evaluation of the changes.

Part 1E of this enclosure provides the regulatory evaluation and environmental consideration evaluation addressing the proposed changes in this license amendment request.

This application requests approval of the license amendment required to implement these changes.

Part 1A - Auxiliary building Wall 11 ~~design~~ changes

1. Summary Description

The proposed changes consist of revising ~~the design of~~ portions of the north wall of the auxiliary building on Column Line 11 (Wall 11) adjacent to the turbine building first bay. The proposed changes to ~~the~~ Wall 11 ~~design~~ are located in the portions of Wall 11 that form the north walls of Main Steam Isolation Valve (MSIV) Compartment A (Room 12406/12506; the "west" MSIV compartment) and MSIV Compartment B (Room 12404/12504; the "east" MSIV compartment).

The proposed changes, summarized below, and detailed in Section 2, include:

- Removal of an opening near the top of each of the MSIV compartment north walls (Wall 11 upper vent openings),
- Reconfiguration of the reinforcement ~~design~~ detailing and development in the vicinity of the main steam line Wall 11 penetration to satisfy ACI 349-01 and ACI 318-11 detailing and development requirements,
- Modification of the main steam line Wall 11 anchorage sleeve shear lugs and headed studs to provide sufficient clearance to facilitate construction of the reinforcement in the vicinity of the main steam line Wall 11 penetrations,
- Identification of the application of ACI code requirements to the shear reinforcement placement tolerances in the vicinity of the main steam line Wall 11 penetrations,
- Identification that the Wall 11 reinforcement ~~design~~ detailing and development for the west MSIV compartment varies from the Wall 11 reinforcement ~~design~~ detailing and development for the east MSIV compartment, and
- Clarification of the HELB loadings applicable to the MSIV compartments.

These changes impact Tier 2* information contained in Updated Final Safety Analysis Report (UFSAR) Subsection 3H.5.1.4, and associated Figure 3H.5-5.

The Wall 11 upper vent openings were originally intended to accommodate MSIV compartment pressure relief vents to mitigate postulated pipe breaks in the MSIV compartments. However, these relief vents were not credited in the MSIV compartment pressurization analysis, because it was not expected they would be retained in the final ~~detailed~~ Wall 11 design due to changes that increased the relief capacity of the roof vents in each MSIV compartment. Removal of the Wall 11 upper vent openings consists of extension of the surrounding wall reinforcement through the openings, and fill of the openings with concrete during placement.

Changes are proposed to identify that the reinforcement ~~design~~ detailing and development represented in UFSAR Figure 3H.5-5 for the east MSIV compartment (defined as a "critical section") varies from the reinforcement ~~design~~ detailing and development for the west MSIV compartment because the west MSIV compartment Wall 11 section ties into auxiliary building Wall Q.

Changes are proposed to UFSAR subsection 3H.5.1.4 to clarify the HELB loadings considered in the east MSIV compartment and applied to the design of the critical section, and provide

consistency with UFSAR subsection 3.6.1, “Postulated Piping Failures in Fluid Systems Inside and Outside Containment,” and UFSAR subsection 3.6.1.2.2, “Main Control Room Habitability.”

A technical evaluation of these changes is provided in Section 3 below.

2. Detailed Description

General Description of Wall 11 Changes

The ~~reinforcement and concrete design of the~~ sections of auxiliary building Wall 11 that form the north walls of the east and west MSIV compartments ~~is~~ are proposed to be reconfigured. The Wall 11 upper vent openings previously intended for vents for the MSIV compartments are proposed to be removed and the openings closed with reinforced concrete consistent with the surrounding structure. In addition, changes are proposed to the reinforcement detailing and development in the vicinity of the main steam line Wall 11 anchors to address issues identified as a result of conformance reviews of the reinforcement ~~design~~ detailing and development to ACI 349-01 and ACI 318-11 requirements.

The sections of the auxiliary building Wall 11 affected by the proposed changes are on the north side of the MSIV compartments, as shown in UFSAR Figure 3.7.2-12, Sheets 4, 5 and 8 (UFSAR Figure 3.7.2-12 is not affected by the subject changes to Wall 11). As described in UFSAR subsection 3H.5.1.4, the north wall of the east MSIV compartment between elevation 117′-6″ and elevation 153′-0″ is identified as a critical section. Elevation 153′-0″ is approximately at the roof of the auxiliary building. The wall continues above the roof to form a parapet around the roof. Elevation 117′-6″ is the top of the floor of the MSIV compartments. The wall in this area is a reinforced concrete wall which is four feet thick between elevations 115′-6″ and 135′-3″ and two feet thick between elevations 135′-3″ and 153′-0″ and functions to anchor several pipes, including the main steam line, the main feedwater line, and the startup feedwater line, which pass through the wall.

Wall 11 is an exterior wall of the auxiliary building. One of the design functions of Wall 11 is to separate and protect systems and components located in the auxiliary building from postulated equipment failures, and pipe ruptures occurring in the adjacent turbine building. The wall supports the auxiliary building roof. The walls for the MSIV compartments are designed to maintain their structural integrity for the combination of dead load, live load, seismic load and thermal load. The walls are also designed to withstand the compartment pressurization effects of a one square foot pipe rupture in the MSIV compartment. Where it forms the north wall of the east MSIV compartment, Wall 11 is evaluated for the dynamic and environmental effects of pipe breaks (jet loads, ~~and~~ reactions at the pipe anchors, etc.) due to breaks in the east MSIV compartment and in the turbine building. Additionally, the Wall 11 design for both MSIV compartments considers loads from postulated breaks in the turbine building, which include turbine building first bay pressurization, jet loads, reactions at the Wall 11 pipe anchors (Wall 11), and pipe whip associated with HELB events. The Wall 11 design also considers loads from the design basis tornado event, including the loads associated with tornado missiles.

Removal of Wall 11 Upper Vent Openings

The MSIV compartment Wall 11 upper vent openings on the north wall of the auxiliary building, which are currently shown on UFSAR Figure 3H.5-5, Sheets 1 and 3, at elevation 148′-9″ - 151′-6″

are proposed to be removed and the openings closed with reinforced concrete consistent with the surrounding structure.

Specific changes to address removal of the Wall 11 upper vent openings include the following:

- The wall reinforcement in the vicinity of the openings is extended through the area of the openings with the same size, spacing, and pattern of the reinforcement in the vicinity of the openings.
- The reinforcement detailing and development features associated with the termination of the wall reinforcement at the area of the openings are removed.
- The area of the openings is filled with concrete in accordance with the same requirements as the remainder of the wall.

Wall 11 Changes to Conform With ACI 349-01 and ACI 318

The proposed changes to address conformance of detailing and development with ACI 349-01 and ACI 318-11 consist of revising the auxiliary building Wall 11 reinforcement ~~design~~ detailing and development in the vicinity of the main steam line penetration. UFSAR Figure 3H.5-5 is revised to show these changes. Additionally, UFSAR Figure 3H.5-5 and UFSAR subsection 3H.5.1.4 are changed to identify that the Wall 11 reinforcement ~~design~~ detailing and development in the west MSIV compartments deviates from that shown in Figure 3H.5-5 for the east MSIV compartment (critical section) due to the west MSIV compartment tie-in with auxiliary building Wall Q. Notes are added to UFSAR Figure 3H.5-5 to provide additional information concerning the reinforcement detailing. Subsection 3.8.4.6.3 is revised to identify that the tolerance on placement of out-of-plane shear reinforcement in the vicinity of the main steam line Wall 11 penetrations is specified to maintain the maximum spacing requirements of ACI 349, and the minimum spacing requirements of ACI 318 for headed reinforcement.

Specific changes to the reinforcement ~~design~~ detailing and development to address ACI 349-01 and ACI 318-11 ~~detailing and development~~ conformance are described below. Refer to Section 3, subsection “Wall 11 ACI 349-01 Conformance Review,” where reference is made to specific “review items.”

1. The horizontal and vertical reinforcing bars are lengthened and the development method of the horizontal and vertical reinforcing bars inside the extents of the radial and circumferential pattern is modified to include hooks in addition to headed reinforcement where necessary to meet spacing requirements for development of headed reinforcement in ACI 318-11 Section 12.6.1(f). This change addresses Review Items #1 and #2 identified in Section 3 below under “Wall 11 ACI 349-01 Conformance Review.” Because of the density of the reinforcement pattern in the figures, the headed reinforcement and hooks are not shown in the revised Figure 3H.5-5, Sheet 1 (as indicated in Notes 2 and 5) and the headed reinforcement is not shown on Sheet 3 (as indicated in Figure 3H.5-5, Sheet 1, Note 2) for clarity in presentation.
2. Several of the circumferential bars around the main steam line penetration are moved inward toward the center of the wall thickness to be contained within the radial hoops and to provide clearance to extend horizontal and vertical reinforcing bars. See Review Item #1

identified in Section 3 below under "Wall 11 ACI 349-01 Conformance Review." These changes are shown in UFSAR Figure 3H.5-5, Sheet 3. This figure has also been revised to show both the horizontal and circumferential reinforcement in the section.

3. Development of horizontal and vertical bars is increased beyond the extent of the radial and circumferential arrangement around the main steam line penetration to accommodate ACI 349-01 development requirements. In the existing ~~design~~ configuration, the horizontal and vertical bars extended through approximately the outer three circumferential hoops. In the proposed ~~design~~ configuration, the horizontal and vertical bars extend almost to the main steam line penetration. The horizontal and vertical bars were extended further into the wall to comply with ACI 349-01 detailing requirements, while providing additional continuity to the transition of the 4′-0″ thick section to the 2′-0″ thick section which also provides improved strength and resistance to cracking under normal operating loading. See Review Item #1 identified in Section 3 below under "Wall 11 ACI 349-01 Conformance Review." This is shown in Figure 3H.5-5, Sheets 1, 2, and 3.

4. Additional space is provided between radial hoop reinforcing around the main steam line penetration to meet the requirements of ACI 349-01 Sections 7.6.1 and 3.3.2(c). See Review Item #3 identified in Section 3 below under "Wall 11 ACI 349-01 Conformance Review." This is shown in Figure 3H.5-5, Sheet 1.

5. The #5 radial stirrups are removed from the reinforcement ~~design~~ configuration around the main steam line penetration to accommodate additional space required in Change Items #3 and #4, and because the #5 stirrups provided negligible strength to the section, and are not required to satisfy ACI 349-01 requirements. See Review Item #3 identified in Section 3 below under "Wall 11 ACI 349-01 Conformance Review." This is shown in Figure 3H.5-5, Sheets 1 and 3.

6. Mechanical splices are changed to lap splices at the boundary of the 4′-0″ thick wall panel at elevation 135′-3″. See Review Item #4 identified in Section 3 below under "Wall 11 ACI 349-01 Conformance Review." This is shown in Figure 3H.5-5, Sheets 1, 2, and 3. Some detailing associated with reinforcement splices and development is not presented in the figure. This is identified in Note 5 of Figure 3H.5-5. The ~~design of this~~ revised detailing and development conforms with the requirements of ACI 349-01.

7. Development of vertical bars from below elevation 117′-6″ at the drain/vent openings is modified to include standard hooks to meet the development length requirements of ACI 349-01 Chapter 12. See Review Item #5 identified in Section 3 below under "Wall 11 ACI 349-01 Conformance Review." This is shown in Figure 3H.5-5, Sheets 1 and 3.

8. The shear tie arrangement between the drain/vent openings located below the main steam line penetrations and the adjacent piping penetrations is modified to provide a constructible configuration which meets spacing requirements of ACI 349-01 Sections 7.6.1 and 3.3.2(c). See Review Item #6 identified in Section 3 below under "Wall 11 ACI 349-01 Conformance Review." This is shown in Figure 3H.5-5, Sheet 1.

9. Horizontal bars below the main steam line penetration and above the drain/vent openings are adjusted (shifted) and bends are removed to provide a straight bar to alleviate resultant forces acting in the vicinity of free edges, and to meet the requirements of ACI 349-01 Section 7.8.1.3. See Review Item #7 identified in Section 3 below under "Wall 11 ACI 349-01 Conformance Review." This is shown in Figure 3H.5-5, Sheet 1.

10. Some non-critical features not required to satisfy ACI 349-01 requirements are modified or removed to facilitate fabrication of the reinforcement in the wall, adjacent floors, and placement of the penetration anchorage sleeve. These include:
    - The diagonal reinforcement provided between the main steam line penetration and the main feedwater penetration has been removed. This was previously provided to prevent cracking of the concrete around the main feedwater penetration. It was determined that this reinforcement was not required because of the density of reinforcement around the main steam line penetration in conjunction with the main feedwater line penetration anchorage sleeve features, e.g., shear lugs, gussets, which rendered the diagonal reinforcement unnecessary.
    - The end configuration of Layer 5 shown on UFSAR Figure 3H.5-5, Sheet 2 is being changed from a non-standard 180 degree bend to a standard 90 degree hook with additional runout. This change is being made to provide improved cracking resistance at the transition of the 2 ft. wall section to the 4 ft. wall section.
    - The need for, and use of mechanical couplers is determined during reinforcement detail fabrication. Where used, mechanical couplers ~~are designed in accordance~~ comply with the requirements of ACI 349-01. Because mechanical couplers are an acceptable alternative to using a full straight bar or lap splice between the critical section and adjacent areas without adversely affecting compliance of the critical section reinforcement detailing and development with ACI 349-01 ~~design~~, this information has been removed from Figure 3H.5-5.

    The removal of these details is noted in new Note 5 added to Figure 3H.5-5, Sheet 1. The representation of the shear lugs and headed studs on the penetration anchorage sleeve is reconfigured to be consistent with the proposed detailed design. See Review Item #10 identified in Section 3 below under “Wall 11 ACI 349-01 Conformance Review.” This is shown in Figure 3H.5-5, Sheets 1, 2 and 3.

11. The #5 hooked bar below the drain/vent openings below the main steam line penetrations and adjacent to the floor below elevation 117′-6″ is modified to an enclosed hoop to meet development requirements of ACI 349-01 Section 12.2. See Review Item #8 identified in Section 3 below under “Wall 11 ACI 349-01 Conformance Review.” This is shown in Figure 3H.5-5, Sheet 3.

12. Anchorage in the wall of the bottom horizontal bar from the floor slab below elevation 117′ 6″ is modified from a standard hook bent upward to a mechanical T-headed anchorage to provide for constructability. It was determined that a standard 90 degree hook configuration would not fit within the section. The bar with headed reinforcement satisfies the supplemental requirements for headed reinforcement identified in UFSAR subsection 3.8.4.4.1. See Review Item #10 identified in Section 3 below under “Wall 11 ACI 349-01 Conformance Review.” This is shown in Figure 3H.5-5, Sheet 3.

13. A tolerance is specified for the out-of-plane shear reinforcing bars to provide that spacing between the out-of-plane shear reinforcing bars satisfies the limit on maximum spacing allowed by ACI 349-01, and the minimum spacing allowed by ACI 318-11 for headed reinforcement. See Review Item #9 identified in Section 3 below under “Wall 11 ACI 349-01 Conformance Review.” This is described in UFSAR subsection 3.8.4.6.3, “Special Construction Techniques.”

Several additional notes were added to Figure 3H.5-5, Sheet 1 to reference other UFSAR sections for further information, or to identify differences between the critical section depicted in Figure 3H.5-5, Sheet 1 (east MSIV compartment) and the west MSIV compartment. These notes (Notes 1, 3, 4, and 6) are described under "Licensing Basis Change Descriptions," below.

Additionally, changes are made to the main steam line anchorage sleeve shear lugs and headed studs to provide sufficient clearance to facilitate construction of the Wall 11 reinforcement in the area of the main steam line penetration. These are shown in Figure 3H.5-5, Sheets 1 and 3.

Clarification of HELB Loadings Considered in east MSIV Compartment

Additional revisions are proposed to UFSAR subsection 3H.5.1.4 to clarify the HELB loadings applied to Wall 11 within the east and west MSIV compartments, and provide consistency with the information contained in UFSAR subsection 3.6.1, "Postulated Piping Failures in Fluid Systems Inside and Outside Containment," and UFSAR subsection 3.6.1.2.2, "Main Control Room Habitability." Specifically, UFSAR subsection 3H.5.1.4 is revised to separate discussion of the one square foot pipe rupture pressurization loadings applicable to both the east and west MSIV compartments from the discussion of the HELB dynamic loads applicable to Wall 11 in the east MSIV compartment for consistency with UFSAR subsections 3.6.1 and 3.6.1.2.2. Additionally, references to "MSIV room(s)" are changed to "MSIV compartment(s)" for consistency.

Licensing Basis Change Descriptions

The UFSAR subsections and figures proposed to be revised to reflect the requested changes to Wall 11 are discussed below.

Revisions are proposed to UFSAR subsection 3H.5.1.4 to provide more clarity with regard to the development of Wall 11 HELB loadings within the east MSIV compartment, located adjacent to the main control room, and to provide consistency with the information contained in UFSAR subsection 3.6.1, "Postulated Piping Failures in Fluid Systems Inside and Outside Containment," and UFSAR subsection 3.6.1.2.2, "Main Control Room Habitability." These include the following proposed revisions:

1. UFSAR subsection 3.8.4.6.3 is revised to identify that the tolerance on placement of out-of-plane shear reinforcement in the vicinity of the main steam line Wall 11 penetrations is specified to maintain the maximum spacing requirements of ACI 349-01, and the minimum spacing requirements of ACI 318-11 for headed reinforcement.
2. UFSAR subsection 3H.5.1.4, first and fourth paragraphs, are revised to clarify that:
   - Both the east and west MSIV compartments are assumed to incur compartment pressurization loads associated with a one square foot piping rupture,
   - Wall 11 in the east MSIV compartment is also designed to withstand the jet loads and the reactions at the pipe anchors for main steam and main feedwater line breaks assumed to occur in the east MSIV compartment, and
   - The Wall 11 design for both compartments considers the dynamic and environmental effects of breaks assumed to occur in the turbine building, which include turbine building

first bay pressurization, jet loads, reactions at the Wall 11 pipe anchors (Wall 11), and pipe whip.

3. UFSAR subsection 3H.5.1.4, sixth paragraph, which references Figure 3H.5-5 is revised to clarify that:
   - Figure 3H.5-5 provides the wall reinforcement details for the critical section (Wall 11 in the east MSIV compartment), and
   - The reinforcement ~~design associated with~~ detailing and development of the north wall of the auxiliary building for the west MSIV compartment varies from that of the east MSIV compartment due to its interface with Wall Q in the corner of the auxiliary building, which is oriented at 90 degrees to Wall 11.
4. Figure 3H.5-5 (Sheets 1 and 3) is revised to remove the openings at elevation 148′-9″ - 151′-6″ and close the openings off with reinforced concrete consistent with the surrounding wall.
5. Figure 3H.5-5 (Sheets 1, 2, and 3) is revised to incorporate the changes to the reinforcement ~~design and details~~ detailing and development surrounding the main steam line penetration.
6. Notes are added to UFSAR Figure 3H.5-5, Sheet 1 to:
   i. Identify that the figure depicts detail specific to Wall 11 between column lines L and M (east MSIV compartment), and subsection 3H.5.1.4 provides information concerning ~~design details~~ variations in reinforcement detailing and development applicable to the other wall section (west MSIV compartment).
   ii. Identify that layers 1, 2, 5, and 6 terminating within the radial and circumferential reinforcement are developed using standard hooks or headed reinforcement which is not shown in the figure. It also identifies that reinforcement terminating within the 4′-0″ thick section may be developed with either a full straight development in accordance with ACI 349-01, Chapters 12 and 21, or a full straight bar development in accordance with ACI 349-01, Chapter 12, with additional headed anchorage.
   iii. Identify that UFSAR subsection 3.8.4.4.1 provides the requirements for development of headed reinforcement.
   iv. Identify that the other wall section between column line P and column line Q (west MSIV compartment) varies due to interface with an adjacent wall (Wall Q), and that reinforcement ~~design~~ detailing and development is consistent with ACI 349-01 requirements for an adjacent wall at a corner.
   v. State that some detailing associated with reinforcement splices and development is not presented in the figure, but conforms to the requirements of ACI 349-01.
   vi. Identify that the critical section boundaries are defined in UFSAR subsection 3H.5.1.4.
   vii. Identify that reinforcing bars provided for the purpose of crack control may deviate from that depicted in the figure as necessary to facilitate construction, but shall comply with ACI 349-01.
   viii. Identify that for clarity, out-of-plane shear reinforcement is not depicted in the figure, but shall comply with ACI 349-01.
7. The UFSAR Figure 3H.5-5, Sheet 3 callout at the bottom of the main steam line penetration identifying the size and quantity of circumferential hoops is revised to identify that there are

24 circumferential rebar hoops at the bottom; to reflect the truncation of one set of rebar hoops in the vicinity of the drain/vent opening. The callout lines identifying the circumferential bars are extended to the first sets of rebar for clarity.

8. UFSAR Figure 3H.5-5, Sheet 1 is revised to reflect a change in the design of the main steam line penetration sleeve headed studs. UFSAR Figure 3H.5-5, Sheet 3 is revised to reflect a change in the design of the main steam line penetration sleeve shear lugs and headed studs.
9. UFSAR Figure 3H.5-5, Sheet 2 is revised to remove references to the 2′-0″ floor and the 117′-6″ elevation, and identify the elevation of the bottom of the 4′-0″ thick section of the wall as 115′-6″ for clarity.

3. Technical Evaluation

UFSAR Figure 3H.5-5 shows the reinforcement design for the Wall 11 critical section, which forms the north wall of the east MSIV compartment. The reinforcement ~~design~~ detailing and development for the critical section is representative of, but not identical to the reinforcement ~~design~~ detailing and development for the Wall 11 section that forms the north wall of the west MSIV compartment. Information is added to UFSAR subsection 3H.5.1.4 and UFSAR Figure 3H.5-5 to note variations in Wall 11 for the west MSIV compartment from that shown in Figure 3H.5-5 for the critical section. In the case of the west MSIV compartment wall section, one end of the wall is at the corner of the auxiliary building and because of the 90 degree connection with Wall Q, the reinforcement detailing and development deviates from that shown in Figure 3H.5-5 to satisfy ACI 349-01 requirements for detailing and development in a ~~the~~ corner ~~design~~.

The proposed changes include implementation of requirements for development of headed reinforcement. These requirements are based on application of provisions in ACI 318-11, Section 12.6. The use of these requirements is similar to their use as previously approved in license amendments related to use of headed reinforcement in the basemat and the nuclear island above the basemat. These requirements are incorporated into UFSAR subsections 3.8.3.5, 3.8.4.4.1, and 3.8.4.5.1 of the licensing basis via license amendments 5 and 9.

Removal of Wall 11 Upper Vent Openings

The MSIV compartments are provided with pressure relief devices, including steam relief vents, doors, and other features designed and specified to open under established differential pressures. The purpose of the MSIV compartment pressure relief devices is to relieve pressure from the MSIV compartments into the turbine building or other areas or through the roof to the atmosphere in the event of a pipe rupture in an MSIV compartment. The structures forming the MSIV compartment boundaries are designed and analyzed to withstand MSIV compartment pressurization. Thus, the MSIV steam relief devices are collectively designed, sized, and the MSIV compartments analyzed, such that for the worst case pipe break postulated, the MSIV compartment pressures remain~~s~~ less than or equal to the design limit.

Auxiliary building Wall 11 was originally designed with steam vents located in the upper MSIV compartments beginning at elevation 148′ - 9″, and lower steam vents located just below the main steam line penetrations, in the lower MSIV compartments. The Wall 11 upper vent openings are proposed to be removed for the following reasons:

- The current MSIV compartment pressurization analysis does not credit the Wall 11 upper vents in the analysis. The MSIV compartment was determined to have sufficient venting capacity to adequately relieve the analyzed pipe rupture loadings in the MSIV compartment without credit of the Wall 11 vent openings.
- The location of the Wall 11 upper vent openings (Wall 11 opening at 148′-9″ - 151′-6″) would have resulted in interference with the turbine building first bay floor at elevation 148′ - 10″, impacting or preventing their operation.
- The qualification of the Wall 11 upper vents as a 3-hour rated fire barrier would have been a challenge, given their large size (approximately 16′ x 3′).
- Retaining the Wall 11 upper vents would have also required additional tornado missile protection considerations in the changes required to credit the turbine building first bay and associated missile barriers for protection of Wall 11 openings from tornado missiles ~~protection~~, discussed in Part 1D.
- Relocation of the Wall 11 upper vents would require revising the design of the Wall 11 reinforcement in the area to which the MSIV vents were moved.

Thus, retaining the Wall 11 upper vents in their existing location or relocating them to a new location would potentially create a need for additional plant changes as a result of the impact of those options. Since at the time of development of this design change and prior to NRC approval of the AP1000 design certification amended rule, the MSIV compartment pressurization analysis determined that the MSIV compartment pressure would remain below the design limit without credit of the Wall 11 upper vents, they were proposed to be removed from the Wall 11 design.

Removal of the Wall 11 upper vent openings requires consideration of the change in the wall structural design. The structural design of the wall is changed to extend the wall reinforcement with the same size and spacing through the area of the openings and fill the openings with concrete monolithically with the rest of the wall. The proposed change, which removes the Wall 11 upper vent openings facilitates meeting the 3-hour fire rating requirement for the wall, and removes MSIV compartment steam relief vents which are not credited in the MSIV compartment pressurization analysis. Additionally, removal of the openings provides added reinforcement to the Column Line 11 auxiliary building wall to provide improved support and stability to the auxiliary building roof. The removal of the vents does not affect any seismic response data presented in the UFSAR.

The revised design of Wall 11 with the Wall 11 upper vent openings removed is in conformance with the requirements of ACI 349-01. As discussed further below, these analyses have confirmed that the revised design, including the removal of the MSIV compartment vents, continues to meet the applicable acceptance criteria contained in ACI 349-01. Therefore, there are no significant impacts resulting from this proposed change.

Wall 11 ACI 349-01 Conformance Review

Wall 11 contains the penetrations and anchors for several pipes, including those for the main steam line, main feedwater line, and the startup feedwater line. The penetrations carry the pipes through the wall from the seismic Category I auxiliary building to the seismic Category II

first bay of the turbine building. The reinforcement design shown in UFSAR Figure 3H.5-5 was reviewed during the AP1000 Design Certification and determined to provide a sufficient amount of reinforcement in the wall. During design finalization of the auxiliary building, additional internal design review was completed to confirm conformance of the Wall 11 reinforcement ~~design~~ detailing and development in the vicinity of the main steam line penetrations with ACI 349-01 requirements. This review determined that revisions were required to maintain conformance with ACI code requirements addressing reinforcement detailing and development. The changes proposed to the Wall 11 detailing and development do not change or affect the minimum area of reinforcement determined to be acceptable in the approved AP1000 design.

Wall 11 ACI 349-01 Conformance Review Items

The specific areas reviewed for conformance with ACI 349-01 detailing and development requirements for the configuration shown in Figure 3H.5-5 include the following "Review items"

1. The reinforcing pattern provided in the vicinity of the main steam line penetrations was reviewed to determine that it provides continuous tensile reinforcement to meet the requirements of ACI 349-01 Section 12.1.1. This review item applies to Change Item Nos. 1, 2 and 3 identified in Section 2 above under "Wall 11 Changes to Conform With ACI 349-01 and ACI 318."
2. Development of horizontal and vertical reinforcing bars using headed reinforcement within the extent of the radial and circumferential reinforcement arrangement surrounding the main steam penetration was reviewed to determine that the reinforcement ~~design~~ detailing and development meets spacing requirements for headed reinforcement of ACI 318-11 Section 12.6.1(f). This review item applies to Change Item No. 1 identified in Section 2 above under "Wall 11 Changes to Conform With ACI 349-01 and ACI 318."
3. Spacing between radial hoop reinforcing bars around the main steam line penetration was reviewed to determine that it meets the requirements of ACI 349-01 Sections 7.6.1 and 3.3.2(c). This review item applies to Change Item Nos. 4 and 5 identified in Section 2 above under "Wall 11 Changes to Conform With ACI 349-01 and ACI 318."
4. Mechanical splices to bars of a reduced size at the boundary of the 4′-0″ thick wall at elevation 135′-3″ were reviewed to determine that they provide sufficient anchorage of vertical reinforcing bars in the 4′-0″ thick wall according to ACI 349-01 Section 12.1.1. This review item applies to Change Item No. 6 identified in Section 2 above under "Wall 11 Changes to Conform With ACI 349-01 and ACI 318."
5. Development of vertical bars from below 117′-6″ at the drain/vent openings located below the main steam line penetrations was reviewed to determine that it meets the development length requirements of ACI 349-01 Chapter 12.5. This review item applies to Change Item No. 7 identified in Section 2 above under "Wall 11 Changes to Conform With ACI 349-01 and ACI 318."
6. Shear tie ~~design~~ detailing and development between the drain/vent openings located below the main steam line penetration and the adjacent piping penetrations was reviewed to determine that it meets the spacing requirements of ACI 349-01 Sections 7.6.1 and 3.3.2(c). This review item applies to Change Item No. 8 identified in Section 2 above under "Wall 11 Changes to Conform With ACI 349-01 and ACI 318."

7. Horizontal bars between the drain/vent openings and the main steam line penetration were reviewed to determine that they meet the requirements for bent bars according to ACI 349-01 Section 7.8.1.3, and the development requirements of Section 12 & 21. This review item applies to Change Item No. 9 identified in Section 2 above under "Wall 11 Changes to Conform With ACI 349-01 and ACI 318."
8. The #5 hooked bar below the drain/vent openings located below the main steam line penetration was reviewed to determine that it meets development requirements according to ACI 349-01 Section 12.2. This review item applies to Change Item No. 11 identified in Section 2 above under "Wall 11 Changes to Conform With ACI 349-01 and ACI 318."
9. The description of the wall section in UFSAR subsection 3H.5.1.4 and associated figures were reviewed to determine how tolerances in fabrication and construction are addressed. The existing licensing basis was reviewed to confirm that it reflected the configuration required to meet the design basis requirements. This review item applies to Change Item No. 13 identified in Section 2 above under "Wall 11 Changes to Conform With ACI 349-01 and ACI 318."
10. Some non-critical features of the reinforcement ~~design~~ detailing and development, not required to satisfy ACI 349-01 requirements, were reviewed and either removed or revised to facilitate fabrication of the reinforcement in the wall, adjacent floors, and the penetration anchorage sleeve. This review item applies to Change Item Nos. 10 and 12 identified in Section 2 above under "Wall 11 Changes to Conform With ACI 349-01 and ACI 318."

The proposed changes to the reinforcement ~~design~~ detailing and development address the results of these review items. The proposed changes do not change the size or spacing of the reinforcement in the wall outside the vicinity of the penetrations and other openings, nor change the minimum required area of reinforcement required to meet ACI 349-01. UFSAR Figure 3H.5-5 is revised to be consistent with the changes in reinforcement ~~design details~~ detailing and development. Some ~~design detail~~ detailing and development features including development details of bars in adjacent wall sections, development details in congested areas, and reinforcement details in the area of splices are not shown in the figure. The notes added to the figure explain and are consistent with the changes in the reinforcement ~~design details~~ detailing and development. The notes also identify the variations in ~~detail design~~ reinforcement detailing and development for the ~~similar section other than the~~ wall of the ~~east~~ west MSIV compartment.

The revised ~~design and~~ Wall 11 reinforcement configuration, including the variations in the detailing and development of the west MSIV compartment at the corner have been reviewed and are in conformance with ACI 349-01 requirements for reinforcement detailing and development including those in ACI 349-01, Chapter 21. Tolerances are in accordance with ACI 349-01, and in accordance with ACI-318-11 for headed reinforcement. Where out-of-plane shear reinforcement is provided within the radial/circumferential pattern, a larger tolerance on the placement of the shear reinforcement is provided because of the density of the reinforcement around the penetration. The increased tolerance on placement of shear reinforcement is allowed by ACI 349-01, and is specified to maintain the maximum spacing requirements of ACI 349-01, and the minimum spacing requirements of ACI 318-11 for headed reinforcement.

The need for, and use of, mechanical couplers is determined during reinforcement detail fabrication. Where used, mechanical couplers ~~are designed in accordance~~ comply with the requirements of ACI 349-01. Because mechanical couplers are an acceptable alternative to using a full straight bar or lap splice between the critical section and adjacent areas without adversely affecting compliance of the critical section reinforcement detailing and development with ACI 349-01 ~~design~~, this information has been removed from Figure 3H.5-5.

The detail design of the Main Steam Line (MSL) penetration sleeve, including the size and spacing of the MSL anchorage sleeve shear lugs and headed studs, does not impact the wall reinforcement requirements. This information is not a direct input for the Wall 11 reinforcement detail evaluation, nor credited in the evaluation of the MSL penetration sleeve. The revised structural design of the MSL penetration sleeve, including the design of the shear studs and other structural shapes anchoring the penetration in the concrete, satisfies the requirements of AISC N690-1994.

As discussed previously, the addition of concrete and reinforcement in the previous vent openings does not affect any seismic response data presented in the UFSAR.

Clarification of HELB Loadings Considered in east MSIV Compartment

Additional revisions are proposed to UFSAR subsection 3H.5.1.4 to clarify the HELB loads applied to Wall 11 in each of the MSIV compartments, and provide consistency with the information contained in UFSAR subsection 3.6.1, “Postulated Piping Failures in Fluid Systems Inside and Outside Containment,” and UFSAR subsection 3.6.1.2.2, “Main Control Room Habitability.”

As discussed in UFSAR subsection 3.6.1, areas designated as break exclusion zones within the MSIV compartments are evaluated for pressurization loads associated with postulated breaks of one square foot break in the main steam and main feedwater lines. These pressurization loads are applicable to both the east and west MSIV compartments. Additionally, because the east MSIV compartment is located adjacent to the main control room and above a safety-related electrical equipment room, the wall between the east MSIV compartment and the main control room, and the east MSIV compartment floor are also evaluated for the effect for pipe whip and jet impingement loads associated with worst case breaks in the east MSIV compartment. Thus, Wall 11 in the east MSIV compartment is also evaluated for the dynamic and environmental effects of pipe breaks for these non-mechanistic breaks assumed to occur within the east MSIV compartment, including jet loads and reactions at the pipe anchors. Additionally, Wall 11 for both the east and west MSIV compartments is evaluated for the dynamic and environmental effects of pipe ruptures postulated to occur in the turbine building. As discussed in UFSAR subsection 3.6.1.2.2, the pressurization loads are considered separately from the rest of the HELB loads postulated in the east MSIV compartment. Thus, the proposed changes to UFSAR subsection 3H.5.1.4 clarify how the HELB loads are considered for each MSIV compartment, and provide consistency with UFSAR subsection 3.6.1.2.2.

Evaluation of Proposed Changes

The auxiliary building is a seismic Category I structure and is designed to the design basis earthquake loadings and criteria specified in UFSAR subsections 3.7.1 and 3.7.2, and the additional loads identified in UFSAR subsection 3.8.4.3.1, in accordance with the load combinations identified in UFSAR Table 3.8.4-2 ~~criteria specified in UFSAR subsection 3.7.2~~. The auxiliary building is designed in accordance with the codes and standards identified in UFSAR subsection 3.8.4.2 including ACI 349-01 for concrete structures, and AISC N690-1994 for steel structures, including the supplemental requirements described in UFSAR subsections 3.8.4.4.1, "Seismic Category I Structures," and UFSAR subsection 3.8.4.5, and the guidance contained in NRC Regulatory Guides 1.69, 1.115, 1.142, and 1.143 as discussed in UFSAR Appendix 1A, "Conformance with Regulatory Guides." The proposed changes do not impact conformance with, and thus the auxiliary building will continue to comply with, the requirements specified in UFSAR subsections 3.7.1, 3.7.2, 3.8.4.4.1, and 3.8.4.5, the requirements contained in ACI 349-01, and the guidance contained in NRC Regulatory Guides 1.69, 1.115, 1.142, and 1.143 as discussed in UFSAR Appendix 1A. The proposed changes do not impact the detailed descriptions of the auxiliary building, as provided in UFSAR subsections 3.8.4.1.2 and 3H.2.1.

Table 1 below provides additional information concerning how the design loads defined in UFSAR subsection 3.8.4.3.1 were developed and/or applied in the Wall 11 design and analysis in accordance with the load combinations defined in UFSAR Table 3.8.4-2.

Table 1 - Loads Applied in Wall 11 Design

Design Load		Description
Dead	D	Structure and equipment dead loads applied.
Liquid	F	Applied loading from water pressure analyses of the fuel pools (Fuel transfer canal, spent fuel pool, cask loading pit, and cask washdown pit).
Live	L	Live loading is calculated and applied.
Earth	H	At-rest earth pressure applied during normal operation. Passive earth pressure applied during seismic event. Load applied from EL. 63'-6" to EL. 99'-9".
Design Pressure	P_d	As identified in Note 4 of Table 3.8.4-2, this load is applicable to basemat design only, and does not apply to the Wall 11 analysis.
Normal Reaction	R_o	Normal piping reactions for the main steam, main feedwater, start-up feedwater, and steam generator blowdown lines obtained from applicable piping analysis reports and applied assuming most limiting loads from ASME condition levels A or B as applicable.

Table 1 - Loads Applied in Wall 11 Design		
Design Load		**Description**
Normal Thermal	T_o	Calculated through thermal analysis and applied. Design temperatures identified in UFSAR Table 3H.5-1.
Wind	W	The wind loads required to be considered in Table 3.8.4-2, load combinations 2 and 9 are replaced with flooding loads for the elastic analysis in accordance with ACI 349-01, Section 9.2.7, and are bounded by the seismic loads considered in Table 3.8.4-2, load combinations 3 and 7.
Safe Shutdown Earthquake	E_s	Seismic loads are developed according to the methodology described in UFSAR subsection 3.7.2 and applied.
Tornado	W_t	Tornado loads required to be applied per UFSAR Table 3.8.4-2 were considered in the design of Wall 11. The tornado missile loads associated with the design basis tornado missiles described in UFSAR subsection 3.5.1.4 are evaluated in accordance with the methodology described in UFSAR subsection 3.5.3 and ACI 349-01 and applied. The tornado wind and differential pressure loads required to be considered in Table 3.8.4-2, load combination 4 and subsection 3.8.4.3.1.3 are bounded by the seismic loads considered in Table 3.8.4-2, load combination 3. In accordance with ACI 349-01, Section 9.2.7, tornado wind and differential pressure loads are replaced with flooding loads for the elastic analysis and applied.
Accident Pressure	P_a	A pressure of at least 6.0 psi is applied in the east and west MSIV compartments and in Room 12306 (Valve/Piping Penetration Room), in accordance with UFSAR subsection 3.8.4.3.1.4. A pressure of 6.0 psi is applied for pipe ruptures considered in the turbine building first bay.
Accident Thermal	T_a	Calculated through thermal analysis and applied.
Accident Thermal Reactions	R_a	Accident thermal reactions for the main steam, main feedwater, start-up feedwater, and steam generator blowdown lines obtained from applicable piping analysis reports and applied assuming most limiting loads from ASME condition levels C or D as applicable.
Accident Pipe Reactions	Y_r	Accident piping reaction loads developed from PRHA calculations for the main steam, main feedwater, start-up feedwater, and steam generator blowdown lines are applied.

Table 1 - Loads Applied in Wall 11 Design		
Design Load		**Description**
Jet Impingement	Y_j	Jet impingement loads developed from PRHA calculations for the main steam, main feedwater, start-up feedwater, and steam generator blowdown lines are applied.
Pipe Impact	Y_m	Pipe impact loads developed from PRHA calculations for the main steam, main feedwater, start-up feedwater, and steam generator blowdown lines are applied.

The ~~detail design~~ changes to the reinforcement detailing and development ~~walls~~ in ~~the~~ auxiliary building Wall 11 do not interface with or adversely affect safety-related equipment or a fission product barrier. No system or design function or equipment qualification would be adversely affected by the proposed changes. The changes do not result in a new failure mode, malfunction or sequence of events that could adversely affect a radioactive material barrier or safety-related equipment. The proposed changes do not allow for a new fission product release path, result in a new fission product barrier failure mode, or create a new sequence of events that would result in significant fuel cladding failures.

The proposed changes do not adversely affect any safety-related system or component, equipment, design code, design code allowable value, function or design analysis, nor do they adversely affect any safety analysis input or result, or design/safety margin.

No structure, component or system design function described in the licensing basis is adversely affected by these proposed changes. The function of the auxiliary building to provide support, protection, and separation for the seismic Category I mechanical and electrical equipment located outside the Containment and Shield Building is not adversely affected by these changes. The ability of the auxiliary building to provide protection for the safety-related equipment contained therein against the consequences of either a postulated internal or external event is not affected. The ability of the auxiliary building MSIV compartments to withstand the pressurization effects from the design basis one square foot pipe rupture in the MSIV compartment is not adversely affected by the removal of the Wall 11 upper vent openings, because vents at these locations are not credited in the subcompartment pressurization analysis.

MSIV compartment temperatures following the postulated one square foot pipe rupture with the wall vents removed remain acceptably within the envelope for environmental qualification of equipment in these compartments.

The shielding capability of the auxiliary building for the radioactive equipment and piping inside the building is not adversely affected with these changes. The function of the auxiliary building walls to maintain their structural integrity for the design basis combination of dead load, live load, seismic load and thermal load, as described in the UFSAR, is not adversely affected by

these proposed changes. This activity does not adversely change the auxiliary building design requirement to withstand the dynamic and environmental effects associated with missiles, pipe whipping, and discharging fluids as described in UFSAR Section 3.6.

Because the 3-hour fire rating of the affected walls is maintained, there is no adverse effect on a fire barrier, and no fire analysis load is affected.

The proposed changes do not involve an adverse change to any method of evaluation for establishing design bases or safety analyses. They do not represent a change to a design feature credited in the ex-vessel severe accident assessment. Tests, experiments, and procedures described in the licensing basis are unchanged by this activity.

The proposed activity has no adverse effect on the ex-vessel severe accident. The design, geometry, and strength of the containment internal structures are not changed. The design and material selection of the concrete floor beneath the reactor vessel is not altered. The response of the containment to a postulated reactor vessel failure, including direct containment heating, ex-vessel steam explosions, and core concrete interactions is not altered by the changes to the ~~detail design of floors and roof in the~~ reinforcement detailing and development of auxiliary building Wall 11. The design of the reactor vessel and the response of the reactor vessel to a postulated severe accident are not altered by the changes to the ~~detail design of walls in the~~ reinforcement detailing and development of auxiliary building Wall 11.

The proposed changes to Wall 11 have no adverse effect on the Aircraft Impact Assessment. The proposed changes to Wall 11 include adding reinforcement and concrete to the wall, and do not adversely affect the design strength of the Wall 11. These changes do not adversely impact the design or response of the containment vessel and shield building. The changes do not affect the number and thickness of intervening barriers, as required by NEI 07-13, which are credited in the assessment. There is no change to protection of plant structures, systems, and components against aircraft impact provided by the design of the auxiliary building. There is no change to the design of any of the key design features described in UFSAR Appendix 19F. The activity described does not change the design or construction of the shield building.

The proposed changes to the auxiliary building do not affect the operation of any systems or equipment inside or outside the auxiliary building that could initiate or mitigate abnormal events, e.g., accidents, anticipated operational occurrences, earthquakes, floods and turbine missiles, or their safety or design analyses, evaluated in the UFSAR.

The proposed changes associated with this license amendment request include ~~a~~ changes ~~in~~ to the ~~detail design of~~ reinforcement detailing and development in the auxiliary building wall. The changes are internal to the structures and the configuration, thickness, and density of the structures, except for the removal of the Wall 11 upper vent openings, are not changed.

The proposed changes do not affect the radiological source terms (i.e., amounts and types of radioactive materials released, their release rates and release durations) used in the accident analyses, thus, the consequences of accidents are not affected. These changes do not adversely affect the containment, control, channeling, monitoring, processing or releasing of radioactive and non-radioactive materials. The location and design of penetrations and the

permeability of the concrete structures are ~~is~~ not changed. Removal of the Wall 11 MSIV upper vent openings will result in a somewhat larger proportion of effluent release through the MSIV compartment roof vents for a steam line rupture occurring in a compartment. This change has a negligible effect on the calculated site boundary and low population zone outer boundary doses. The main control room dose calculation assumes the effluent exits through the MSIV compartment roof vent; therefore, this change has no adverse impact on main control room dose.

Consequently there are no changes in dose consequences associated with this change. The types and quantities of expected effluents are not changed. The functionality of the design and operational features that are credited with controlling the release of effluents during plant operation is not diminished. Therefore, neither radioactive nor non-radioactive material effluents are affected.

The proposed changes are unrelated to any aspect of plant construction or operation that would introduce any change to effluent types (e.g., effluents containing chemicals or biocides, sanitary system effluents, and other effluents), or affect any plant radiological or non-radiological effluent release quantities. The proposed changes to the auxiliary building do not adversely affect any plant radiation zones, and controls under 10 CFR 20 preclude a significant increase in occupational radiation exposure. Therefore, the proposed amendment does not involve a significant increase in individual or cumulative occupational radiation exposure.

The thickness of the walls and the density of the concrete are not changed; therefore, there is no adverse change to the shielding provided by the walls. There is no change to plant systems or the response of systems to postulated accident conditions. There is no change to the predicted radioactive releases due to normal operation or postulated accident conditions. Therefore, individual and cumulative radiation exposures do not change.

The proposed activity has no adverse effect on emergency plans or physical security plans, because a vent opening is being filled. The reinforcement changes are internal to the concrete wall. There is no change to any perimeter walls acting as a security barrier or other aspects of the structures that could impact physical security. The change activity has no adverse impact on the emergency plans or the physical security evaluation since there are no changes to the external configuration of the roof, walls, doors, or access to the Nuclear Island.

Summary

The proposed changes would revise the licensing basis documents in regard to the AP1000 auxiliary building north wall at Column Line 11 by: 1) removing the Wall 11 upper vent openings at approximately elevation 148′-9″ - 151′-6″ within the MSIV compartments, 2) changing the ~~detail design of reinforcement in~~ Wall 11 reinforcement detailing and development to conform with ACI 349-01 and ACI 318-11 requirements ~~for detailing and development~~, and 3) clarifying the treatment of HELB loadings within the east MSIV compartment.

These proposed changes do not adversely affect any safety-related equipment, design function, or radioactive material barrier. The proposed changes do not involve a change to any method of evaluation for establishing design bases or safety analyses. They do not represent a change to

a design feature credited in the ex-vessel severe accident assessment. Tests, experiments, and procedures described in the licensing basis are unchanged by these proposed changes.

4. Regulatory Evaluation (See Part 1E)

Part 1B - Use and classification of seismic Category II structures providing a protective function for nonseismic events and for high energy line break (HELB) events in the nonseismic portion of the turbine building

1. Summary Description

Changes are proposed to clarify several UFSAR subsections that identify the safety and seismic classifications of structures that provide protective functions for nonseismic events and for HELB events in the nonseismic portion of the turbine building. These changes, described in Section 2 below, have been determined necessary to support the use of the turbine building first bay building structure, or portions thereof, to provide certain nonsafety-related, but important to safety protective functions. These include use of the turbine first bay Wall 11.2 (Wall 11.2) as a HELB barrier (discussed in Part 1C), and the use of the turbine building first bay building structure and associated missile barriers to protect openings in auxiliary building Wall 11 (Wall 11) from tornado missiles (discussed in Part 1D). These Tier 2 changes were determined to involve the Tier 2* information being revised to reflect changes ~~in the design of~~ to auxiliary building Wall 11 identified in Part 1A, since credit of the seismic Category II turbine building first bay, or portions thereof, for ~~these protective functions~~ the protection of Wall 11 and/or its openings affects the finalization of the Wall 11 design ~~loads applied to Wall 11~~. A technical evaluation of these changes is provided in Section 3 below.

2. Detailed Description

This license amendment request proposes changes to the UFSAR to clarify the use of seismic Category II building structures as protective barriers in mitigating nonseismic events, and specifically, as a HELB ~~pipe whip and jet impingement~~ barrier for piping ruptures postulated in the nonseismic portion of the turbine building, and for protection of Wall 11 openings from tornado missiles. Thus, the proposed changes revise the UFSAR licensing basis to be: 1) clear and consistent with regard to the credit of seismic Category II building structures for protective functions, and 2) clear and consistent with regard to the classification, and thereby the associated quality requirements, of seismic Category II building structures providing a protective function for nonseismic events and for HELB events in the nonseismic portion of the turbine building. The proposed changes also request an exception to the safety classification of tornado missile barriers used on or within the seismic Category II turbine building first bay for protection of Wall 11 openings. Specifically, this change would allow classification of the turbine building first bay tornado missile barriers as seismic Category II, Equipment Class D. These proposed changes support the requested changes to allow use of portions of the turbine building first bay building structure to protect Wall 11 from the dynamic effects of main steam and main feedwater line breaks postulated in the turbine building, and the turbine building first bay and associated tornado missile barriers to protect openings in Wall 11 from the effects of postulated tornado missiles.

The affected UFSAR subsections include:

- UFSAR subsection 3.2.1.1.1, “Seismic Category I (C-I),” which states:

> Seismic Category I applies to, in general, safety-related structures, systems, and components. Seismic Category I also applies to those structures, systems, and components required to support or protect safety-related structures, systems, and components. The exceptions to this general rule are a limited number of structures, such as those required for tornado missile protection, which do not have a safety-related function to perform during or following a seismic event. (See subsection 3.2.2.3.)

The reference to subsection 3.2.2.3 above should be UFSAR subsection 3.2.2.5, which addresses the stated exception.

- UFSAR subsection 3.2.1.1.2, "Seismic Category II (C-II)," which states:

> Seismic Category II applies to plant structures, systems, and components which perform no safety-related function, and the continued function of which is not required.

The above statement appears to conflict with the statements in UFSAR subsection 3.2.1.1.1 and subsection 3.2.2.5 (ninth bullet) which assigns "Equipment Class C" to "equipment" providing a protective function for nonseismic events and states that structures that provide protection for nonseismic events (such as tornado missiles) are not required to be seismic Category I. This is addressed further in Section 3 below, under "Use of Seismic Category II Structures to Provide Protection From Other GDC 2, GDC 4 Events."

- UFSAR subsection 3.2.2.5, "Equipment Class C," which states:

> Class C applies to structures, systems, and components not included in Class A or Class B that are designed and relied upon to accomplish one or more of the following safety-related functions:
>
> - Provide structures and buildings to protect Class A, B, and C structures, systems, and components from events such as internal/external missiles, seismic, and flooding. Structures protecting equipment from nonseismic events are not required to be seismic Category I. (Emphasis added).

This statement conflicts with UFSAR subsection 3.2.1.3, "Classification of Building Structures," which states:

> Building structures are assigned a seismic category as indicated in Table 3.2-2. Codes and standards used in the design and construction of building structures are given in Section 3.8. The building structures are not assigned a safety classification in subsection 3.2.2 with the exception of the containment vessel. (Emphasis added).

UFSAR subsection 3.2.2.5 would also require, without a stated exception, the tornado missile barriers in the turbine building first bay to be equipment Class C.

Accordingly, changes are proposed as identified below to clarify the licensing basis to more clearly identify that seismic Category II structures are acceptable for providing a protective function for tornado and HELB events. Changes are proposed to UFSAR subsections 3.2.1.1.2 and 3.2.2.5 to clearly identify the use of the seismic Category II turbine building first bay as a protective feature for tornado missiles, and turbine building first bay Wall 11.2 as a HELB barrier for piping breaks postulated to occur in the nonseismic portion of the turbine building. Changes are also proposed to UFSAR subsection 3.2.2.5 and 3.2.2.6 to identify acceptability of use of tornado missile barriers classified as seismic Category II, equipment Class D in the turbine building first bay for this protective function.

Licensing Basis Change Descriptions

The following changes are proposed to more clearly identify the requirements associated with use of a seismic Category II building structure as a protective feature for nonseismic events and for HELB events in the nonseismic portion of the turbine building, and identify the classification of associated missile barriers:

1. Revision to UFSAR subsection 3.2.1.1.1, “Seismic Category I (C-I),” first paragraph, to change the reference to the UFSAR subsection discussing the acceptability of using seismic Category II structures as protective features for nonseismic events such as internal/external missiles (change the reference from subsection “3.2.2.3” to “3.2.2.5”). This change provides the appropriate cross-reference within the UFSAR.
2. Revision to UFSAR subsection 3.2.1.1.2, “Seismic Category II (C-II),” as follows:
    a. Revision of the first paragraph to identify that the turbine building first bay building structure is a seismic Category II structure, that the turbine building first bay building structure provides tornado missile protection for openings in Wall 11, and that turbine first bay Wall 11.2 protects Wall 11 from the dynamic effects of pipe failure events postulated to occur in the nonseismic portion of the turbine building,
    b. Revision of the third paragraph to identify that seismic Category II building structures are designed for the safe shutdown earthquake using the same methods and stress limits used for seismic Category I structures, and that seismic Category II structures are also designed to withstand design basis tornado loads, including missiles, in accordance with the load combinations identified in Table 3.8.4-2, and
    c. Revision of the fourth paragraph to specifically identify that the quality requirements described therein apply to the turbine building first bay building structure.
3. Revision to UFSAR subsection 3.2.2.5, “Equipment Class C,” ninth bullet, to remove reference to “buildings,” add the “dynamic and environmental effects of pipe failures” to the list of events for which the structures provide a protective function, identify the equipment Class D tornado missile barriers in the turbine building first bay as an exception to the equipment Class C classification, ~~and~~ provide reference to new UFSAR Table 3.5-1 for identification of the tornado missile protection provided by the turbine building first bay, identify that the turbine building first bay building structure also provides tornado missile protection for openings in Wall 11, and identify that turbine building first bay building structure Wall 11.2 provides protection of Wall 11 from HELB loads resulting from postulated ruptures in main steam and main feedwater piping north of the turbine building first bay.

4. Revision to UFSAR subsection 3.2.2.6, "Equipment Class D," eighth paragraph, to identify that the tornado missile barriers in the turbine building first bay building structure identified in Table 3.5-1 are seismic Category II, equipment Class D.
5. Revision to UFSAR Table 3.2-1, "Comparison Of Safety Classification Requirements," to add new footnote 14, applicable to the third column ("RG 1.29 Seismic Design Reqmnts") for Equipment Class C ("AP1000 Code Letter C") and Equipment Class D ("AP1000 Code Letter D") to identify that the seismic Category II tornado missile barriers located on or within the turbine building first bay and identified in UFSAR subsections 3.2.2.5, 3.2.2.6, and in Table 3.5-1 provide tornado missile protection for openings in auxiliary building Wall 11.

Because these changes are needed to support use of Wall 11.2 as a HELB barrier to protect Wall 11 from the dynamic effects of HELB events postulated to occur north of Wall 11.2, and support use of the turbine building first bay building structure and associated missile barriers to protect Wall 11 openings from ~~for~~ tornado missile~~s protection~~, ~~and the final design of Wall 11 is contingent on its load definitions,~~ these changes are needed to support the finalization of the Wall 11 design. Evaluation of the licensing basis changes in accordance with the requirements contained in 10 CFR Part 52, Appendix D, Section VIII, has determined that NRC approval is required. These Tier 2 changes, identified above, were determined to involve the Tier 2* information being revised to reflect changes ~~in the design of~~ to auxiliary building Wall 11 identified in Part 1A, since credit of the seismic Category II turbine building first bay, or portions thereof, for ~~these protective functions~~ the protection of Wall 11 and/or its openings affects the finalization of the Wall 11 design ~~loads applied to Wall 11~~.

A more detailed description and evaluation of these proposed changes is provided in Section 3 below.

3. Technical Evaluation

Overview

As discussed in Section 2 above, this license amendment request, in part, proposes to clarify 1) credit of the north wall of the turbine building first bay building structure (Wall 11.2) as a barrier providing protection of auxiliary building Wall 11 from the dynamic effects of piping breaks postulated to occur north of Wall 11.2, and 2) credit of the seismic Category II turbine building first bay building structure and associated missile barriers to provide protection of ~~the~~ auxiliary building Wall 11 openings from tornado missiles. As discussed further in Section 2 above, this license amendment request also proposes to revise statements in the licensing basis regarding the use and credit of seismic Category II structures as a protective feature for nonseismic events, and revise UFSAR subsections 3.2.2.5 and 3.2.2.6 to enable classification of the turbine building first bay tornado missile barriers as seismic Category II, equipment Class D.

As identified in UFSAR subsection 3.5.2, "Protection from Externally Generated Missiles," systems required for safe shutdown are protected from the effects of external missiles, including those generated by natural phenomena, by the external walls and roof of the seismic Category I nuclear island structures, and openings in these structures are evaluated on a case-by-case

basis. As part of the AP1000 design philosophy, it was planned to credit adjacent seismic Category II structures to the extent feasible in protecting the nuclear island openings from postulated missiles. As detailed in Section 2 above, the licensing basis identifies, in several areas, the acceptability of using other than seismic Category I structures as a protective feature in mitigation of nonseismic events. However other areas would imply that a safety-related or seismic Category I structure must be used for this purpose. A key difference between seismic Category I and seismic Category II building structures is in the quality assurance requirements applicable to each category.

In the AP1000 design, the quality assurance requirements for building structures are based on its seismic category. Whereas seismic Category I building structures are required to comply with 10 CFR 50, Appendix B in its entirety, seismic Category II building structures are designed and analyzed to the "pertinent portions" of 10 CFR 50, Appendix B. Thus, the construction, installation, and testing of seismic Category II building structures comply with the broader quality assurance program that addresses nonsafety-related equipment "important to safety." In practice, the difference between AP1000 seismic Category I and seismic Category II structures is that seismic Category I structures are designed, analyzed, and constructed to ACI 349-01 for concrete structures and AISC N690-1994 for steel structures, whereas seismic Category II structures are designed and analyzed to ACI 349-01 for concrete structures and AISC N690-1994 for steel structures, and constructed to ACI 318-11 and AISC S335-1989[1].

In the AP1000 ~~certified~~ design, building structures are not assigned a safety classification, with the exception of the containment vessel. Additionally, "building structures" that provide a protective function for nonseismic events such as internal/external missiles are considered "important to safety," but not "safety-related" structures. With the exception of a few statements within the UFSAR that require revision to provide more clarity in the licensing basis, this position is established within the approved AP1000 ~~certified~~ design licensing basis. Additionally, as discussed below, this position is consistent with the NRC's position concerning application of the terms "important to safety" and "safety related" and the level of quality requirements appropriate for these different safety categories. Accordingly, the quality requirements applied to the design and construction of the seismic Category II turbine building first bay building structure are commensurate with the "important to safety" function of providing protection of safety-related equipment from nonseismic events and for HELB events in the nonseismic portion of the turbine building.

The following sections identify the turbine building first bay building structure design, construction, and quality requirements, present the current licensing basis relevant to this portion of the license amendment request, and present a regulatory evaluation of the proposed changes, based on applicable NRC regulations and guidance.

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[1] Note: The UFSAR currently identifies AISC S355 as the code applicable to seismic Category II steel structures. The applicable code reference is AISC S335-1989. This change is being addressed under a separate non-LAR departure.

Turbine Building First Bay Building Structure Design and Construction Requirements

As identified in UFSAR Table 3.2-2, "Seismic Classification of Building Structures," and described further in UFSAR subsection 3.7.2.8.3, "Turbine Building," the turbine building first bay is a seismic Category II structure. Seismic Category II classification is defined in UFSAR subsection 3.2.1.1.2, "Seismic Category II (C-II)," which identifies that pertinent portions of 10 CFR 50, Appendix B apply to the analysis and design.

As identified in UFSAR subsection 3.7.2, "Seismic System Analysis," seismic Category II building structures are designed and analyzed for the safe shutdown earthquake using the same methods and design allowables used for seismic Category I structures, including the load combinations identified in UFSAR Table 3.8.4-2. As identified in UFSAR subsection 3.3.2.3, seismic Category II structures are designed and analyzed to ACI 349-01 for concrete structures and to AISC N690-1994 for steel structures, and constructed to ACI 318-11 for concrete structures, and AISC S335-1989 for steel structures. The design acceptance criteria are based on ACI 349-01 for concrete structures and on AISC N690-1994 for steel structures, including the supplemental requirements described in UFSAR subsections 3.8.4.4.1, "Seismic Category I Structures," and 3.8.4.5, "Structural Criteria."

Current Licensing Basis and Relevant Regulatory Information

Safety Classification of Building Structures

With the exception of the containment vessel, building structures are not given a safety classification. UFSAR subsection 3.2.1.3, "Classification of Building Structures," states:

> Building structures are assigned a seismic category as indicated in Table 3.2-2. Codes and standards used in the design and construction of building structures are given in Section 3.8. The building structures are not assigned a safety classification in subsection 3.2.2 with the exception of the containment vessel.

As identified in Table 3.2-2, the turbine building first bay is categorized as seismic Category II.

Quality Assurance Requirements Applicable to Building Structures

As building structures are not assigned a safety classification in the licensing basis, their quality requirements are based on their seismic categorization. UFSAR subsections 3.2.1.1.1, "Seismic Category I (C-I)," and 3.2.1.1.2, "Seismic Category II (C-II)," identify the quality assurance requirements for seismic Category I and seismic Category II building structures, respectively. As detailed in the aforementioned UFSAR subsections, seismic Category I and seismic Category II SSCs must comply with the pertinent portions of 10 CFR 50, Appendix B. AP1000 licensees and their consortium members address QA requirements for design, analysis, procurement, fabrication, installation, construction, and testing of SSCs through conformance with their respective QA programs. Because the consortium members' QA programs conform with ASME NQA-1, it is concluded that the QA programs developed to support design, analysis, procurement, fabrication, installation, construction, and testing of SSCs considered important to safety meet the quality requirements contained in the current

licensing basis, and are adequate to support the capability of SSCs considered important to safety to perform their intended design functions.

Seismic Classification of Structures Providing a Protective Function for Nonseismic Events

As discussed previously, the current licensing basis documents the original design intent to use and credit other than seismic Category I buildings as protective structures for nonseismic events in several areas. UFSAR subsection 3.2.1.1.1, "Seismic Category I (C-I)," states:

> Seismic Category I applies to, in general, safety-related structures, systems, and components. Seismic Category I also applies to those structures, systems, and components required to support or protect safety-related structures, systems, and components. The exceptions to this general rule are a limited number of structures, such as those required for tornado missile protection, which do not have a safety-related function to perform during or following a seismic event. (See subsection 3.2.2.3.)[2] (Emphasis added).

Thus, the above statement identifies the intent to use and credit structures not classified as seismic Category I as protective features or barriers for safety-related structures, systems, and components if the structure does not have a safety-related function to perform during or following a seismic event. The use of structures not qualified to seismic Category I for the nonseismic event of providing tornado missile protection is stated explicitly.

Similarly, UFSAR subsection 3.2.1.2, "Classifications," states:

> Table 3.2-1 illustrates the general relationship between safety-related equipment classes and seismic categories. In most cases, except as noted in subsection 3.2.2.5, safety-related items are also seismic Category I items.

Again, UFSAR subsection 3.2.1.2 also points to the exception in UFSAR subsection 3.2.2.5, which states:

> Class C applies to structures, systems, and components not included in Class A or Class B that are designed and relied upon to accomplish one or more of the following safety-related functions:
>
> - Provide structures and buildings to protect Class A, B, and C structures, systems, and components from events such as internal/external missiles, seismic, and flooding. Structures protecting equipment from nonseismic events are not required to be seismic Category I. (Emphasis added).

Thus, UFSAR subsections 3.2.1.1.1 and 3.2.2.5 statements both state explicitly in the current licensing basis that structures not classified as seismic Category I (e.g., seismic Category II

[2] This cross reference should be "subsection 3.2.2.5." Revision of this cross-reference is included with the proposed changes accompanying this license amendment request.

structures) which have a function to protect safety-related equipment from nonseismic events need not be seismic Category I. UFSAR subsection 3.2.1.2 further highlights this exception via reference to UFSAR subsection 3.2.2.5.

The credit of seismic Category II structures for protection of safety related structures, systems, and components was addressed during the V.C. Summer, Units 2 and 3 ~~combined operating~~ COL NRC licensing~~e~~ ~~proceedings~~ review. By letter dated May 27, 2010 (ML101520188), Westinghouse provided Revision 2 of its response to RAI COL03.05.01.04-1, which addressed protection from the automobile tornado missile. While not part of the current licensing basis, Westinghouse identified in its response its intention to credit the Annex building (a seismic Category II structure) in providing tornado missile protection for openings in the east side of the auxiliary building, where it states (emphasis added):

> There are no structures, systems, and components (SSCs) located on the exterior of the AP1000 standard design facilities at any elevation that require protection from tornado missiles. The systems and components required to shut down the reactor, address transient conditions, and mitigate postulated accidents are protected by the reinforced concrete walls of the shield building and auxiliary building. Openings created by doors are on the East side of the Nuclear Island. The Annex building provides protection, and the roll-up door at the fuel handling area has no systems in the vicinity that are required for safe shutdown. (Emphasis added).

Thus, in addition to the statements contained in UFSAR subsections 3.2.2.5, and the references to it in UFSAR subsections 3.2.1.1.1, and 3.2.1.2, the intent to use seismic Category II structures to provide tornado missile protection was identified in this RAI response.

Safety Classification of Structures Providing a Protective Function for Nonseismic Events

As discussed above, UFSAR subsection 3.2.2.5 identifies the provision of structures to protect Class A, B, and C structures from events "…such as internal/external missiles, seismic, and flooding…" as a safety-related, equipment Class C function. As discussed further in the "Evaluation" section below, this licensing amendment request, in part, seeks NRC approval to apply an exception to this Equipment Class C classification criterion to enable classification of the turbine building first bay tornado missile barriers as seismic Category II, Equipment Class D.

Summary

The current licensing basis identifies the acceptability of using barriers and structures not designed and constructed to seismic Category I requirements as protective features for safety-related equipment. The intent to credit seismic Category II structures in the evaluation and protection of nuclear island openings from tornado missiles is also supported by Westinghouse's response to RAI COL03.05.01.04-1 in support of the V.C. Summer COL NRC licensing ~~proceedings~~ review.

However, as detailed in Section 2 above, several areas within the current licensing basis that impact the safety and seismic classifications associated with SSCs credited in providing protection of Equipment Class A, B, and C SSCs from events such as internal/external missiles,

seismic, and flooding, and the dynamic effects of pipe failures (specifically for HELB events in the nonseismic portion of the turbine building), require clarification. Additionally, an exception to the current licensing basis requirements that require tornado missile barriers to be equipment Class C is requested for the tornado missile barriers being provided in the turbine building first bay. An exception to the current licensing basis requirements for seismic Category I building structures is also needed for HELB events in the nonseismic portion of the turbine building.

Evaluation

NRC Requirements Applicable to Protective Barrier Design

The NRC requirements associated with protective barrier design are as identified in the NRC Standard Review Plan (NUREG-0800), Section 3.5.3, "Barrier Design Procedures." These requirements include 10 CFR 50, Appendix A, General Design Criterion (GDC) 2 which states:

> Criterion 2—Design bases for protection against natural phenomena. Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (3) the importance of the safety functions to be performed. (Emphasis added).

Thus, GDC 2 requires that structures, systems, and components "important to safety" are "designed" to withstand the effects of natural phenomena, including earthquakes and tornados, without the loss of "their safety function."

The requirements also include 10 CFR 50, Appendix A, GDC 4, which states:

> Criterion 4—Environmental and dynamic effects design bases. Structures, systems, and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. These structures, systems, and components shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit. However, dynamic effects associated with postulated pipe ruptures in nuclear power units may be excluded from the design basis when analyses reviewed and approved by the Commission demonstrate that the probability of fluid system piping rupture is extremely low under conditions consistent with the design basis for the piping. (Emphasis added).

Thus, GDC 4 requires that structures, systems, and components "important to safety" be designed to accommodate the environmental effects of, and be "appropriately protected" against dynamic effects, including missiles that may result from either internal or external events.

10 CFR 50, Appendix A, GDC 1 also applies:

> Criterion 1—Quality standards and records. Structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be identified and evaluated to determine their applicability, adequacy, and sufficiency and shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function. A quality assurance program shall be established and implemented in order to provide adequate assurance that these structures, systems, and components will satisfactorily perform their safety functions. Appropriate records of the design, fabrication, erection, and testing of structures, systems, and components important to safety shall be maintained by or under the control of the nuclear power unit licensee throughout the life of the unit. (Emphasis added).

Accordingly, GDC 1 identifies the requirement to establish a quality assurance program for structures, systems, and components "important to safety" to be designed, fabricated, erected, and tested "commensurate with the importance of the safety functions to be performed."

Summary

To summarize, as it pertains to the subject matter in this amendment request, General Design Criteria 1, 2, and 4 collectively require that:

- SSCs "important to safety" shall be designed to withstand effects of severe natural phenomena, including earthquakes and tornados without loss of capability of performing their "safety function,"
- SSCs "important to safety" shall be designed to withstand the environmental effects of internal and external events,
- SSCs "important to safety" shall be "appropriately protected" against dynamic effects, including pipe whip, jet impingement, and missiles, and
- SSCs "important to safety" shall be designed, fabricated, erected, and tested to quality standards "commensurate with the importance of the safety functions to be performed."

"Safety Function" vs. "Important to Safety" and Applicable Quality Assurance Requirements

"Safety-related" is defined in 10 CFR 50.2:

> *Safety-related* structures, systems and components means those structures, systems and components that are relied upon to remain functional during and following design basis events to assure:
>
> (1) The integrity of the reactor coolant pressure boundary
>
> (2) The capability to shut down the reactor and maintain it in a safe shutdown condition; or
>
> (3) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to the applicable guideline exposures set forth in § 50.34(a)(1) or § 100.11 of this chapter, as applicable.

"Important to safety" is not formally defined in 10 CFR 50 or 10 CFR 52; however, 10 CFR 50.49 implicitly provides a definition of "important to safety" as it pertains to the 10 CFR 50.49 requirements:

> (b) Electric equipment important to safety covered by this section is:
>
> (1) Safety-related electric equipment.[3]
>
> (i) This equipment is that relied upon to remain functional during and following design basis events to ensure—
>
> (A) The integrity of the reactor coolant pressure boundary;
>
> (B) The capability to shut down the reactor and maintain it in a safe shutdown condition; or
>
> (C) The capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guidelines in § 50.34(a)(1), § 50.67(b)(2), or § 100.11 of this chapter, as applicable.
>
> (ii) Design basis events are defined as conditions of normal operation, including anticipated operational occurrences, design basis accidents, external events, and natural phenomena for which the plant must be designed to ensure functions (b)(1)(i) (A) through (C) of this section.
>
> (2) Non-safety-related electric equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions specified in subparagraphs (b)(1)(i)(A) through (C) of paragraph (b)(1) of this section by the safety-related equipment. (Emphasis added).

Thus, 10 CFR 50.49 implicitly defines "important to safety" to be a greater set of electrical equipment than defined as "safety-related," consisting of both "safety-related" and "non-safety-related" electrical equipment whose failure under postulated environmental conditions could prevent accomplishment of a "safety function." Therefore, nonsafety-related equipment whose

failure under accident conditions could adversely affect safety-related equipment must be demonstrated to withstand those conditions and not fail in such a manner that could prevent accomplishment of a safety function.

NRC Generic Letter 84-01, “NRC Use of the Terms”, "Important to Safety" and "Safety Related," dated January 5, 1984 (ML031150515), addresses this issue directly, as well as the difference in quality assurance requirements associated with these categories of equipment. NRC Generic Letter 84-01 was issued to respond to concerns expressed by the Utility Classification Group concerning interpretation of the terms “important to safety” and “safety-related.” Enclosure 2 of Generic Letter 84-01, which was the NRC’s response to the Utility Classification Group concerns, clearly sets forth the differences between these terms:

> As you are aware, the position taken in that memorandum was that "important to safety" and "safety-related" are not synonymous terms as used in Commission regulations applicable to nuclear power reactors. The former encompasses the broad scope of equipment covered by Appendix A to 10 CFR Part 50, the General Design Criteria, while the latter refers to a narrower subset of this class of equipment defined in Appendix A to 10 CFR Part 100 Section VI(a)(1) and, more recently, in 10 CFR 50.49(b)(1). Based on such a distinction between these terms, it generally has been staff practice to apply the quality assurance requirements of Appendix B to 10 CFR Part 50 only to the narrower class of "safety-related" equipment, absent a specific regulation directing otherwise. (Emphasis added).

The NRC response continues, addressing the quality assurance aspects of this difference:

> More importantly, however, this does not mean that there are no existing NRC requirements for quality standards or quality assurance programs for the broader class of nuclear power plant equipment which does not meet the definition of "safety-related." General Design Criterion 1 requires quality standards and a quality assurance program for all structures, systems and components "important to safety." These requirements, like those of Appendix B to 10 CFR Part 50, are "graded" in that GDC 1 mandates the application of quality standards and programs "commensurate with the importance of the safety functions to be performed," and expressly allows the use of "generally recognized codes and standards" where applicable and sufficient. Documentation and record keeping requirements for such equipment are likewise graded. Pursuant to our regulations, permittees or licensees are responsible for developing and implementing quality assurance programs for plant design and construction or for plant operation which meet the more general requirements of GDC 1 for plant equipment "important to safety," and the more prescriptive requirements of Appendix B for "safety-related" plant equipment. (Emphasis added).

And finally:

> Rather, our practice was based upon the staff view that normal industry practice is generally acceptable for most equipment not covered by Appendix B within this class. Nevertheless, in specific situations in the past where we have found that

> quality assurance requirements beyond normal industry practice were needed for equipment "important to safety," we have not hesitated in imposing additional requirements commensurate with the importance to safety of the equipment involved. We intend to continue that practice. (Emphasis added).

Thus, Generic Letter 84-01 states very clearly that:

- SSCs “important to safety” include both “safety-related” SSCs and nonsafety-related SSCs,
- GDC 1 mandates application of quality standards and programs "commensurate with the importance of the safety functions to be performed,” and expressly allows the use of "generally recognized codes and standards" where applicable and sufficient,
- Thus, quality assurance requirements for nonsafety-related equipment “important to safety” are graded; “normal industry practice” is generally acceptable for most “important to safety” equipment not covered by Appendix B, and
- Licensees are responsible for developing a quality assurance program that meets:
  - The more general requirements of GDC 1 for equipment “important to safety;” and
  - The more prescriptive requirements of Appendix B for “safety-related” plant equipment.

Generic Letter 84-01 makes a clear distinction between the terms “safety-related,” and “important to safety,” where “important to safety” includes “the broad scope of equipment” covered by 10 CFR 50, Appendix A General Design Criteria, and “safety-related” refers to the equipment defined in 10 CFR 50.2, 10 CFR 50.49(b)(1), and Appendix A to 10 CFR Part 100, Section VI(a)(1). Generic Letter 84-01 also indicates that, generally, 10 CFR 50 Appendix B quality assurance programs apply to safety-related SSCs, whereas “generally recognized codes,” and “normal industry practice,” are generally acceptable for most “important to safety” equipment not covered by Appendix B.

Other relevant guidance appears consistent with this position. NUREG-0800, “NRC Standard Review Plan,” (SRP) Section 3.5.3, “Barrier Design Procedures,” identifies procedures acceptable to the staff for evaluating barrier penetration resistance and structural response for missile barriers, whether the barriers are classified as seismic Category I structures or are another classification of shield or barrier, (e.g., seismic Category II). This is acknowledged in the SRP 3.5.3 “Evaluation Findings” text:

> The use of these procedures provides reasonable assurance that in the event of design basis missiles striking seismic Category I structures or other missile shields and barriers, the structural integrity of the structures, shields and barriers will not be impaired or degraded to an extent that will result in a loss of required protection. Seismic Category I systems and components protected by these structures are, therefore, adequately protected against the effects of missiles and will perform their intended safety function, if needed. Conformance with these procedures is an acceptable basis for satisfying in part the requirements of General Design Criteria 2 and 4. (Emphasis added).

It is also noteworthy that the stated criteria for providing reasonable assurance that the barriers will successfully perform their protective function is the application or "use" of the missile barrier design procedures, and that "conformance with these procedures" is an acceptable basis for satisfying the applicable portions (i.e., tornado events) of General Design Criteria 2 and 4.

The above ~~language~~ SRP 3.5.3 language is also used in NUREG-1793, Vol. 1, "AP1000 Final Safety Evaluation Report," (AP1000 FSER) section 3.5.3, "Barrier Design Procedures," where the NRC documented its acceptance of the AP1000 barrier design:

> The use of these procedures provides reasonable assurance that if a design-basis missile should strike a seismic Category I structure or other missile shields and barriers, the structures, shields, and barriers will not be impaired or degraded to an extent that will result in a loss of required protection. Seismic Category I systems and components protected by these structures will, therefore; be adequately protected against the effects of missiles and will be capable of performing their intended safety functions. Conformance with these procedures is an acceptable basis for satisfying the requirements of GDC 2 and 4, as they relate to the capabilities of the structures, shields, and barriers to provide sufficient protection to equipment that must withstand the effects of natural phenomena (tornado missiles) and environmental effects, including the effects of missiles, pipe whipping, and discharging fluids. (Emphasis added).

Thus, as documented in Section 3.5.3 of the AP1000 FSER, the stated basis for NRC acceptance of the AP1000 missile barrier design is application and use of the missile barrier design procedures included in SRP section 3.5.3, "Barrier Design Procedures." As documented in UFSAR subsection 3.5.3, "Barrier Design Procedures," the design procedures provided in SRP 3.5.3 are the procedures used for design of AP1000 missile barriers.

Use of Seismic Category II Structures to Provide Protection From Other GDC 2, GDC 4 Events

As discussed above, existing NRC requirements and guidance draw a clear distinction between "safety-related" and "important to safety," and their associated quality assurance requirements. The use of protective structures that do not meet the definition of "safety-related" but serve a function considered "important to safety" are used for other accidents and events. There are several precedents that apply this distinction.

The most salient example, or precedent of use of seismic Category II structures to provide an important to safety function is their use in protecting seismic Category I safety-related structures, systems, and components from adverse effects associated with the safe shutdown earthquake. The current licensing basis defines "seismic Category II" in UFSAR subsection 3.2.1.1.2 as follows:

> Seismic Category II applies to plant structures, systems, and components which perform no safety-related function, and the continued function of which is not required. Seismic Category II applies to structures, systems, and components designed to prevent their collapse under the safe shutdown earthquake. Structures, systems and components are classified as seismic Category II to

> preclude their structural failure during a safe shutdown earthquake or interaction with seismic Category I items which could degrade the functioning of a safety-related structure, system, or component to an unacceptable level, or could result in incapacitating injury to occupants of the main control room.
>
> Seismic Category II structures, systems, and components are designed so that the safe shutdown earthquake does not cause unacceptable structural failure of or interaction with seismic Category I items. (Emphasis Added).

As stated in the above definition, seismic Category II applies to SSCs that do not perform a safety-related function, and the continued function of which is not required. Unlike seismic Category I SSCs, which must withstand the safe shutdown earthquake loads and continue to function and/or support seismic Category I SSCs, a seismic Category II structure must only withstand the safe shutdown earthquake loads for the duration of that loading event and meet its important to safety acceptance criteria of not adversely impacting seismic Category I SSCs. This is accomplished via design and analysis of seismic Category II structures to the same standards and codes, design requirements, load combinations, methodology and quality program used for seismic Category I structures, and construction of seismic Category II structures to the standards and quality assurance requirements which have been determined to be acceptable in the AP1000 ~~certified~~ approved design for accomplishing their design function of preventing adverse interaction with seismic Category I SSCs. Accordingly, the design, construction, and quality requirements applied to seismic Category II structures have been determined to be adequate to fulfill their design function for the safe shutdown earthquake to comply with 10 CFR 50, Appendix A, GDC 2.

Approval of the proposed changes to clarify use of the seismic Category II turbine building first bay for protecting safety-related equipment from tornado missiles (addressed in GDC 2 and GDC 4), and from pipe ruptures (addressed in GDC 4), would only authorize credit of the same structure for other events also addressed by GDC 2 (tornados, floods) and GDC 4 ("the effects of missiles, pipe whipping, and discharging fluids," that may result from events outside the plant). UFSAR subsection 3.2.2.5 identifies the acceptability of using seismic Category II structures for protection against some of the events identified in GDC 2 and GDC 4 ("nonseismic events" "…such as internal/external missiles, ~~seismic,~~ …flooding.").

Consistent with the design function of seismic Category II SSCs as defined in UFSAR subsection 3.2.1.1.2, and the application of that design function in the evaluation of seismic Category II structures for the earthquake event, use and credit of the seismic Category II turbine building first bay or portions thereof for protection of Wall 11 against the dynamic effects from HELB ~~effects and/or~~ events postulated to occur north of Wall 11.2, and/or protection of Wall 11 openings from tornado missiles involves demonstration that the structure can withstand its design basis loading for a given event, while maintaining its integrity. Meeting these criteria demonstrate the seismic Category II structure can fulfill an important to safety barrier function to provide protection against tornado missiles and HELB effects for the duration of those applied loads, while no "continued function" of the structure is required.

HELB events that could be postulated to occur concurrent with the safe shutdown earthquake are also addressed in the design of seismic Category II structures. As discussed above, seismic Category II structures are designed and analyzed to the same standards and codes, design requirements, load combinations, and methodology used for design of seismic Category I structures. The required loading combinations are identified in UFSAR Tables 3.8.4-1 and 3.8.4-2. Loading combination No. 7 in each table requires consideration of HELB loads concurrent with the safe shutdown earthquake. Accordingly, seismic Category II structures are designed and analyzed to a load combination that includes HELB loads concurrent with the safe shutdown earthquake loads, and demonstrated to meet the acceptance criteria contained in ACI 349-01 for concrete structures and AISC N690-1994 for steel structures for the duration of the loading events. No continued function of the structure is required following the initial loading period.

Accordingly, use of the seismic Category II turbine building first bay, or portions thereof, as a barrier protecting safety-related equipment from the effects of HELB or tornado missiles is essentially just an extension of the credit for a structure determined to be acceptable for mitigating the GDC 2 earthquake event, to another GDC 2 event (tornado), and a GDC 4 event (HELB). Like with the earthquake event, the turbine building first bay is analyzed to the loading(s) associated with the tornado and HELB events, and demonstrated to meet the acceptance criteria contained in ACI 349-01 for concrete structures and AISC N690-1994 for steel structures, with no further acceptance criteria other than to maintain its integrity following these loadings. Thus, as with the earthquake event, following the initial loading, no continued function of the structure is required. Thus, the use and acceptance of seismic Category II structures (and their associated design, analysis, construction, and quality requirements) for mitigation of the earthquake event has direct relevance to the use of seismic Category II structures to provide protection from tornado missiles and HELB effects.

The design, analysis, construction, and quality assurance requirements associated with AP1000 seismic Category II structures were reviewed and approved by the NRC as documented in the AP1000 FSER, Section 3.7.2.8.1, “Annex Building,” which states:

> The annex building is classified as seismic Category II and the minimum clearance between the structural elements of this building above grade and the NI is 10.2 cm (4 in.). As stated in DCD Tier 2, Section 3.2.1.1.2, seismic Category II SSCs are designed to prevent their collapse under the SSE and to preclude their structural failure during an SSE or interaction with SC-I items. Either of these outcomes could degrade the functioning of a safety-related SSC to an unacceptable level, or could result in an incapacitating injury to the occupants of the MCR. The applicant also states in DCD Tier 2, Section 3.7.2 that seismic Category II building structures are designed for the SSE using the same method and allowable limits as those used for seismic Category I structures. In addition, during the review meetings, the staff examined the design calculations and found that the 10.2 cm (4 in.) clearance between the annex building and the NI will prevent any interaction between these two buildings. On the basis of the above

> discussion, the staff finds that the interaction from the annex building to the NI will not be a concern in the event of an SSE.

And in AP1000 FSER Section 3.2.1:

> To satisfy Position C.4 of RG 1.29, the pertinent QA requirements of Appendix B to 10 CFR Part 50 should apply to all seismic Category II SSCs. In DCD Tier 2, Section 3.2.1.1.2, the applicant stated that pertinent portions of 10 CFR Part 50, Appendix B are applicable to the AP1000 seismic Category II SSCs. Accordingly, the staff concludes that this represents an acceptable commitment to item (2) above and is consistent with Position C.4 of RG 1.29.

Thus, for the earthquake event, which is one of several natural phenomena within the scope of GDC 2, the NRC has accepted the design and analysis methods, industry codes used, and quality assurance requirements associated with seismic Category II structures for the purpose of protecting safety-related, seismic Category I structures, systems, and components from adverse effects of the earthquake event, and ultimately to protect against the loss of the safety function of a safety-related SSC.

In the AP1000 ~~certified~~ approved design, seismic Category II design, analysis, and quality assurance program requirements were determined to be acceptable for the purpose of preventing unacceptable interaction between a seismic Category II structure and an adjacent seismic Category I structure. Accordingly, the design, analysis, construction and quality of a seismic Category II structure has been determined to be acceptable for protecting safety-related or seismic Category I SSCs during the earthquake event, one of the natural phenomena addressed in 10 CFR 50 Appendix A, GDC 2. This license amendment requests approval of the credit of a seismic Category II structure to protect against other events addressed in GDC 2 and GDC 4, namely, tornado missile events and HELB ~~pipe whip~~ events. Thus, the NRC is being requested to approve the credit and use of the same structure subjected to different load cases, which are required already as part of the design and analysis of the structure.

The quality assurance programs established to design and construct seismic Category II structures are considered reasonable and appropriate, and graded to enable successful performance of these structures under accident or event loading conditions, are commensurate with the importance of the safety functions being performed, and thus provide adequate assurance that the public health and safety will be protected.

Finally, it is worthy of noting that while not an event addressed by the general design criteria, as discussed in UFSAR Appendix 19F, turbine building first bay Wall 11.2 is a key design feature for the protection of the auxiliary building from the impact of a large commercial aircraft, credited to assist in mitigating damage and fire spread from the event.

Safety Classification of Structures Providing a Protective Function for Nonseismic Events

As discussed above, UFSAR subsection 3.2.2.5 identifies the provision of structures to protect Class A, B, and C structures from events "…such as internal/external missiles, seismic, and

flooding…" as a safety-related, equipment Class C function. While these protective functions are currently classified in the AP1000 licensing basis as a safety-related function, these functions better align with a nonsafety-related, but "important to safety" function as discussed above. However, this license amendment request does not propose that all such non-building structures providing one of these protective functions be classified as nonsafety-related equipment Class D. Rather, with regard to this safety classification, this license amendment request seeks an exception to this equipment Class C classification only for the tornado missile barriers provided on or within the turbine building first bay.

The turbine building first bay missile barriers are proposed to be classified as seismic Category II, equipment Class D since 1) this classification aligns with the philosophy outlined in NRC Generic Letter 84-01, which indicates that a classification of nonsafety-related, but "important to safety" is appropriate for this protective function, 2) the level of quality applied to Equipment Class D SSCs, which although non-safety related, contains additional requirements on procurement, inspection, or monitoring, which is in line with the level of quality expected for nonsafety-related, but "important to safety," functions, and 3) the level of quality applied to equipment Class D SSCs corresponds with the level of quality applied to seismic Category II structures, such as the turbine building first bay building structure, and thus commensurate with the level of quality of the structure to which they are mounted and structurally supported by (turbine building first bay building structure).

Conclusions

The turbine building first bay is a robust reinforced concrete structure, classified as seismic Category II, designed and analyzed for tornado loads and for tornado missile impacts, and credited as a key design feature for the protection of the auxiliary building from the impact of a large commercial aircraft. It is designed and analyzed to the same codes (ACI 349-01, AISC N690-1994), same load combinations, as applicable, and subject to the same acceptance criteria as seismic Category I structures.

The NRC requirements applicable to the use and credit of a structure for protection against natural phenomena are embodied in 10 CFR 50, Appendix A, General Design Criterion 2. The NRC requirements applicable to the use and credit of a structure for protection against the environmental and dynamic effects associated with both internal and external events are embodied in 10 CFR 50, Appendix A, General Design Criterion 1. The NRC requirements applicable to quality assurance for equipment important to safety are embodied in 10 CFR 50, Appendix A, General Design Criterion 4. The application of GDC 1 and GDC 2 have included a distinction between equipment "important to safety" and equipment that is "safety-related" or having a "safety function," as discussed in Generic Letter 84-01. GDC 1 identifies the requirement to design and construct SSCs to quality standards "commensurate with the importance of the safety functions to be performed." Generic Letter 84-01 and 10 CFR 50.49(b)(2) provide insight on the meaning of these terms, drawing a clear distinction between "safety-related" and "important to safety," and identifying that safety-related SSCs are generally subject to a 10 CFR 50, Appendix B program, whereas quality assurance programs for nonsafety-related equipment important to safety are generally based on normal industry practice and generally recognized codes and standards.

The quality assurance program applied to the design and construction of the seismic Category II turbine building first bay is consistent with the general quality assurance program requirements described in Generic Letter 84-01, in that it is graded. The design and analysis of the structures have been performed under a 10 CFR 50, Appendix B program, using design methods described in UFSAR subsections 3.5.3 and 3.8.4 and the guidance contained in NRC Regulatory Guide 1.142 as described in UFSAR Appendix 1A, and in accordance with the acceptance criteria provided in ACI 349-01 for concrete structures, and AISC N690-1994 for steel structures, the industry codes for designing and constructing safety-related concrete and steel structures, and seismic Category I building structures. The construction of the turbine building first bay is also subject to a quality assurance program that complies with the pertinent portions of 10 CFR 50, Appendix B, and thus appropriate to nonsafety-related SSC's determined to be "important to safety." The construction of the seismic Category II turbine building first bay is performed to recognized industry codes and standards. Control of supply quality is addressed via the procurement process. Inspection of the construction is performed by qualified line organization personnel. Thus, the quality controls in place for the design and construction of the seismic Category II turbine building first bay are reasonable and appropriate, commensurate with the importance of the safety functions to be performed, and consistent with the guidance contained in NRC Generic Letter 84-01.

The NRC reviewed and accepted the AP1000 quality assurance program for seismic Category II structures as part of the AP1000 design certification process, at a minimum, with the knowledge that seismic Category II building structures had the protective function of preventing adverse interaction with adjacent seismic Category I structures. Thus, the NRC accepted the quality assurance program for seismic Category II structures, including those applied during construction, for the earthquake event. The tornado missile event, and HELB events are merely different load cases analyzed for the same structure.

SRP 3.5.3 acknowledges the possibility that there may be missile barriers designed to other than seismic Category I requirements, and bases its reasonable assurance findings upon application of the design procedures contained therein, consistent with the NRC's reasonable assurance findings that the AP1000 missile barriers will provide their intended protective function.

The classification of the turbine building first bay tornado missile barriers as seismic Category II, equipment Class D is consistent with their "important to safety" function, and corresponds with the level of quality applied to the turbine building first bay to which they are mounted and by which they are structurally supported.

Based on the above, the design and analysis methods and controls, use of the barrier design procedures contained in SRP 3.5.3, and the quality assurance program applied to design, analysis, and construction of the turbine building first bay are considered sufficient and there is reasonable assurance that the seismic Category II structures will perform their protective function if struck by a tornado missile, or subjected to the dynamic effects of a HELB, including a whipping pipe.

4. Regulatory Evaluation (See Part 1E)

Part 1C - Use of turbine building first bay Wall 11.2 as a HELB barrier for postulated breaks in the nonseismic portion of the turbine building

1. Summary Description

Changes are proposed to the UFSAR to use the north wall of the seismic Category II turbine building first bay Wall 11.2 (Wall 11.2) as a HELB barrier providing the important to safety design function of providing protection of auxiliary building Wall 11 (Wall 11) from the effects of pipe breaks postulated to occur north of Wall 11.2. As identified in UFSAR subsection 3.2.1.3, "Classification of Building Structures," with the exception of the containment vessel, building structures are not assigned a safety classification. Thus, these proposed changes request NRC approval of use of seismic Category II Wall 11.2 as a HELB barrier.

Section 2 briefly discusses the proposed use of Wall 11.2 as a HELB barrier, and identifies additional UFSAR changes to clarify this design function.

A technical evaluation of these changes is provided in Section 3 below.

2. Detailed Description

General Description of Qualification of Turbine Building First Bay Wall 11.2 as a HELB Barrier

The auxiliary building, including Wall 11, is designed and constructed to seismic Category I requirements. The turbine building first bay is immediately adjacent to the north side of auxiliary building Wall 11, and is designed to seismic Category II requirements to preclude its structural failure or adverse interaction with the seismic Category I auxiliary building during a safe shutdown earthquake. Wall 11.2 is the north wall of the turbine building first bay.

The AP1000 pipe rupture hazards analysis (PRHA) is performed to identify and address the consequences of ruptures in containment and auxiliary building piping, and ruptures in turbine building piping for effects on the Nuclear Island structures, systems, and components (SSCs). Identification of pipe rupture locations, with the exception of the request to credit Wall 11.2 as a HELB barrier to protect Wall 11, and evaluation of the dynamic and environmental effects of pipe ruptures on Wall 11 is consistent with the methodology described in UFSAR subsection 3.6.1, which was reviewed and approved by the NRC during the certification of the AP1000 design Main steam and main feedwater piping in the nonseismic turbine building is not seismically qualified. In accordance with the pipe break criteria in UFSAR subsection 3.6.2.5, breaks are postulated at every fitting and terminal end for piping that has not been seismically analyzed. For breaks in high energy piping postulated to occur in the nonseismic portion of the turbine building (north of Wall 11.2) with the potential for impacting Wall 11, bounding HELB ~~pipe whip and jet impingement~~ loads are applied to Wall 11.2 as a result of the bounding postulated breaks. ~~For simplicity, the pipe rupture loads assumed to act on Wall 11.2 will be referred to hereinafter as "the dynamic effects" of piping ruptures postulated north of Wall 11.2.~~

Thus, Wall 11.2 has been analyzed and determined to be capable of withstanding the loads resulting from the dynamic and environmental effects of piping ruptures postulated to occur north of the turbine building first bay in conjunction with the required load combinations identified in UFSAR subsection 3.8.4. This analysis, including credit for Wall 11.2 as a HELB barrier protecting Wall 11 from the effects of HELB events postulated to occur north of Wall

11.2, establishes the technical basis for excluding HELB ~~pipe whip~~ loads for these breaks from the analysis of auxiliary building Wall 11. For high energy pipe breaks postulated to occur within the turbine building first bay, separate analyses demonstrate the capability of Wall 11 to withstand the HELB loads in conjunction with the load combinations required in UFSAR subsection 3.8.4.

However, as discussed in Part 1B, Section 2, UFSAR subsections 3.2.1 and 3.2.1.1.2 imply that seismic Category II applies to structure, systems, and components that are not required to perform a function, other than to prevent adverse interaction with seismic Category I~~4~~ structures, systems, or components during a seismic event. Thus, credit of Wall 11.2 as a HELB barrier for protection of Wall 11 from the effects of HELB events postulated to occur north of Wall 11.2 imposes a design function upon the wall which appears to conflict with some of the existing licensing basis language as explained in Part 1B, Section 2.

Screening and evaluation of this proposed change under 10 CFR Part 52, Appendix D, Section VIII has determined that NRC approval is required. The Tier 2 changes identified below were determined to involve the Tier 2* information being revised to reflect changes ~~in the design of~~ to auxiliary building Wall 11 identified in Part 1A, since credit of the seismic Category II turbine building first bay, or portions thereof, for ~~these protective functions~~ the protection of Wall 11 and/or its openings affects the finalization of the Wall 11 design ~~loads applied to Wall 11~~.

Analysis of Wall 11.2 for the dynamic and environmental effects of piping ruptures postulated north of Wall 11.2 has confirmed the capability of Wall 11.2 to withstand these loadings. This analysis evaluated the postulated HELB loads on Wall 11.2 in conjunction with the required load combinations identified in UFSAR subsection Table 3.8.4-2, “Load Combinations and Load Factors for Seismic Category I Concrete Structures,” and determined that Wall 11.2 continues to meet the acceptance criteria applicable to seismic Category II structures described in UFSAR subsection 3.7.2. Further details concerning this evaluation are discussed in Section 3 below.

Licensing Basis Change Descriptions

In addition to the proposed changes regarding the use and credit of seismic Category II structures as a protective feature for nonseismic events identified in Part 1B, Section 2, the following changes are also proposed to clarify the licensing basis with regard to the credit of Wall 11.2 as a HELB barrier for protecting Wall 11 from the effects of HELB events postulated to occur north of Wall 11.2:

1. Revision to UFSAR subsection 3.6.1.1, item J, to identify that the north wall of the turbine building first bay (Wall 11.2) is credited with protecting the north wall of the auxiliary building (Wall 11) from the HELB loads ~~dynamic effects~~ resulting from postulated pipe ruptures in main steam and main feedwater piping located north of the turbine building first bay.
2. Revision to UFSAR subsection 3.6.1.3.2 to specifically identify that the north wall of the turbine building first bay (Wall 11.2), designed to seismic Category II requirements, is credited as a HELB barrier protecting the north wall of the auxiliary building (Wall 11) from the effects of HELB events postulated to occur north of Wall 11.2.
3. Revision to the Combined Operating License Condition 2.D(12) to modify the reference to the pipe rupture criteria outlined in “AP1000 DCD, Rev. 19 Sections 3.6.1.3.2 and 3.6.2.5,”

to "AP1000 DCD, Rev. 19 Sections 3.6.1.3.2 (as revised by Amendment No. ##) and 3.6.2.5," to reflect the additional criteria added to UFSAR subsection 3.6.1.3.2 above. Note that the actual amendment number will need to be added at the time of issuance of the amendment.

3. Technical Evaluation

To comply with 10 CFR 50, Appendix A, General Design Criterion 4, PRHA are performed to identify high energy piping break locations, evaluate their effects on essential SSCs, and provide additional engineered features, if necessary, to confirm that the SSCs important to safety can fulfill their design functions during such events. Essential SSCs are defined in UFSAR Section 3.6, "Protection Against the Dynamic Effects Associated with the Postulated Rupture of Piping," as those "…required to shut down the reactor and mitigate the consequences of the postulated piping failure." For HELBs postulated in the turbine building, essential SSCs include the main control room (MCR), the MSIVs, the main steam line, the main and startup feedwater isolation valves and piping, other components forming part of the containment boundary, and instrumentation considered essential in the MSIV compartments. These essential SSCs are located in the auxiliary building.

Auxiliary building Wall 11, which is designed and constructed to seismic Category I requirements, separates the essential equipment identified above from the high energy piping in the turbine building. High energy piping located north of the turbine building first bay is separated further from essential SSCs by the north wall of the turbine building first bay (turbine building Wall 11.2). Wall 11.2 is designed and constructed to seismic Category II requirements. Accordingly, the essential systems required to support shut down of the reactor and mitigate the consequences of a postulated HELB are physically separated from postulated pipe breaks in the turbine building first bay by Wall 11, and from postulated pipe breaks in the turbine building north of the turbine building first bay, by Wall 11.2. Wall 11 is evaluated for the dynamic and environmental effects of HELB events postulated to occur within the turbine building first bay. It should be noted that none of the pipe ruptures postulated to occur in the turbine building first bay result in pipe whip or jet impingement on any of the doors in Wall 11. The design evaluation of Wall 11 credits Wall 11.2 as a protective feature (HELB barrier) for the nuclear island (specifically Wall 11) against postulated breaks in the turbine building north of Wall 11.2. Wall 11.2 is analyzed for the dynamic and environmental effects of breaks in the main steam and main feedwater lines postulated to occur north of Wall 11.2, and therefore Wall 11.2 prevents these pipes from impacting Wall 11.

As identified in UFSAR subsection 3.7.2.8.4, "Seismic Modeling and Analysis of Seismic Category II Building Structures," seismic Category II structures are analyzed and evaluated in the same manner as seismic Category I structures. Thus, seismic Category II structures are designed and analyzed using the same load combinations used for seismic Category I structures, identified in UFSAR Table 3.8.4-2, "Load Combinations and Load Factors for seismic Category I Concrete Structures." For events resulting in pipe rupture, the loading combination requires consideration of seismic loads concurrent with accident thermal loads and pipe rupture dynamic loads.

Table 2 below provides additional information concerning how the design loads defined in UFSAR subsection 3.8.4.3.1 were developed and/or applied in the Wall 11.2 design and analysis in accordance with the load combinations defined in UFSAR Table 3.8.4-2.

Table 2 - Loads Applied in Wall 11.2 Design		
Design Load		**Description**
Dead	D	Turbine building first bay structure and equipment dead loads applied.
Liquid	F	Liquid loads in the turbine building first bay applied.
Live	L	Turbine building first bay live loading is calculated and applied.
Earth	H	The turbine building first bay is above grade. Therefore, no earth pressure loads are applied.
Design Pressure	P_d	As identified in Note 4 of Table 3.8.4-2, this load is applicable to basemat design only, and thus does not apply to the turbine building first bay analysis.
Normal Reaction	R_o	Large piping (e.g., main steam, main feedwater, start-up feedwater) is not supported by Wall 11.2; thus, no piping reaction loads are applied to Wall 11.2. However, piping reaction loads are applied to the turbine building first bay between elevation 117'-6" and elevation 135'-3". Normal reactions from miscellaneous equipment, cable tray supports, etc., applied.
Normal Thermal	T_o	Calculated through thermal analysis and applied. Design temperatures identified in UFSAR Table 3H.5-1.
Wind	W	The wind loads required to be considered in Table 3.8.4-2, load combinations 2 and 9 are bounded by the seismic loads considered in Table 3.8.4-2, Load Combinations 3 and 7.
Safe Shutdown Earthquake	E_s	Seismic loads are developed according to the methodology described in UFSAR subsection 3.7.2, and applied.

Table 2 - Loads Applied in Wall 11.2 Design		
Design Load		**Description**
Tornado	W_t	Tornado loads required to be applied per UFSAR Table 3.8.4-2 were considered in the design of Wall 11.2. The tornado missile loads associated with the design basis tornado missiles described in UFSAR subsection 3.5.1.4 are evaluated in accordance with the methodology described in UFSAR subsection 3.5.3 and ACI 349-01 and applied. The tornado wind and differential pressure loads required to be considered in Table 3.8.4-2, load combination 4 and subsection 3.8.4.3.1.3 are bounded by the seismic loads considered in Table 3.8.4-2, load combination 3.
Accident Pressure	P_a	A pressure of 6.0 psi is applied for pipe ruptures considered in the turbine building first bay.
Accident Thermal	T_a	Calculated through thermal analysis and applied.
Accident Thermal Reactions	R_a	Large piping (e.g., main steam, main feedwater, start-up feedwater) are not supported by Wall 11.2, and thus large piping accident thermal reactions are not applied to Wall 11.2. Normal reactions from miscellaneous equipment, cable tray supports, etc., are applied to Wall 11.2. Large piping is supported by other portions of the turbine building first bay structure, and accident thermal reactions are applied to those supports.
Accident Pipe Reactions	Y_r	Large piping (e.g., main steam, main feedwater, start-up feedwater) are not supported by Wall 11.2, and thus piping reaction loads are not applied to Wall 11.2. Large piping is supported by other portions of the turbine building first bay structure, and accident piping reaction loads are applied to those supports.
Jet Impingement	Y_j	Jet impingement loads developed from PRHA calculations for the main steam, main feedwater, and start-up feedwater are applied to the turbine building first bay structure, including Wall 11.2.
Pipe Impact	Y_m	Pipe impact loads developed from PRHA calculations for the main steam, main feedwater, and start-up feedwater are applied to the turbine building first bay structure, including Wall 11.2.

As discussed in UFSAR subsection 3.8.4.4.1, “Seismic Category I Structures,” seismic Category I structures are designed in accordance with ACI 349-01 for concrete structures and with AISC N690-1994 for steel structures. As identified in UFSAR subsection 3.8.4.6.1.1, “Concrete,” seismic Category I structures are constructed in accordance with ACI 349-01. As discussed in UFSAR subsection 3.3.2.3, “Effect of Failure of Structures or Components Not

Designed for Tornado Loads," seismic Category II structures are designed to ACI 349-01 for concrete structures and to AISC N690-1994 for steel structures, and constructed to the requirements of ACI 318-11 for concrete structures, and AISC S335-1989 for steel structures. Thus the primary difference between seismic Category I and seismic Category II structures is the difference in construction codes.

ACI 318-11 is the general specification used for the design and construction of reinforced concrete buildings in the United States. Earlier versions of ACI 318 provided the basis for the majority of the design information presented in, and the commentary for ACI 349-01. Both ACI 349-01 and ACI 318-11 use the same materials; however, ACI 349-01 requires certified material test reports to document and trace the material used, and has more stringent recordkeeping, inspection and testing requirements for construction.

In accordance with UFSAR subsection 3.2.1.1.2, "Seismic Category II (C-II)," the quality assurance requirements for the analysis and design of seismic Category II structures, systems, and components are in accordance with the quality plan described in UFSAR subsection 17.3. These controls are sufficient to affirm that Wall 11.2 is fully capable of supporting the additional design function of providing a HELB barrier ~~for~~ to protect Wall 11 from the dynamic effects of piping ruptures postulated north of Wall 11.2.

Summary

The proposed changes involve revision of the licensing basis in UFSAR subsections 3.6.1.1 and 3.6.1.3.2 to identify that the north wall of the turbine building first bay (Wall 11.2) is credited as a HELB barrier protecting the north wall of the auxiliary building (Wall 11) from the effects of ruptures in main steam and main feedwater piping postulated north of the turbine building first bay. Because of the proposed change to UFSAR subsection 3.6.1.3.2, a change is also proposed to the Combined Operating License Condition 2.D(12) to replace reference of the criteria outlined in "AP1000 DCD, Rev. 19 Sections 3.6.1.3.2 and 3.6.2.5," with a reference to "AP1000 DCD, Rev. 19 Sections 3.6.1.3.2 (as revised by Amendment No. ##) and 3.6.2.5," to reflect the additional criteria added to UFSAR subsection 3.6.1.3.2 discussed above.

Wall 11.2 is a seismic Category II structure, designed and analyzed to seismic Category I requirements. This includes application of the seismic Category I load combinations specified in UFSAR subsection 3.8.4, and design and analysis in accordance with ACI 349-01. The key difference is that seismic Category II structures, including Wall 11.2, are constructed to the requirements of ACI 318-11. However, it has been determined that the design and construction requirements applicable to Wall 11.2 are adequate to affirm that Wall 11.2 can fulfill the design function of HELB barrier to protect auxiliary building Wall 11. The requested changes would specifically identify in the licensing basis the acceptability of use of seismic Category II Wall 11.2 as a HELB barrier.

4. Regulatory Evaluation (See Part 1E)

Part 1D - Use of the turbine building first bay as a protective structure for tornado missiles

1. Summary Description

Changes are proposed to the UFSAR to use the seismic Category II turbine building first bay building structure, and associated equipment Class D missile barriers to protect openings in auxiliary building Wall 11 (Wall 11) from tornado missiles. Associated with this change is the qualification and use of seismic Category I, equipment Class C doors and spare penetration covers in Wall 11 to protect their associated openings from the 8-inch artillery shell and the 1-inch ~~small rigid~~ sphere missiles defined in UFSAR subsection 3.5.1.4, and discussed below. The use of seismic Category II, equipment Class D classification for the turbine building first bay missile barriers is discussed in Part 1B of this amendment request.

In summary, tornado missile protection is proposed to be provided on the north side of the auxiliary building (Wall 11) on the following basis:

- The seismic Category I auxiliary building Wall 11 reinforced concrete structure, which is capable of stopping all design basis tornado missiles, provides the primary protection for SSCs required for safe shutdown within the nuclear island.
- The seismic Category II turbine building first bay reinforced concrete structure, which is capable of stopping all design basis tornado missiles, provides the primary protection for the openings in auxiliary building Wall 11.
- Tornado missile barriers installed over large openings in the turbine building first bay provide protection for Wall 11 openings from the automobile missile, and in some cases the 8-inch artillery shell and 1-inch sphere missiles based on line of sight evaluations.
- Seismic Category I doors in Wall 11 will stop the 8-inch artillery shell and 1-inch sphere missiles.
- A missile barrier located in the interior of the turbine building first bay, northeast of the east MSIV compartment, protects the east MSIV compartment drain/vent located under the Wall 11 main steam line penetration based on a line of sight missile path evaluation.
- Protection of Wall 11 penetrations, supported by a line of sight evaluation, is provided by demonstration that no credible missile paths to the penetration exist, pipe sleeves/cover plates or penetration contents stop credible missiles, or that a missile passing through the penetration will not adversely impact equipment required for safe shutdown.

Section 2 briefly discusses the proposed use of the turbine building first bay as a tornado missile barrier, and identifies additional UFSAR changes to clarify this design function.

A technical evaluation of these changes is provided in Section 3 below.

2. Detailed Description

As discussed in UFSAR subsection 3.5.2, “Protection from Externally Generated Missiles,” protection from external missiles, including those generated by natural phenomena, is provided by the external walls and roof of the seismic Category I nuclear island structures. Openings in the nuclear island structures are evaluated on a case-by-case basis to provide confidence that a missile passing through the opening would not prevent safe shutdown or result in an offsite release exceeding the limits defined in 10 CFR 50.34. Alternatively, barriers are provided

and/or evaluations are performed to demonstrate that missiles cannot pass through these openings. Accordingly, evaluation of the openings in auxiliary building Wall 11 requires consideration of tornado missiles.

Evaluation of the openings in auxiliary building Wall 11 credits the protection from tornado missiles provided by the seismic Category II turbine building first bay building structure, the seismic Category II missile barriers provided for large openings in turbine building first bay Wall 11.2 (Wall 11.2) and turbine building first bay Wall R (Wall R), and the seismic Category II missile barrier provided in the interior of the turbine building first bay at elevation 117′-6″, northeast of the east MSIV compartment. As identified in Part 1B, changes are proposed to UFSAR subsections 3.2.1.1.1, 3.2.1.1.2, and 3.2.2.5 to clarify acceptability of the use of seismic Category II building structures for providing the important to safety function of protecting Wall 11 openings from tornado missiles.

Because finalization of the tornado missile loadings on Wall 11 are required to finalize its design, this is considered an involved change associated with the Wall 11 reinforcement changes. Therefore, this license amendment request seeks NRC approval to use the seismic Category II turbine building first bay as protection of Wall 11 openings from tornado missiles.

Licensing Basis Change Descriptions

In addition to the proposed changes clarifying the use and credit of seismic Category II structures in providing important to safety protective functions for nonseismic events identified in Part 1B, Section 2, the following changes, specific to the credit of seismic Category II structures for protection of nuclear island structure openings from tornado missiles, are proposed:

1. Revision to UFSAR subsection 3.5.2 to identify that:
    - Buildings credited to protect nuclear island structure openings from tornado missiles are seismic Category I or seismic Category II,
    - Seismic Category II building structures are designed and analyzed for the safe shutdown earthquake using the same methods and design stress limits used for seismic Category I structures,
    - Seismic Category II building structures are designed to withstand design basis tornado loads, including missiles, in accordance with the load combinations identified in Table 3.8.4-2,
    - Evaluation of the openings in Wall 11 considered the protection provided by the turbine building first bay building structure and associated missile barriers,
    - The turbine building first bay building structure and associated missile barriers are designed and analyzed to protect the openings in Wall 11 from the automobile missile,
    - In accordance with the missile protection criteria contained in UF~~F~~SAR subsection 3.5, a realistic assessment of potential missile paths was performed. ~~, and that w~~Where a line of sight of a missile passing through a turbine building first bay building structure opening could potentially result in missile impact on a Wall 11 opening, additional protection was provided, or additional evaluations performed,

- Where the 1-inch ~~diameter solid steel~~ sphere or 8-inch artillery shell missiles were determined to have a line of sight to a Wall 11 penetration, analysis was performed to confirm that there was no line of sight through the penetration, the contents of the penetration would prevent the missile from passing through Wall 11, or equipment required to achieve safe shutdown could not be adversely affected,
- The steel missile barriers provided in the turbine building first bay (seven large openings in Wall 11.2, three large openings in Wall R, and a barrier located in the interior of the turbine building first bay at elevation 117′-6″, northeast of the east MSIV compartment) are designed in accordance with the missile barrier procedures specified in UFSAR subsection 3.5.3, and the acceptance criteria contained in AISC N690-1994,
- The missile protection provided for the Wall 11 openings is tabulated in new Table 3.5-1, and
- Missile protection for Wall 11 openings is provided by the seismic Category II turbine building first bay building structure, the seismic Category II missile barriers provided on or within the turbine building first bay building structure, ~~and~~ the seismic Category I Wall 11 doors, and the seismic Category I Wall 11 penetrations and spare penetration covers within missile lines of sight.

2. UFSAR subsection 3.5.2 is also revised to identify the location of the turbine building first bay missile barriers, identify that the missile barriers are designed and analyzed in accordance with the barrier design procedures and ductility requirements contained in UFSAR subsection 3.5.3, identify that the missile barriers are permanently anchored, and identify that where anchored to concrete, the anchorage is in accordance with UFSAR subsection 3.8.4.5.1. ~~Addition of n~~New Table 3.5-1 is added, which identifies each Wall 11 opening and location, and identifies the protection provided for each opening, by tornado missile type. Footnotes to the table reference UFSAR subsection 3.5.1.4 for identification of the tornado missiles assumed in the licensing basis, identify the classification of Wall 11 doors and spare penetration covers credited in the tornado missile evaluation as equipment Class C, ~~and~~ identify the classification of the turbine building first bay tornado missile barriers as equipment Class D, and identify the minimum material specifications for the missile barriers.

3. Technical Evaluation

Tornado missiles are described in UFSAR subsection 3.5.1.4, “Missiles Generated by Natural Phenomena.” The design basis tornado missiles include:

- A 4000-pound automobile impacting the structure at normal incidence with a horizontal velocity of 105 mph or a vertical velocity of 74 mph; assumed to deform upon impact.
- A 275 pound, ~~eight~~ 8-inch armor-piercing artillery shell impacting the structure at normal incidence with a horizontal velocity of 105 mph or a vertical velocity of 74 mph.
- A ~~one~~ 1-inch diameter solid steel sphere assumed to impinge upon barrier openings in the most damaging direction at a velocity of 105 mph.

As identified in UFSAR subsection 3.5.2, “Protection from Externally Generated Missiles,” protection of systems required for safe shutdown from external missiles is provided by the

external walls and roof of the seismic Category I nuclear island structures. Auxiliary building Wall 11 is a seismic Category I reinforced concrete wall 24 inches or more in thickness. Wall 11 is designed and analyzed to maintain structural integrity during tornado missile impact. The missile impact evaluation for Wall 11 considers both one way (beam action) and two way (punching shear) load dispersion to confirm that the wall thickness is adequate for the worst load application. The reinforced concrete portions of Wall 11 have been evaluated for the three tornado missiles described above. Missile penetration, scabbing, perforation thickness, and overall wall integrity have been evaluated using the procedures described in UFSAR Section 3.5.3, "Barrier Design Procedures." Overall wall integrity is confirmed by evaluation in accordance with ACI 349-01 Appendix C requirements.

As discussed in UFSAR subsection 3.5.2, openings in the nuclear island external walls are evaluated on a case-by-case basis to provide confidence that a missile passing through the opening would not prevent safe shutdown and would not result in an offsite release exceeding the limits defined in 10 CFR 50.34. Alternatively, evaluations are performed to show that missiles do not pass through openings, or barriers are provided to prevent missiles from passing through the openings.

An evaluation of potential tornado missile paths and trajectories from external missiles originating outside of the turbine building first bay has been performed. Openings in turbine building first bay Wall 11.2 and Wall R have been considered in the identification of credible missile paths. The results of the tornado missile path evaluation determined that the design basis tornado missiles are prevented from reaching Wall 11 by the turbine building first bay building structure and associated missile barriers or prevented from entering the auxiliary building by Wall 11 and its doors, or it is shown that there is no credible line of sight pathway for the missiles.

The openings in Wall 11 have been evaluated for the three tornado missiles on a case-by-case basis. The design evaluations demonstrate that the turbine building first bay is structurally adequate to protect Wall 11 openings from credible tornado missile pathways. The results of this evaluation are summarized below.

- Automobile missile
  - The turbine building first bay building structure stops the automobile missile.
  - Where missile paths through large openings in the turbine building first bay to Wall 11 doors or vents were determined to be credible, missile barriers have been added to the turbine building first bay large openings designed to stop the automobile missile.
  - The remaining potential paths through turbine building first bay large openings result in the automobile missile ~~either~~ missing the Wall 11 opening~~s, or striking the edge of the Wall 11 opening, which stops the automobile missile~~.
- 8-inch ~~A~~artillery shell missile
  - The turbine building first bay building structure stops the 8-inch artillery shell missile.

- Wall 11 doors, including the nuclear island nonradioactive ventilation system (VBS) doors, are qualified to stop the 8-inch artillery shell missile.
- A missile barrier added to the interior of the turbine building first bay at elevation 117′-6″, northeast of the east MSIV compartment, protects the east MSIV compartment drain/vent located under the Wall 11 main steam line penetration from the 8-inch artillery shell missile passing through turbine building first bay openings.
- The 8-inch artillery shell missile cannot pass through the steam vent openings in the west MSIV compartment due to the geometry of the potential paths.
- The 8-inch artillery shell missile cannot affect safe shutdown equipment via other Wall 11 penetrations due to one or more of the following:
  - No line of sight through penetration
  - Pipe sleeves and associated piping
  - Penetration contents
  - Covers provided on spare penetrations
  - Pipe analyzed for high energy pipe break
  - No safe shutdown equipment in the line of sight for missiles passing through penetration

- 1-inch ~~Small rigid~~ sphere missile
  - The turbine building first bay structure stops the ~~small rigid~~ 1-inch sphere missile.
  - Wall 11 doors, including VBS doors, are qualified to stop the ~~small rigid~~ 1-inch sphere missile.
  - A missile barrier added to the interior of the turbine building first bay at elevation 117′-6″, northeast of the east MSIV compartment, protects the east MSIV compartment drain/vent located under the Wall 11 main steam line penetration from the ~~small rigid~~ 1-inch sphere missile passing through turbine building first bay openings.
  - The ~~small rigid~~ 1-inch sphere missile cannot pass through the steam vent opening in the west MSIV compartment due to the geometry of the path.
  - The ~~small rigid~~ 1-inch sphere missile cannot affect safe shutdown equipment via other Wall 11 penetrations due to one or more of the following:
    - No line of sight through penetration
    - Pipe sleeves and associated piping
    - Penetration contents
    - Covers provided on spare penetrations
    - Pipe analyzed for high energy pipe break
    - No safe shutdown equipment in the line of sight for missiles passing through penetration

Evaluation of the turbine building first bay as a protective structure for tornado missiles has been performed in accordance with the requirements identified in UFSAR subsection 3.5.3. The turbine building first bay, including Wall 11.2 and Wall R, is categorized as seismic Category II, and designed and analyzed consistent with the requirements for seismic Category I structures. Thus, seismic Category II structures are designed and analyzed in accordance with ACI 349-01 for concrete structures and AISC N690-1994 for steel structures and the design basis load combinations specified in UFSAR subsection 3.8.4. The missile impact evaluation for the turbine building first bay, including Wall 11.2 and Wall R considers both one way (beam action) and two way (punching shear) load dispersion to confirm that the wall thickness is adequate for the worst load application.

The ~~steel~~ tornado missile barriers located on or within the turbine building first bay are designed and analyzed in accordance with the barrier design procedures contained in UFSAR subsection 3.5.3, the ductility requirements contained in UFSAR subsection 3.5.3.1 and applicable AISC N690-1994 requirements, and classified as seismic Category II, Equipment Class D.

The turbine building first bay large opening missile barriers have a steel grating configuration to ~~allow required air-flow through~~ support the pressure relief function provided by the turbine building first bay large openings. The turbine building first bay large opening missile barriers ~~grating~~ extend~~s~~ beyond the first bay wall large opening boundaries for full coverage of the large opening and ~~connection~~ to facilitate anchorage of the barrier to the first bay structure in accordance with code requirements. The turbine building first bay large opening missile barriers are permanently anchored to the turbine building first bay structure, and fabricated with materials in accordance with the material specifications identified in Table 3 below. ~~The grating is made of steel bars.~~ The spacing of the bars prevents missiles larger than 8-inch from passing through the grating into the first bay. The depth and thickness of the steel bars prevent penetration of the automobile missile while meeting the barrier ductility requirements of subsection 3.5.3.1. The depth and thickness of the steel bars also eliminate the 8-inch artillery shell and 1-inch sphere missile~~s~~ lines of sight to the west MSIV compartment drain/vent.

The interior turbine building first bay missile barrier is a solid steel plate with a steel support frame permanently anchored ~~attached~~ to the turbine building first bay floor. The interior turbine building first bay missile barrier is sized and located to eliminate the 8-inch artillery shell and 1-inch sphere missiles lines of sight to the east MSIV compartment drain/vent. The turbine building first bay interior missile barrier is fabricated with materials in accordance with the material specifications identified in Table 3 below. ~~The location and envelope dimensions of the barrier eliminate the 8-inch artillery shell and 1-inch sphere missile lines of sight to the east MSIV compartment drain/vent.~~ The thickness of the steel plate prevents penetration of the 8-inch artillery shell and 1-inch sphere missiles while meeting the barrier ductility requirements contained in UFSAR ~~of~~ subsection 3.5.3.1. The missile barrier ~~F~~framing and supports are sufficient to prevent bending or overturning of the barrier plate under missile impact loadings.

The Wall 11 doors are steel structures, designed and analyzed in accordance with the barrier design procedures contained in subsection 3.5.3, the ductility requirements contained in UFSAR

subsection 3.5.3.1, and applicable AISC N690-1994 requirements, and classified as seismic Category I, Equipment Class C. The Wall 11 doors are steel fabricated with materials in accordance with the material specifications identified in Table 3 below. The Wall 11 doors are designed and analyzed to withstand the impact of the 8-inch artillery shell and 1-inch sphere missiles while meeting the barrier ductility requirements of Section 3.5.3.1.

The Wall 11 spare penetration covers are located in Wall 11 in the elevation 100′-0″ area. The Wall 11 spare penetration covers are designed and analyzed in accordance with the barrier design procedures contained in UFSAR subsection 3.5.3, the ductility requirements contained in UFSAR subsection 3.5.3.1, and applicable AISC N690-1994 requirements, and classified as seismic Category I, Equipment Class C. The Wall 11 spare penetration covers are steel fabricated with materials in accordance with the material specifications identified in Table 3 below. The Wall 11 spare penetration covers are designed and analyzed to withstand the impact of the 8-inch artillery shell and 1-inch sphere missiles while meeting the barrier ductility requirements of Section 3.5.3.1.

To qualify the seismic Category I penetrations on Wall 11 within credible missile lines of sight, a conservative bounding case was analyzed for the 1-inch sphere and 8-inch artillery shell missiles. The bounding case analyzed a penetration containing the largest gap between the penetration sleeve and process piping (approximately 4 inches), and conservatively neglected the remaining contents: forged penetration flued head, the existence of calcium silicate insulation, and the penetration gusset plates, rebar, and anchor plates. The results of this analysis showed that for the bounding case, the 1-inch sphere and 8-inch artillery shell missiles would not penetrate Wall 11. Based on this analysis, no new material specifications for the Wall 11 penetrations are required. The material specifications for the penetrations and their contents remain as specified for their primary functions.

The missile barriers are permanently anchored to the turbine building first bay or auxiliary building as applicable. Where anchored to concrete, the anchors conform with the anchorage requirements contained in subsection 3.8.4.5.1.

The missile barriers credited in providing protection of Wall 11 openings are identified in new UFSAR Table 3.5-1, which identifies the Wall 11 openings and locations, and the protection provided for each opening, by tornado missile type. Table 3 below provides a summary of the design characteristics and locations of barriers provided to protect Wall 11 openings. SUNSI Figures 1 through 4 provide additional missile barrier location information and can be found in Enclosure 4.

Table 3 - Summary of Wall 11 Missile Barrier Design Characteristics and Locations					
Missile Barriers	**Location**	**Equipment/ Seismic Class**	**Material**	**Size**	**Specification**
Wall 11 building structure	North wall of the auxiliary building See SUNSI Figures 1 through 4	Not assigned an equipment classification Seismic Category I	Steel reinforced concrete	Dimensions identified in UFSAR Figure 3.7.2-12 Additional drawings available for audit	• Prevents passage of postulated missiles (1-inch sphere, 8-inch artillery shell, and automobile missiles)
Turbine Building first bay building structure	North of Wall 11 See SUNSI Figures 1 through 4	Not assigned an equipment classification Seismic Category II	Steel reinforced concrete	Drawings available for audit	• Prevents passage of postulated missiles (1-inch sphere, 8-inch artillery shell, and automobile missiles)
Turbine building first bay large opening missile barriers	Seven locations on Wall 11.2 & three locations on Wall R at elevations: • Four at EL100′-0″ • Three at EL 117′-6″ • Two at EL 135′-3″ • One at EL 148′-10″ See SUNSI Figures 1 through 4	Equipment Class D Seismic Category II	Material specified to be as follows or steel with equal or better material properties: • Grating bar, baseplate (ASTM A240) • Perimeter frame (ASTM A36 or ASTM A992) • Anchors (ASTM F1554, Gr. 105)	Gratings sized larger than large openings to provide full opening coverage and facilitate provision of anchorage designed in accordance with AISC N690-1994 and ACI 349-01 requirements	• Grating design selected to facilitate airflow for large opening pressure relief function • Grating sized to prevent passage of postulated 8-inch artillery shell missile • Grating depth selected to eliminate lines of sight of 1-inch sphere and 8-inch artillery shell missiles to lower MSIV Compartment A (west MSIV compartment) vent • Barriers designed in accordance with barrier design procedures contained in UFSAR subsection 3.5.3, and the requirements contained in AISC N690-1994 to prevent passage of postulated 8-inch artillery shell and automobile missiles • Embedded or post-installed anchorage designed in accordance with the requirements contained in UFSAR subsections 3.5.3 and 3.8.4.5.1, and AISC N690-1994 and ACI 349-01 as applicable

Table 3 - Summary of Wall 11 Missile Barrier Design Characteristics and Locations					
Turbine building first bay interior missile barrier	Elevation 117′-6″ in the turbine building first bay See SUNSI Figure 2	Equipment Class D Seismic Category II	Material specified to be as follows or steel with equal or better material properties: • Barrier plate (ASTM A240) • Barrier support frame (ASTM A500, Gr. B) • Anchors (ASTM A325 or ASTM A490, and ASTM F1554, Gr. 105 as required)	Sized to eliminate line of sight to lower MSIV Compartment B vent (Rm 12404; east MSIV compartment)	• Barrier designed in accordance with barrier design procedures contained in UFSAR subsection 3.5.3, and the requirements contained in AISC N690-1994 to prevent passage of postulated 1-inch sphere, and 8-inch artillery shell missiles • Embedded or post-installed anchorage designed in accordance with the requirements contained in UFSAR subsections 3.5.3 and 3.8.4.5.1, and ACI 349-01 and AISC N690-1994, as applicable • Barrier located to eliminate lines of sight for 1-inch sphere and 8-inch artillery shell missiles to MSIV Compartment B (east MSIV compartment) vent
Wall 11 doors	Wall 11 at elevations: • One at EL100′-0″ • One at EL 117′-6″ • Three at EL 135′-3″ See SUNSI Figures 1 through 3	Equipment Class C Seismic Category I	Material specified to be as follows or steel with equal or better material properties: • Door plate (ASTM A240) • Embed plates (ASTM A572, Gr. 50) • Anchors (ASTM A1064)	Sized for door openings	• Prevent passage of postulated 1-inch sphere and 8-inch artillery shell missiles • Embedded or post-installed anchorage designed in accordance with the requirements contained in UFSAR subsections 3.5.3 and 3.8.4.5.1, and ACI 349-01 and AISC N690-1994, as applicable
Wall 11 spare penetration covers	Two at EL100′-0″ See SUNSI Figure 1	Equipment Class C Seismic Category I	Material specified to be as follows or steel with equal or better material properties: • Wall 11 spare penetration covers (ASTM A240)	Sized to mate with spare penetrations	• Prevent passage of postulated 1-inch sphere and 8-inch artillery shell missiles • Embedded or post-installed anchorage designed in accordance with the requirements contained in UFSAR subsections 3.5.3 and 3.8.4.5.1, and ACI 349-01 and AISC N690-1994, as applicable
Wall 11 penetration sleeves & contents	Various elevations	Equipment Class C Seismic Category I	Material to be as specified for their penetration function (steel penetration sleeves and steel process piping)	Various	• Prevent passage of postulated 1-inch sphere and 8-inch artillery shell missiles

The difference between seismic Category I and seismic Category II structures is that seismic Category II concrete structures are constructed to the requirements of ACI 318-11. ACI 318-11 is the general specification for the design and construction of reinforced concrete structures in the United States. The primary difference in construction requirements between ACI 349-01 and ACI 318-11 is that ACI 349-01 has more stringent records and material traceability requirements. As discussed in UFSAR subsection 3.2.1.1.2, "Seismic Category II (C-II)," the quality assurance requirements for the analysis and design of seismic Category II structures, systems, and components are in accordance with the quality plan described in Section 17.3. These controls are sufficient to affirm that the turbine building first bay is fully capable of supporting the additional design function of protecting Wall 11 openings from the effects of the design basis tornado missiles.

Evaluation of Proposed Changes

The turbine building first bay is a seismic Category II structure and is designed in accordance with the codes and standards identified in UFSAR subsection 3.8.4.2 which include ACI 349-01 for concrete structures and AISC N690-1994 for steel structures, the supplemental criteria identified in UFSAR subsections 3.8.4.4.1 and 3.8.4.5, and the guidance contained in NRC Regulatory Guides 1.69, 1.115, 1.142, and 1.143 as discussed in UFSAR Appendix 1A, "Conformance with Regulatory Guides." The proposed changes do not impact conformance with, and thus the turbine building first bay will continue to comply with the requirements specified in UFSAR subsections 3.7.1, 3.7.2, and 3.8.4.5, the requirements contained in ACI 349-01 for concrete structures and AISC N690-1994 for steel structures, and the guidance contained in NRC Regulatory Guides 1.69, 1.115, 1.142, and 1.143 as discussed in UFSAR Appendix 1A.

No structure, component or system design function described in the licensing basis is adversely affected by these proposed changes. The capability of the turbine building first bay to maintain its integrity following a safe shutdown earthquake is not adversely impacted by these changes. The turbine building first bay has been analyzed with the added missile barriers in accordance with the methods and load combinations identified in UFSAR subsection 3.8.4, and determined to meet the acceptance criteria contained in ACI 349-01 and AISC N690-1994 for both tornado and seismic events. Thus the turbine building first bay will continue to have the capability to meet its design function for each of these events.

The turbine building first bay does not have any designated fire barriers, thus the addition of missile barriers to the turbine building first bay does not affect any required fire rating in the turbine building, nor adversely impact the fire ratings of barriers in close proximity to the turbine building first bay.

The missile barriers added to the turbine building first bay do not interface with or affect safety-related equipment or a fission product barrier. No system or design function or equipment qualification would be adversely affected by the proposed changes. The changes do not result in a new failure mode, malfunction or sequence of events that could adversely affect a radioactive material barrier or safety-related equipment. The proposed changes do not allow for

a new fission product release path, result in a new fission product barrier failure mode, or create a new sequence of events that would result in significant fuel cladding failures.

The proposed changes do not adversely affect any safety-related system or component, equipment, design code, design code allowable value, function or design analysis, nor do they adversely affect any safety analysis input or result, or design/safety margin.

The proposed changes do not involve an adverse change to any method of evaluation for establishing design bases or safety analyses. They do not represent a change to a design feature credited in the ex-vessel severe accident assessment. Tests, experiments, and procedures described in the licensing basis are unchanged by this activity.

The proposed activity has no adverse effect on the ex-vessel severe accident. The design, geometry, and strength of the containment internal structures are not changed. The design and material selection of the concrete floor beneath the reactor vessel is not altered. The response of the containment to a postulated reactor vessel failure, including direct containment heating, ex-vessel steam explosions, and core concrete interactions is not altered by the changes to the turbine building first bay. The design of the reactor vessel and the response of the reactor vessel to a postulated severe accident are not altered by the changes to the detail design of walls in the turbine building first bay.

The proposed changes to the turbine building first bay have no adverse effect on the Aircraft Impact Assessment. The proposed changes to the turbine building first bay add missile barriers to the turbine building first bay large openings, and do not adversely affect the design strength of the turbine building first bay. These changes do not adversely impact the design or response of the containment vessel and shield building. The changes do not affect the number and thickness of intervening barriers, as required by NEI 07-13, which are credited in the assessment. There is no change to protection of plant structures, systems, and components against aircraft impact provided by the design of the turbine building first bay. There is no change to the design of any of the key design features described in UFSAR Appendix 19F. The activity described does not change the design or construction of the shield building.

The proposed changes to the turbine building first bay do not affect the operation of any systems or equipment inside or outside the turbine building first bay that could initiate or mitigate abnormal events, e.g., accidents, anticipated operational occurrences, earthquakes, floods and turbine missiles, or their safety or design analyses, evaluated in the UFSAR.

The proposed changes do not affect the radiological source terms (i.e., amounts and types of radioactive materials released, their release rates and release durations) used in the accident analyses, thus, the consequences of accidents are not affected. These changes do not adversely affect the containment, control, channeling, monitoring, processing or releasing of radioactive and non-radioactive materials. The location and design of penetrations and the permeability of the concrete structures is not changed. Consequently, there are no changes in dose consequences associated with this change. The types and quantities of expected effluents are not changed. The functionality of the design and operational features that are

credited with controlling the release of effluents during plant operation is not diminished. Therefore, neither radioactive nor non-radioactive material effluents are affected.

The proposed changes are unrelated to any aspect of plant construction or operation that would introduce any change to effluent types (e.g., effluents containing chemicals or biocides, sanitary system effluents, and other effluents), or affect any plant radiological or non-radiological effluent release quantities. The proposed changes to the turbine building first bay do not adversely affect any plant radiation zones, and controls under 10 CFR 20 preclude a significant increase in occupational radiation exposure. Therefore, the proposed amendment does not involve a significant increase in individual or cumulative occupational radiation exposure.

The thickness of the walls and the density of the concrete are not changed; therefore, there is no adverse change to the shielding provided by the walls. There is no change to plant systems or the response of systems to postulated accident conditions. There is no change to the predicted radioactive releases due to normal operation or postulated accident conditions. Therefore, individual and cumulative radiation exposures do not change.

The proposed activity has no adverse effect on emergency plans or physical security plans. There is no change to any perimeter walls acting as a security barrier or other aspects of the structures that could impact physical security. The change activity has no impact on the emergency plans or the physical security evaluation since there are no changes to the external configuration of the roof, walls, doors, or access to the Nuclear Island.

4. Regulatory Evaluation (See Part 1E)

Part 1E - Regulatory evaluation and environmental consideration evaluation

4. Regulatory Evaluation

4.1 Applicable Regulatory Requirements/Criteria

10 CFR Part 52, Appendix D, Section VIII, paragraphs B.6 and B.5.a, require prior Nuclear Regulatory Commission (NRC) approval for departures from Tier 2* information, and for departures from Tier 2 information that involve Tier 2* information, respectively. This departure affects the auxiliary building wall reinforcement as described in Tier 2* ~~in~~ subsection 3H.5.1.4 and depicted in Tier 2* Figure 3H.5-5 of the Updated Final Safety Analysis Report (UFSAR), and thus, Tier 2* information is changed and NRC approval is required. This departure also 1) clarifies the use and classification of building structures that provide a protective function for nonseismic events, 2) credits turbine building first bay Wall 11.2 as a HELB barrier protecting Wall 11 from the effects of HELB events postulated to occur north of Wall 11.2, and 3) credits the turbine building first bay and associated missile barriers as a tornado missile barrier protecting Wall 11 openings and penetrations. These departures impact Tier 2 information that involves the changes to the Tier 2* information associated with the Wall 11 changes. Thus, as required by 10 CFR 50, a licensing amendment is required. Additionally, the proposed changes to credit turbine building first bay Wall 11.2 as a HELB barrier protecting Wall 11 from the effects of HELB events postulated to occur north of Wall 11.2 impacts Tier 2 information contained in UFSAR subsection 3.6.1.3.2. A change to UFSAR subsection 3.6.1.3.2 requires a corresponding change to the Combined Operating License Condition 2.D(12), which requires a licensing amendment in accordance with 10 CFR 50.90. Therefore, a license amendment request (LAR) (as supplied herein) is required.

- 10 CFR 50 Appendix A General Design Criterion (GDC) 1 states that structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Implementation of these changes does not impact compliance with the relevant Regulatory Guides (RGs) and industry codes and standards. Consequently, the auxiliary building meets the requirements of 10 CFR 50.55a and GDC 1 for the design, fabrication, erection, and construction to quality standards commensurate with the safety functions.
- 10 CFR 50 Appendix A GDC 2 states that structures, systems and components important to safety shall be designed to withstand the effects of natural phenomena, such as earthquakes. The requirement to design the auxiliary building and the components contained therein to the design basis seismic loadings and appropriate combinations of the effects of normal and accident conditions, including the effects of environmental loading, such as earthquakes and other natural phenomena with sufficient margin for limitation in site data is unchanged. The requirement to design the seismic Category II turbine building first bay using the same methods, applicable load combinations (including tornado loads and pipe rupture loads), and acceptance criteria required for seismic Category I structures, remains unchanged. Therefore, this criterion continues to be satisfied.

- 10 CFR 50 Appendix A GDC 4 states that structures, systems and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. These changes do not affect the auxiliary building design requirement to withstand the dynamic effects associated with missiles, pipe whipping, and discharging fluids as described in UFSAR subsection 3.6. The ability of the auxiliary building Main Steam Isolation Valve (MSIV) compartments to withstand the pressurization effects from the design basis one square foot pipe rupture in the MSIV compartment is not adversely affected by the removal of the Wall 11 upper vents, because these vents are not credited in the subcompartment pressurization analysis. The MSIV compartment roof vents are credited in the subcompartment analysis and provide sufficient venting to maintain the MSIV compartment pressures below the design limit for the design basis one square foot main steam line and main feedwater line breaks. Analysis of MSIV compartment temperatures with the Wall 11 upper vents removed following the limiting one square foot pipe rupture determined that the MSIV compartment temperatures remain acceptably within the envelope for environmental qualification of equipment in these compartments. The change in the detail design of ~~the wall reinforcement~~ Wall 11 to extend the wall reinforcement to fill the upper vent openings, as well as changes related to the reinforcement detailing and development do~~es~~ not reduce the capacity of the wall for MSIV compartment pressure loads or other loads resulting from the dynamic effects of pipe rupture. These changes do not affect the auxiliary building design requirement to withstand the dynamic effects associated with missiles, pipe whipping, and discharging fluids as described in UFSAR subsection 3.6. The requirement to design the seismic Category II turbine building first bay using the same methods, applicable load combinations (including tornado loads and pipe rupture loads), and acceptance criteria required for seismic Category I structures, remains unchanged. Therefore, this criterion continues to be satisfied.

4.2 Precedent

The most salient example, or precedent, of use of seismic Category II structures to provide an important to safety function is their use in protecting seismic Category I safety-related structures, systems, and components from adverse effects associated with the safe shutdown earthquake. The current licensing basis defines “seismic Category II” in UFSAR subsection 3.2.1.1.2 as follows:

> Seismic Category II applies to plant structures, systems, and components which perform no safety-related function, and the continued function of which is not required. Seismic Category II applies to structures, systems, and components designed to prevent their collapse under the safe shutdown earthquake. Structures, systems and components are classified as seismic Category II to preclude their structural failure during a safe shutdown earthquake or interaction with seismic Category I items which could degrade the functioning of a safety-related structure, system, or component to an unacceptable level, or could result in incapacitating injury to occupants of the main control room.

> Seismic Category II structures, systems, and components are designed so that the safe shutdown earthquake does not cause unacceptable structural failure of or interaction with seismic Category I items. (Emphasis Added).

As stated in the above definition, seismic Category II applies to SSCs that do not perform a safety-related function, and the continued function of which is not required. Unlike seismic Category I SSCs, which must withstand the safe shutdown earthquake loads and continue to function and/or support seismic Category I SSCs for some specified period of time, e.g., 72 hours, a seismic Category II structure must only withstand the safe shutdown earthquake loads for the duration of that loading event and meet its important to safety acceptance criteria of not adversely impacting seismic Category I SSCs. This is accomplished via design and analysis of seismic Category II structures to the same standards and codes, design requirements, load combinations, methodology and quality program used for seismic Category I structures, and construction of seismic Category II structures to the standards and quality assurance requirements which have been determined to be acceptable in the AP1000 ~~certified~~ approved design for accomplishing their design function of preventing adverse interaction with seismic Category I SSCs. Accordingly, the design, construction, and quality requirements applied to seismic Category II structures have been determined to be adequate to fulfill their design function for the safe shutdown earthquake to comply with 10 CFR 50, Appendix A, GDC 2.

Approval of the proposed changes to clarify use of the seismic Category II turbine building first bay for protecting safety-related equipment from tornado missiles (addressed in GDC 2 and GDC 4), and from pipe ruptures (addressed in GDC 4), would only authorize credit of the same structure for other events also addressed by GDC 2 (tornados, floods) and GDC 4 ("the effects of missiles, pipe whipping, and discharging fluids," that may result from events outside the plant). UFSAR subsection 3.2.2.5 identifies the acceptability of using seismic Category II structures for protection against some of the events identified in GDC 2 and GDC 4 ("nonseismic events" "…such as internal/external missiles, ~~seismic,~~ …flooding.").

Consistent with the design function of seismic Category II SSCs as defined in UFSAR subsection 3.2.1.1.2, and the application of that design function in the evaluation of seismic Category II structures for the earthquake event, use and credit of the seismic Category II turbine building first bay for protection of Wall 11 against the effects of HELB ~~effects~~ events postulated to occur north of Wall 11.2 and/or protection of Wall 11 openings from tornado missiles involves demonstration that the structure can withstand its design basis loading for a given event, while maintaining its integrity. Meeting these criteria demonstrate the seismic Category II structure can fulfill an important to safety barrier function to provide protection against tornado missiles and HELB effects for the duration of those applied loads, while no "continued function" of the structure is required.

HELB events that could be postulated to occur concurrent with the safe shutdown earthquake are also addressed in the design of seismic Category II structures. As discussed above, seismic Category II structures are designed and analyzed to the same standards and codes, design requirements, load combinations, and methodology used for design of seismic Category I structures. The required loading combinations are identified in

UFSAR Tables 3.8.4-1 and 3.8.4-2. Loading combination No. 7 in each table requires consideration of HELB loads concurrent with the safe shutdown earthquake. Accordingly, seismic Category II structures are designed and analyzed to a load combination that includes HELB loads concurrent with the safe shutdown earthquake loads, and demonstrated to meet the acceptance criteria contained in ACI 349-01 for concrete structures and AISC N690-1994 for steel structures for the duration of the loading events. No continued function of the structure is required following the initial loading period.

Accordingly, use of the seismic Category II turbine building first bay, or portions thereof, as a barrier protecting safety-related equipment from the effects of HELB or tornado missiles is essentially just an extension of the credit of a structure determined to be acceptable for mitigating the GDC 2 earthquake event, to another GDC 2 event (tornado), and a GDC 4 event (HELB). Like with the earthquake event, the turbine building first bay is analyzed to the loading(s) associated with the tornado and HELB events, and demonstrated to meet the acceptance criteria contained in ACI 349-01 for concrete structures and AISC N690-1994 for steel structures, with no further acceptance criteria other than to maintain its integrity following these loadings. Thus, as with the earthquake event, following the initial loading, no continued function of the structure is required. Thus, the use and acceptance of seismic Category II structures (and their associated design, analysis, construction, and quality requirements) for mitigation of the earthquake event has direct relevance to the use of seismic Category II structures to provide protection from tornado missiles and HELB effects.

The design, analysis, construction, and quality assurance requirements associated with AP1000 seismic Category II structures were reviewed and approved by the NRC as documented in the AP1000 FSER, Section 3.7.2.8.1, “Annex Building,” which states:

> The annex building is classified as seismic Category II and the minimum clearance between the structural elements of this building above grade and the NI is 10.2 cm (4 in.). As stated in DCD Tier 2, Section 3.2.1.1.2, seismic Category II SSCs are designed to prevent their collapse under the SSE and to preclude their structural failure during an SSE or interaction with SC-I items. Either of these outcomes could degrade the functioning of a safety-related SSC to an unacceptable level, or could result in an incapacitating injury to the occupants of the MCR. The applicant also states in DCD Tier 2, Section 3.7.2 that seismic Category II building structures are designed for the SSE using the same method and allowable limits as those used for seismic Category I structures. In addition, during the review meetings, the staff examined the design calculations and found that the 10.2 cm (4 in.) clearance between the annex building and the NI will prevent any interaction between these two buildings. On the basis of the above discussion, the staff finds that the interaction from the annex building to the NI will not be a concern in the event of an SSE.

And in AP1000 FSER Section 3.2.1:

> To satisfy Position C.4 of RG 1.29, the pertinent QA requirements of Appendix B to 10 CFR Part 50 should apply to all seismic Category ll SSCs. In DCD Tier 2,

> Section 3.2.1.1.2, the applicant stated that pertinent portions of 10 CFR Part 50, Appendix B are applicable to the AP1000 seismic Category II SSCs. Accordingly, the staff concludes that this represents an acceptable commitment to item (2) above and is consistent with Position C.4 of RG 1.29.

Thus, for the earthquake event, which is one of several natural phenomena within the scope of GDC 2, the NRC has accepted the design and analysis methods, industry codes used, and quality assurance requirements associated with seismic Category II structures for the purpose of protecting safety-related, seismic Category I structures, systems, and components from adverse effects of the earthquake event, and ultimately to protect against the loss of the safety function of a safety-related SSC.

In the AP1000 ~~certified~~ approved design, seismic Category II design, analysis, and quality assurance program requirements were determined to be acceptable for the purpose of preventing unacceptable interaction between a seismic Category II structure and an adjacent seismic Category I structure. Accordingly, the design, analysis, construction and quality of a seismic Category II structure has been determined to be acceptable for protecting safety-related or seismic Category I SSCs during the earthquake event, one of the natural phenomena addressed in 10 CFR 50 Appendix A, GDC 2. This license amendment requests approval of the credit of a seismic Category II structure to protect against other events addressed in GDC 2 and GDC 4, namely, tornado missile events and HELB ~~pipe whip~~ events. Thus, the NRC is being requested to approve the credit and use of the same structure subjected to different load cases, which are required already as part of the design and analysis of the structure.

The quality assurance programs established to design and construct seismic Category II structures are considered reasonable and appropriate, and graded to enable successful performance of these structures under accident or event loading conditions, are commensurate with the importance of the safety functions being performed, and thus provide adequate assurance that the public health and safety will be protected.

Finally, it is worthy of noting that while not an event addressed by the general design criteria, as discussed in UFSAR Appendix 19F, turbine building first bay Wall 11.2 is a key design feature for the protection of the auxiliary building from the impact of a large commercial aircraft, credited to assist in mitigating damage and fire spread from the event.

4.3 Significant Hazards Consideration

The proposed changes would revise the licensing basis documents by 1) modifying the auxiliary building north wall at Column Line 11 (Wall 11) by removing vent openings at elevation 148′-9″ - 151′-6″ within the main steam isolation valve (MSIV) compartments (Wall 11 upper vent openings), and changing the detail design of reinforcement in Wall 11 to extend the wall reinforcement to fill the openings, and modifying the reinforcement detailing and development to conform with American Concrete Institute (ACI) 349 and ACI 318-11 requirements for detailing and development, 2) clarifying the use and classification of building structures that provide a protective function during nonseismic events, 3) crediting turbine building Wall 11.2 as a high energy line break (HELB) barrier protecting Wall 11 from

the effects of HELB events postulated to occur north of Wall 11.2, and 4) crediting the seismic Category II turbine building first bay to provide protection of Wall 11 openings from tornado missiles. This activity proposes changes to Updated Final Safety Analysis Report (UFSAR) Tier 2 information and involves changes to Tier 2* information, and to a License Condition.

An evaluation to determine whether or not a significant hazards consideration is involved with the proposed amendment was completed by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below.

4.3.1 Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: **No**

The proposed changes do not adversely affect the operation of any systems or equipment inside or outside the auxiliary building that could initiate or mitigate abnormal events, e.g., accidents, anticipated operational occurrences, earthquakes, floods, tornado missiles, and turbine missiles, or their safety or design analyses, evaluated in the UFSAR. The changes do not adversely affect any design function of the auxiliary building or the systems and equipment contained therein. The ability of the affected auxiliary building MSIV compartments to withstand the pressurization effects from the design basis pipe rupture is not adversely affected by the removal of the Wall 11 upper vent openings, because vents at these locations are not credited in the subcompartment pressurization analysis. MSIV compartment temperatures following the limiting one square foot pipe rupture with the vent openings removed remain acceptably within the envelope for environmental qualification of equipment in the compartments. The credit of seismic Category II Wall 11.2 as a HELB barrier protecting Wall 11 from the effects of HELB events postulated to occur north of Wall 11.2 and the seismic Category II turbine building first bay and associated missile barriers to protect Wall 11 openings from tornado missiles continues to provide adequate protection of structures, systems, and components (SSCs) required to safely shut down the plant, as these structures are designed to the same requirements as seismic Category I structures, and with the additional HELB loadings assumed, remain well within the applicable acceptance criteria.

Therefore, the proposed activity does not involve a significant increase in the probability or consequences of an accident previously evaluated.

4.3.2 Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: **No**

The proposed changes do not change the design function of the auxiliary building or of any of the systems or equipment in the auxiliary building or elsewhere within the

Nuclear Island structure. These proposed changes do not introduce any new equipment or components that would result in a new failure mode, malfunction or sequence of events that could affect safety-related or nonsafety-related equipment. This activity will not allow for a new fission product release path, result in a new fission product barrier failure mode, or create a new sequence of events that would result in significant fuel cladding failures.

Therefore, this activity does not create the possibility of a new or different kind of accident from any accident previously evaluated.

4.3.3 Does the proposed amendment involve a significant reduction in a margin of safety?

Response: **No**

The margin of safety for the design of the auxiliary building is maintained through continued use of the current codes and standards as stated in the UFSAR and adherence to the assumptions used in the analyses of this structure and the events associated with this structure. The auxiliary building will continue to maintain a seismic Category I rating which preserves the current structural safety margins. The 3-hour fire rating requirements for the impacted auxiliary building walls are maintained. The Wall 11 upper vents are not credited in the subcompartment pressurization analysis and the remaining vents and pressure relief devices provide sufficient venting to maintain the MSIV compartment pressures below the design limit and design basis. The credit of turbine building Wall 11.2 as a HELB barrier provides protection of Wall 11 from the ~~selected~~ dynamic effects of HELB events postulated to occur north of Wall 11.2, which in turn provides that essential SSCs remain protected from the effects of postulated HELB events. The credit of the seismic Category II turbine building first bay and associated missile barriers to provide protection of Wall 11 openings from tornado missiles provides sufficient protection for the essential SSCs located in the auxiliary building in the vicinity of Wall 11 from the effects of external missiles. Thus, the requested changes will not adversely affect any safety-related equipment, design code, function, design analysis, safety analysis input or result, or design/safety margin. No safety analysis or design basis acceptance limit/criterion is challenged or exceeded by the requested change, thus, no margin of safety is reduced

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

4.4 Conclusions

Based on the considerations discussed above, 1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, 2) such activities will be conducted in compliance with the Commission's regulations, and 3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public. The above evaluations demonstrate that the proposed changes can be accommodated without an increase in the probability or

consequences of an accident previously evaluated, without creating the possibility of a new or different kind of accident from any accident previously evaluated, and without a significant reduction in a margin of safety. Having arrived at negative declarations with regard to the criteria of 10 CFR 50.92, this assessment determined that the proposed change does not involve a Significant Hazards Consideration.

5. Environmental Considerations

The details of the proposed changes are provided in other portions of this licensing amendment request. This is a request to amend the licensing basis documents to allow departure from various elements of the plant-specific design control document Tier 2* information incorporated into the Updated Final Safety Analysis Report (UFSAR). The proposed changes would revise the licensing basis documents in regard to the AP1000 auxiliary building north wall at Column Line 11 by: removing Wall 11 upper vent openings at elevation 148′-9″ - 151′-6″ within the MSIV compartments, by changing the detail design of reinforcement in Wall 11 to extend the wall reinforcement to fill the openings and modifying the reinforcement detailing and development to conform with ACI 349-01 and ACI 318-11 requirements for detailing and development, and by clarifying the treatment of HELB loadings within the east MSIV compartment. In addition, the proposed changes would clarify the use and classification of building structures that provide a protective function during nonseismic events, credit the turbine building Wall 11.2 as a HELB ~~pipe whip and jet impingement~~ barrier in the pipe rupture hazard analyses to protect Wall 11 from the effects of HELB events postulated to occur north of Wall 11.2, and credit the turbine building first bay and associated missile barriers for protection of Wall 11 openings in the tornado missile hazards analysis. These physical changes will be collectively called “proposed changes.”

This Licensee has determined that the anticipated construction and operational effects of the proposed amendment meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9), in that:

(i) There is no significant hazards consideration.

As documented in Section 4.3, Significant Hazards Consideration, of this license amendment request, an evaluation was completed to determine whether or not a significant hazards consideration is involved by focusing on the three standards set forth in 10 CFR 50.92, “Issuance of amendment.” The Significant Hazards Consideration determined that 1) the proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated; 2) the proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated; and 3) the proposed amendment does not involve a significant reduction in a margin of safety. Therefore, it is concluded that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and accordingly, a finding of “no significant hazards consideration” is justified.

(ii) There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

The proposed change to remove the Wall 11 upper vent openings within the MSIV compartments in the auxiliary building by extending the wall reinforcement and filling the openings with concrete ~~and to close off the openings with reinforced concrete~~, removes a potential leakage path for effluents that can be released offsite. The proposed change to remove the Wall 11 upper vent openings within the MSIV compartments and the changes to the ~~detail design of reinforcement in~~ Wall 11 reinforcement detailing and development to conform with ACI 349-01 and ACI 318-11 requirements ~~for detailing and development~~ improves the structural capability of the impacted auxiliary building wall and facilitates ~~designing~~ maintaining the wall as a 3-hour fire barrier. The change to the description of the HELB loads in the east MSIV compartment provides clarity and consistency within the licensing basis. Analyses performed to credit Wall 11.2 as a HELB barrier confirm its ability to protect the auxiliary building from the dynamic effects of piping ruptures postulated in the turbine building north of Wall 11.2. Analyses performed to credit the turbine building first bay ~~as protection of~~ to protect Wall 11 openings from tornado missiles confirms its ability to protect the auxiliary building openings from external missiles. The functions of the auxiliary building to support, protect, and separate the seismic Category I mechanical and electrical equipment contained therein, to provide shielding for the radioactive equipment and piping within the building and to maintain its structural integrity for design basis loads are not adversely affected by this change. The proposed change is, therefore, unrelated to any aspect of plant construction or operation that would introduce any change to effluent types (e.g., effluents containing chemicals or biocides, sanitary system effluents, and other effluents), or affect any plant radiological or non-radiological effluent release quantities. Furthermore, the proposed change does not adversely affect any effluent release path or diminish the functionality of any design or operational features that are credited with controlling the release of effluents during plant operation. Therefore, it is concluded that the proposed amendment does not involve a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite.

(iii) There is no significant increase in individual or cumulative occupational radiation exposure.

The proposed change to remove the Wall 11 upper vent openings within the MSIV compartments in the auxiliary building by extending the wall reinforcement and filling ~~to close off~~ the openings with ~~reinforced~~ concrete~~,~~ removes a potential leakage path for effluents that can be released offsite. The proposed change to remove the~~se~~ Wall 11 upper vent openings within the MSIV compartments, and the changes to the ~~detail design of reinforcement in~~ Wall 11 reinforcement detailing and development to conform with ACI 349-01 and ACI 318-11 requirements ~~for detailing and development~~ improve the structural capability of the impacted auxiliary building wall and facilitate ~~designing~~ maintaining the wall as a 3-hour fire barrier. The change to the description

of the HELB loads in the east MSIV compartment provides clarity and consistency within the licensing basis. Analyses performed to credit Wall 11.2 as a HELB barrier confirms its ability to protect the auxiliary building from the dynamic effects of piping ruptures postulated in the turbine building north of Wall 11.2. Analyses performed to credit the turbine building first bay ~~as protection of~~ to protect the essential SSCs located in the auxiliary building in the vicinity of Wall 11 openings from tornado missiles confirms its ability to protect the auxiliary building openings from external missiles. The functions of the auxiliary building to support, protect, and separate the seismic Category I mechanical and electrical equipment contained therein, to provide shielding for the radioactive equipment and piping within the building and to maintain its structural integrity for design basis loads are not adversely affected by this change. The proposed change to the auxiliary building does not adversely affect any plant radiation zones, and controls under 10 CFR 20 preclude a significant increase in occupational radiation exposure. Therefore, the proposed amendment does not involve a significant increase in individual or cumulative occupational radiation exposure.

Based on the above review of the proposed amendment, it has been determined that anticipated construction and operational impacts of the proposed amendment do not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in the individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), an environmental impact statement or environmental assessment of the proposed exemption is not required.

Southern Nuclear Operating Company

Vogtle Electric Generating Plant (VEGP) Units 3 and 4

ND-16-0557

Enclosure 2

Proposed Changes to Licensing Basis Documents

(LAR-15-021S1)

(This Enclosure consists of 18 pages, including this cover page.
Original revisions are depicted in red and green.
Green text indicates moved to/from another location without revision.
Supplemental revisions are depicted in blue.)

Part 1A Associated Licensing Basis Changes related to auxiliary building Wall 11 changes ~~design~~

UFSAR Subsection 3.8.4.6.3, Special Construction Techniques - Revise to include additional information in a new final paragraph shown below.

Where out-of-plane shear reinforcement is provided within the radial/circumferential reinforcement pattern for the main steam line anchor in auxiliary building Wall 11 (Figure 3H.5-5), tolerance on shear reinforcement is specified to maintain the maximum spacing requirements of ACI 349-01, and the minimum spacing requirements of ACI 318-11 for headed reinforcement.

UFSAR Subsection 3H.5.1.4, Wall at Column Line 11 - Revise information in the first, fourth, and sixth paragraphs in the locations shown below.

[*The north wall of the MSIV east compartment, at column line 11 (Wall 11) between elevation 117'-6" and elevation 153'-0", has been identified as a critical section.*

The segment of the wall between elevation 117'-6" and elevation 135'-3" is 4 feet thick, and several pipes such as the main steam line, main feed water line, and the start-up feed water line are anchored to this wall at the interface with the turbine building.

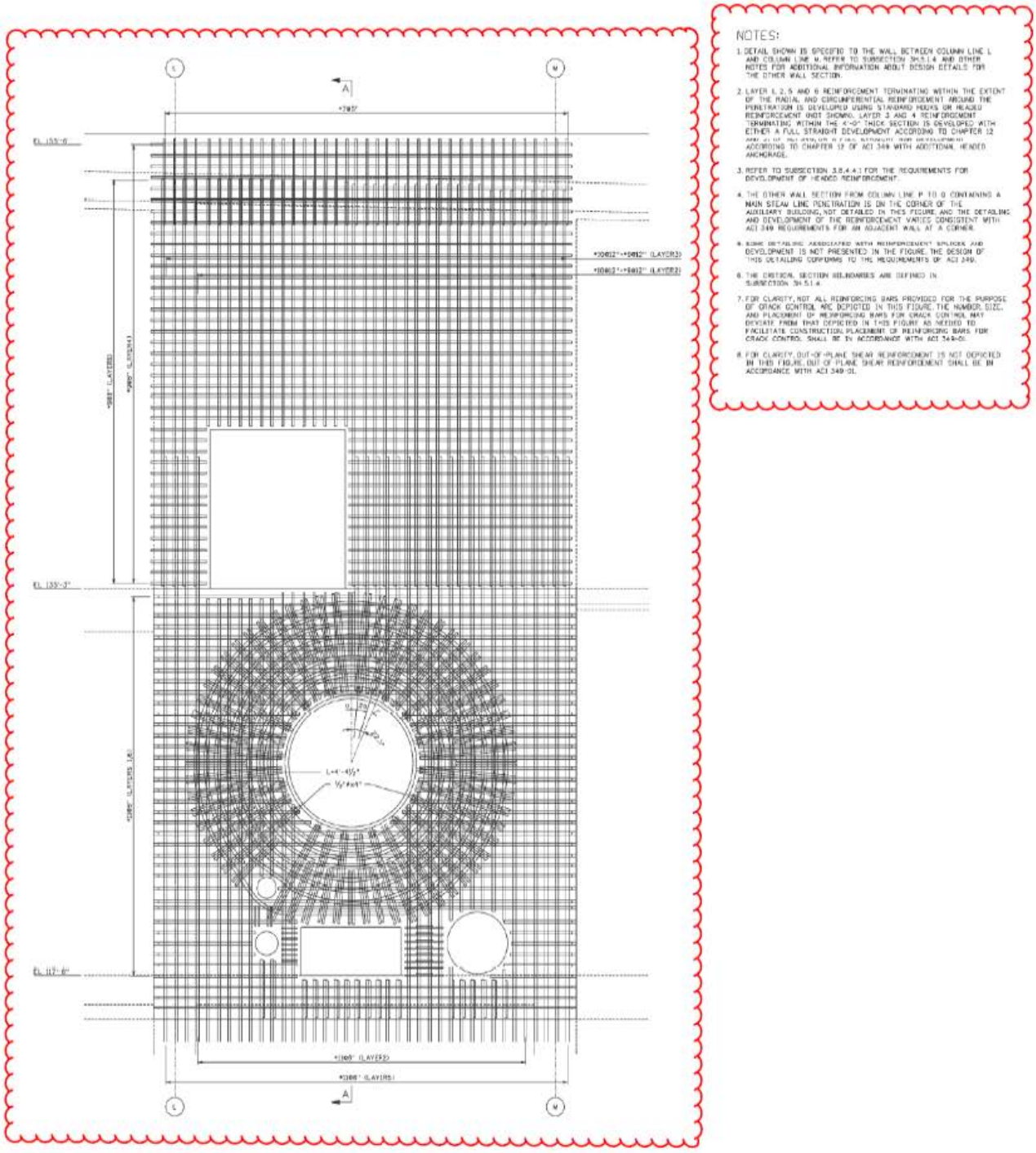
The wall segment from elevation 135'-3" to elevation 153'-0" does not provide support to any high energy lines, and is 2 feet thick. This portion does not have to withstand reactions from high energy line breaks.

The wall (Wall 11) is designed to withstand loads such as the dead load, live load, seismic load and the thermal load. The MSIV compartments are ~~room is a~~ break exclusion areas, but the design also considered the compartment pressurization load~~s~~ associated with a one square foot pipe rupture in the MSIV compartments. ~~room, such as compartment pressurization,~~ Wall 11 in the east MSIV compartment is also designed to withstand the jet loads~~,~~ and the reactions at the pipe anchors for main steam and main feedwater line breaks assumed to occur in the east MSIV compartment. Additionally, the Wall 11 design for both MSIV compartments considers loads from postulated breaks in the turbine building, which include turbine building first bay pressurization, jet loads, reactions at the Wall 11 pipe anchors, and pipe whip. ~~The loads on the pipe anchor include pipe rupture loads for breaks in the turbine building.~~

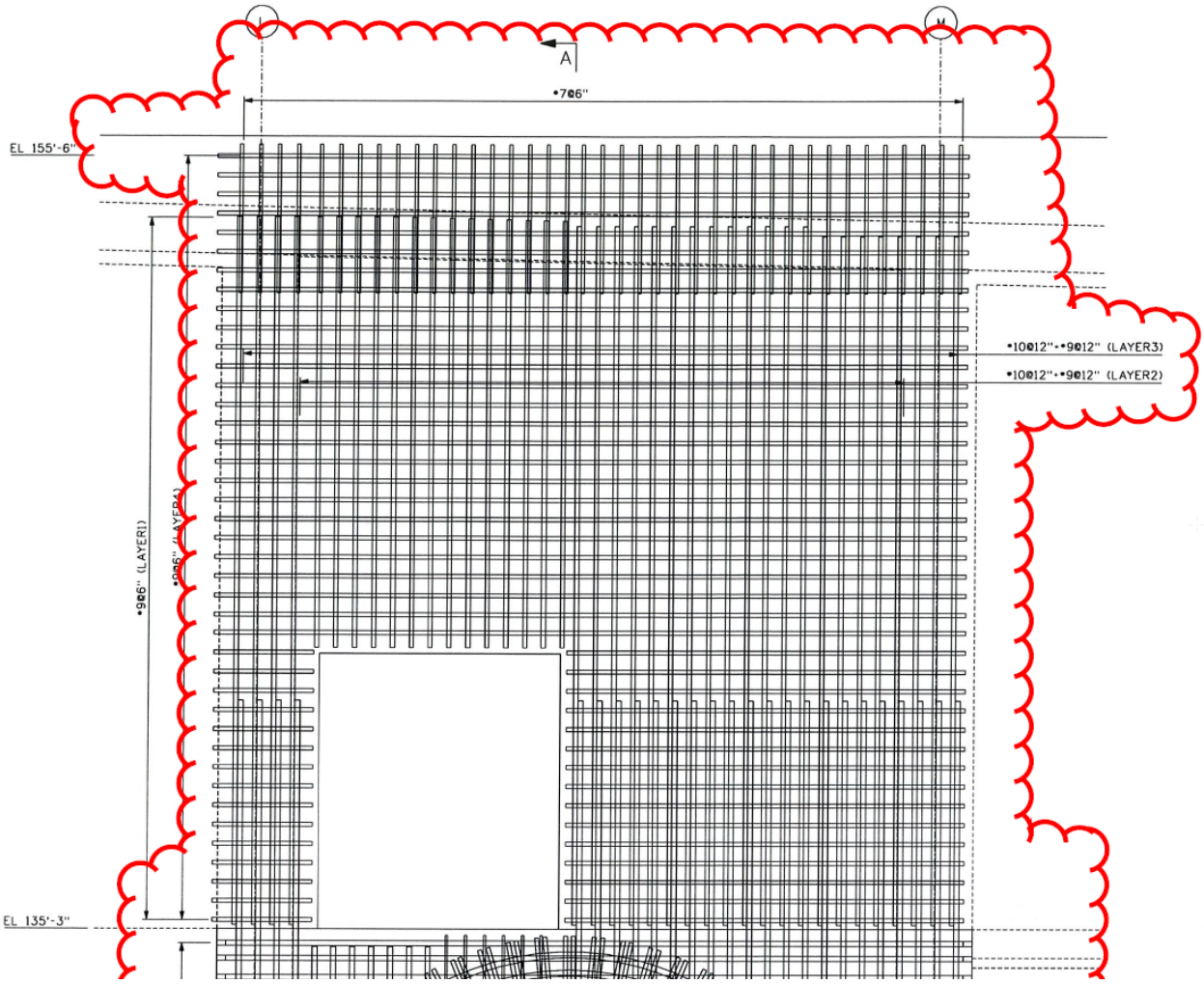
The wall structure is analyzed using three dimensional finite element analyses supplemented by hand calculations. Analyses are performed for individual loads, and design loads are determined for applicable load combinations from Table 3.8.4-2.

~~Typical w~~Wall reinforcement for this location is shown in Figure 3H.5-5 illustrating conformance with ACI 349-01 requirements. The reinforcement ~~design associated with some~~ detailing and development for the wall of the MSIV west compartment varies because the compartment is in the corner of the auxiliary building and the adjacent wall on column line Q (Wall Q) is oriented at 90 degrees to Wall 11.]*

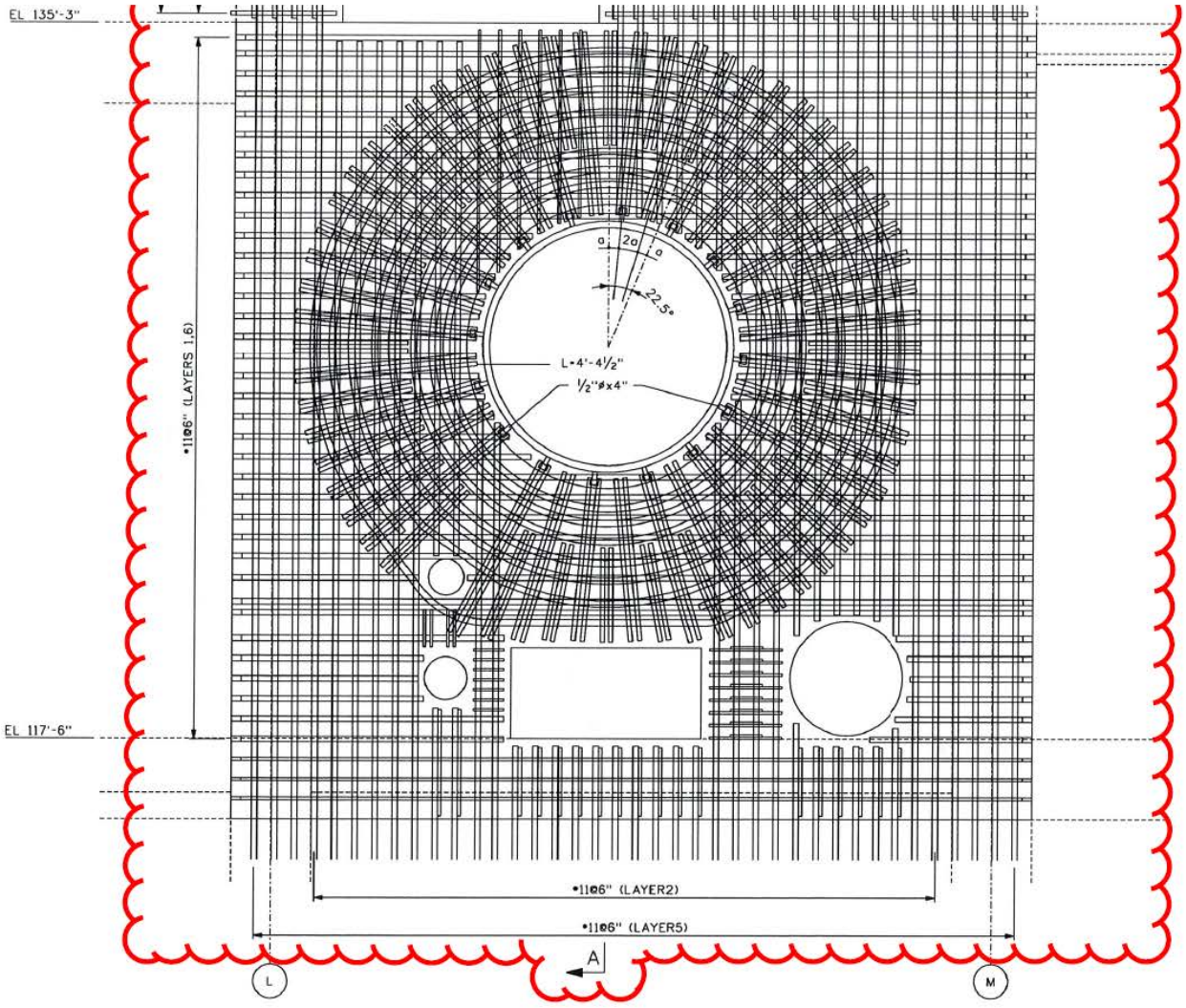
UFSAR Appendix 3H, Figure 3H.5-5, Sheet 1 of 3 [*Concrete Reinforcement in Wall 11*]* - Revise information for the figure as shown below (complete figure) [Note 4 revised with this supplement].



UFSAR Appendix 3H, Figure 3H.5-5, Sheet 1 of 3 [*Concrete Reinforcement in Wall 11*]* - Detailed view of the revised information for the upper portion of reinforcement.



UFSAR Appendix 3H, Figure 3H.5-5, Sheet 1 of 3 [*Concrete Reinforcement in Wall 11*]* - Detailed view of the revised information for the lower portion of reinforcement.



UFSAR Appendix 3H, Figure 3H.5-5, Sheet 1 of 3 [*Concrete Reinforcement in Wall 11*]* - Revise the figure to add notes as shown below [Note 4 revised with this supplement].

NOTES:

1. DETAIL SHOWN IS SPECIFIC TO THE WALL BETWEEN COLUMN LINE L AND COLUMN LINE M. REFER TO SUBSECTION 3H.5.1.4 AND OTHER NOTES FOR ADDITIONAL INFORMATION ABOUT DESIGN DETAILS FOR THE OTHER WALL SECTION.

2. LAYER 1, 2, 5 AND 6 REINFORCEMENT TERMINATING WITHIN THE EXTENT OF THE RADIAL AND CIRCUMFERENTIAL REINFORCEMENT AROUND THE PENETRATION IS DEVELOPED USING STANDARD HOOKS OR HEADED REINFORCEMENT (NOT SHOWN). LAYER 3 AND 4 REINFORCEMENT TERMINATING WITHIN THE 4'-0" THICK SECTION IS DEVELOPED WITH EITHER A FULL STRAIGHT DEVELOPMENT ACCORDING TO CHAPTER 12 AND 21 OF ACI 349, OR A FULL STRAIGHT BAR DEVELOPMENT ACCORDING TO CHAPTER 12 OF ACI 349 WITH ADDITIONAL HEADED ANCHORAGE.

3. REFER TO SUBSECTION 3.8.4.4.1 FOR THE REQUIREMENTS FOR DEVELOPMENT OF HEADED REINFORCEMENT.

4. THE OTHER WALL SECTION FROM COLUMN LINE P TO Q CONTAINING A MAIN STEAM LINE PENETRATION IS ON THE CORNER OF THE AUXILIARY BUILDING, NOT DETAILED IN THIS FIGURE, AND THE DETAILING AND DEVELOPMENT OF THE REINFORCEMENT VARIES CONSISTENT WITH ACI 349 REQUIREMENTS FOR AN ADJACENT WALL AT A CORNER.

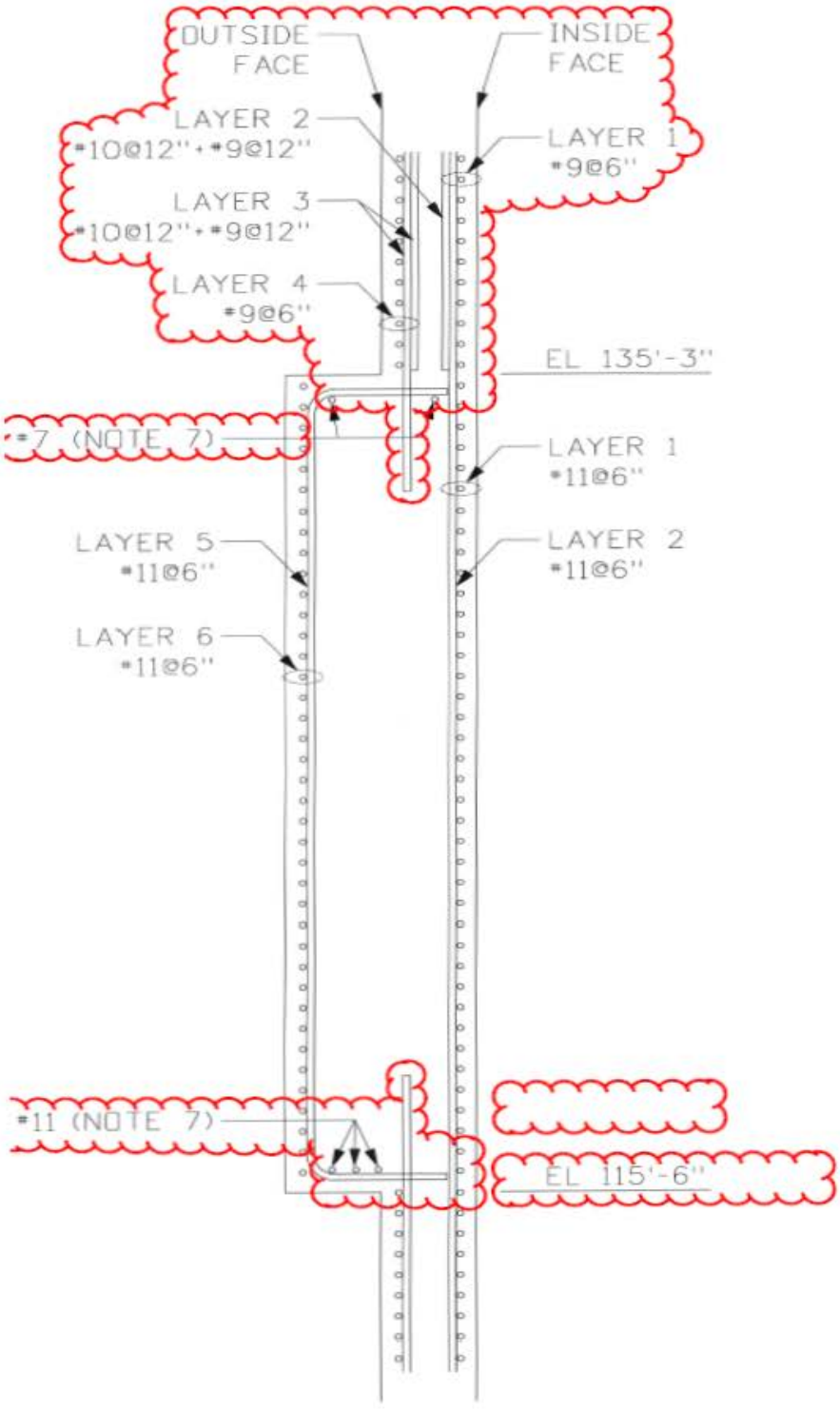
5. SOME DETAILING ASSOCIATED WITH REINFORCEMENT SPLICES AND DEVELOPMENT IS NOT PRESENTED IN THE FIGURE. THE DESIGN OF THIS DETAILING CONFORMS TO THE REQUIREMENTS OF ACI 349.

6. THE CRITICAL SECTION BOUNDARIES ARE DEFINED IN SUBSECTION 3H.5.1.4.

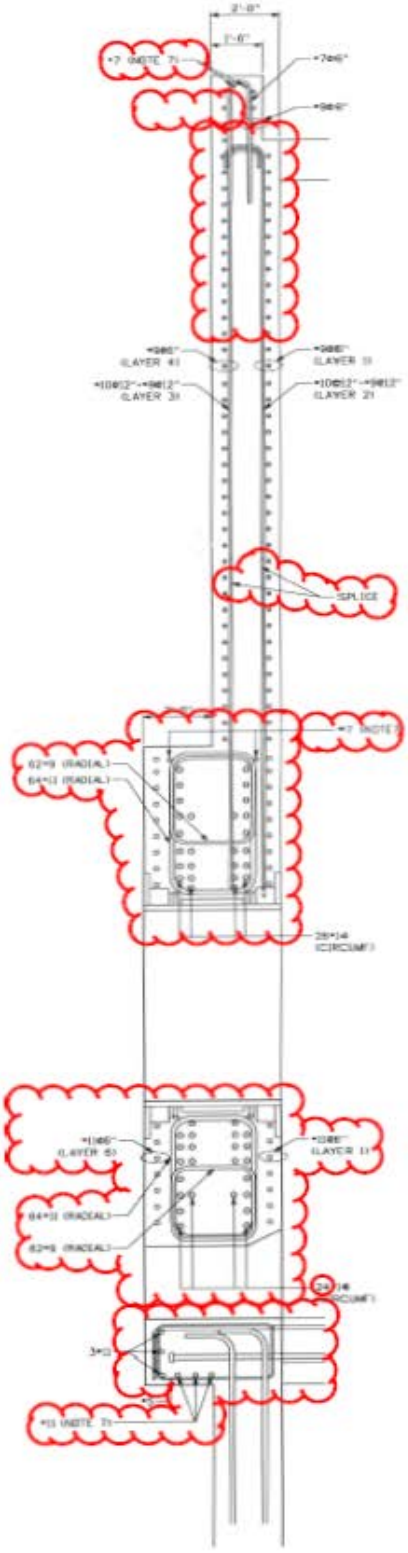
7. FOR CLARITY, NOT ALL REINFORCING BARS PROVIDED FOR THE PURPOSE OF CRACK CONTROL ARE DEPICTED IN THIS FIGURE. THE NUMBER, SIZE, AND PLACEMENT OF REINFORCING BARS FOR CRACK CONTROL MAY DEVIATE FROM THAT DEPICTED IN THIS FIGURE AS NEEDED TO FACILITATE CONSTRUCTION. PLACEMENT OF REINFORCING BARS FOR CRACK CONTROL SHALL BE IN ACCORDANCE WITH ACI 349-01.

8. FOR CLARITY, OUT-OF-PLANE SHEAR REINFORCEMENT IS NOT DEPICTED IN THIS FIGURE. OUT-OF-PLANE SHEAR REINFORCEMENT SHALL BE IN ACCORDANCE WITH ACI 349-01.

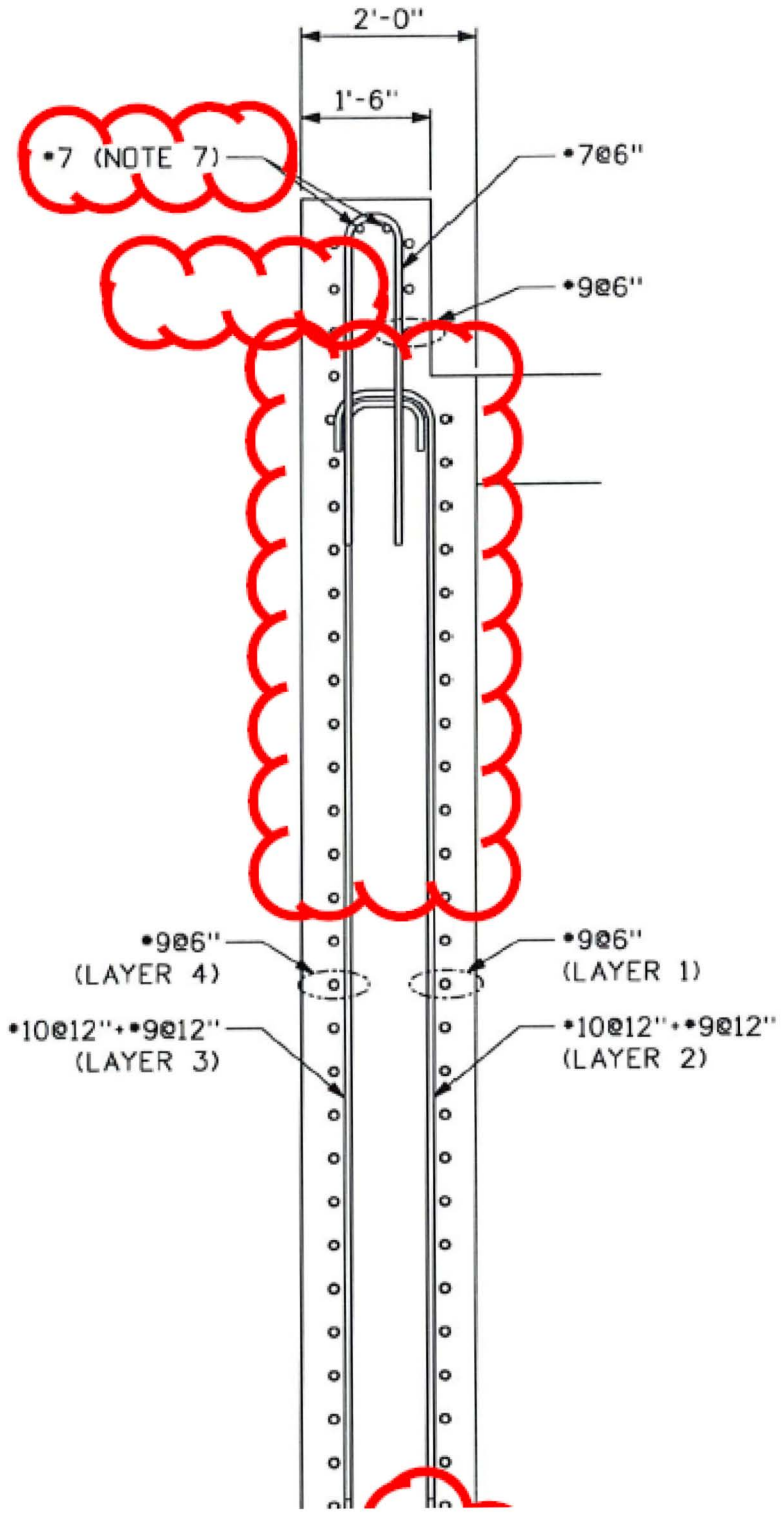
UFSAR Appendix 3H, Figure 3H.5-5, Sheet 2 of 3 [*Concrete Reinforcement Layers in Wall 11 (Looking East)*]* - Revise information for the figure as shown below.



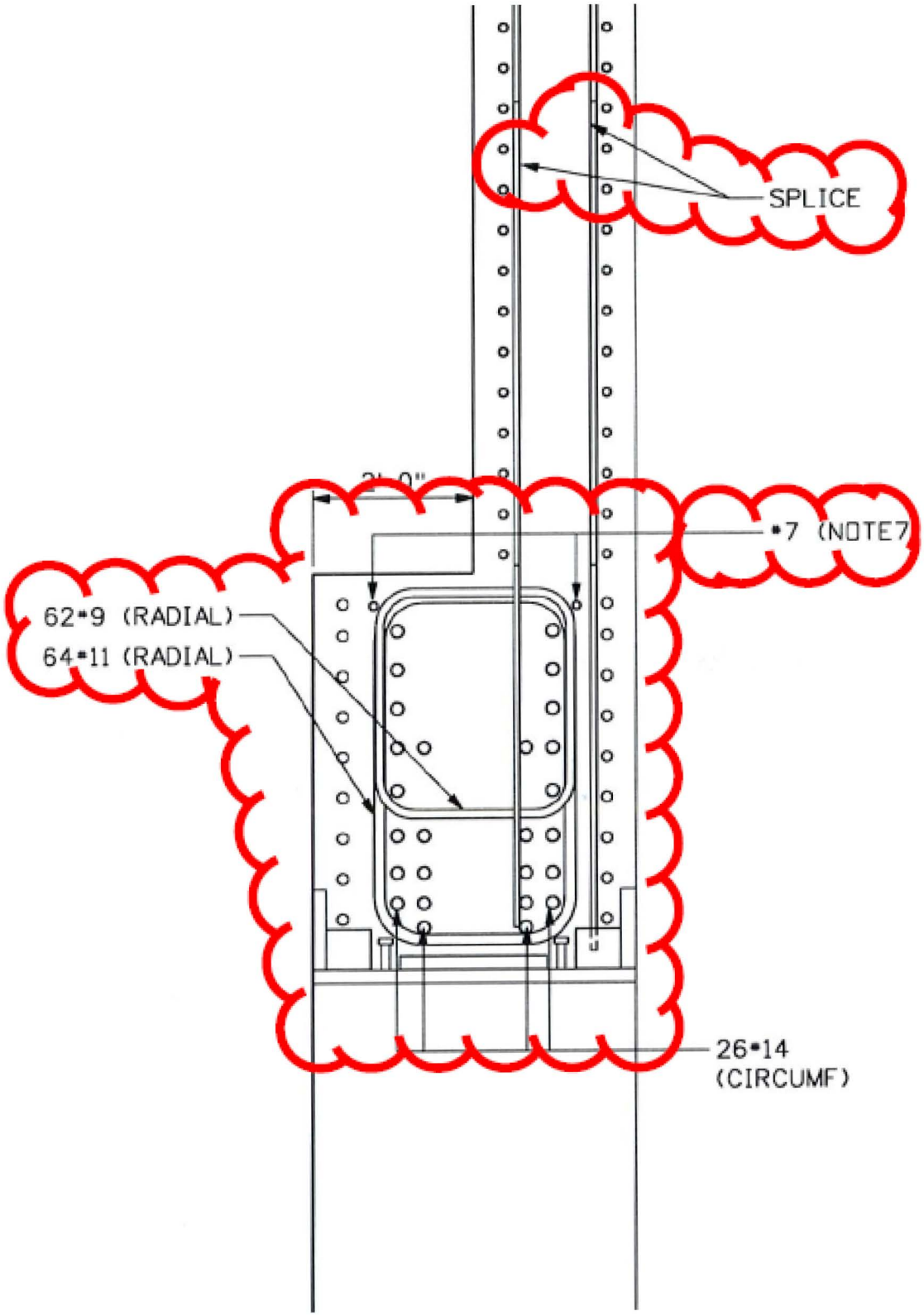
UFSAR Appendix 3H, Figure 3H.5-5, Sheet 3 of 3 [*Wall 11 at Main Steamline Anchor Section A-A*]* - Revise information for the figure as shown below (complete figure).



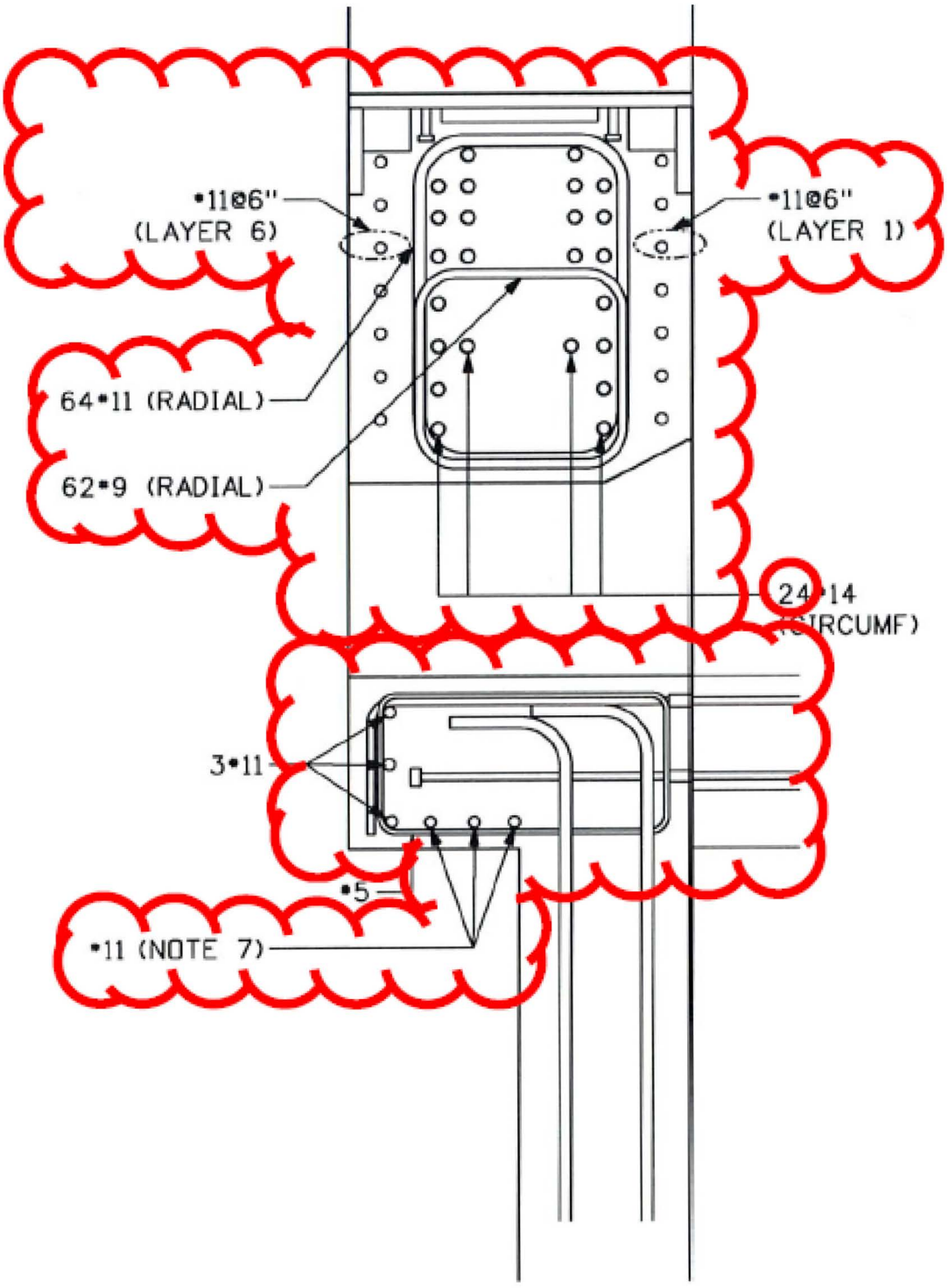
UFSAR Appendix 3H, Figure 3H.5-5, Sheet 3 of 3 [*Wall 11 at Main Steamline Anchor Section A-A*]* - Detailed view of the revised information for the upper portion of the figure.



UFSAR Appendix 3H, Figure 3H.5-5, Sheet 3 of 3 [*Wall 11 at Main Steamline Anchor Section A-A*]* - Detailed view of the revised information for the middle portion of the figure.



UFSAR Appendix 3H, Figure 3H.5-5, Sheet 3 of 3 [*Wall 11 at Main Steamline Anchor Section A-A*]* - Detailed view of the revised information for the lower portion of the figure.



Part 1B Associated Licensing Basis Changes related to use and classification of seismic category II structures providing a protective function for nonseismic events

UFSAR Subsection 3.2.1.1.1, Seismic Category I (C-I) - Revise cross reference in first paragraph as shown below (and fix editorial punctuation at the end of the first sentence).

Seismic Category I applies to, in general, safety-related structures, systems, and components.~~,~~
Seismic Category I also applies to…
… (See Subsection 3.2.2.5~~3~~.)

UFSAR Subsection 3.2.1.1.2, Seismic Category II (C-II) - Revise first, third and last paragraphs to include new sentences in the locations shown below.

Seismic Category II applies to plant structures, systems, and components which perform no safety-related function, and the continued function of which is not required. Seismic Category II applies to structures, systems, and components designed to prevent their collapse under the safe shutdown earthquake. Structures, systems and components are classified as seismic Category II to preclude their structural failure during a safe shutdown earthquake or interaction with seismic Category I items which could degrade the functioning of a safety-related structure, system, or component to an unacceptable level, or could result in incapacitating injury to occupants of the main control room. The turbine building first bay building structure, including Wall 11.2, is a seismic Category II structure as identified in Table 3.2-2. The turbine building first bay building structure provides tornado missile protection for openings in Wall 11 as described in Table 3.5-1. Wall 11.2 also protects Wall 11 from the dynamic effects of pipe failure events in the nonseismic portion of the turbine building.

Seismic Category II structures, systems, and components are designed so that the safe shutdown earthquake does not cause unacceptable structural failure of or interaction with seismic Category I items. Seismic Category II fluid systems require an appropriate level of pressure boundary integrity if located near sensitive equipment.

The criteria used for the design of seismic Category II structures, systems, and components are discussed in Section 3.7. As identified in Subsection 3.7.2, seismic Category II building structures are designed for the safe shutdown earthquake using the same methods and design stress limits as are used for seismic Category I structures. Seismic Category II building structures are also designed to withstand the design basis tornado loads, including missiles, in accordance with the loading combinations identified in Table 3.8.4-2.

Pertinent portions of 10 CFR 50, Appendix B apply to the analysis and design of seismic Category II structures, systems, and components. The quality assurance requirements for the analysis and design of seismic Category II structures, systems, and components are performed in accordance with the Westinghouse AP1000 quality plan as described in Section 17.3 and are sufficient to provide that these components will meet the requirement to not cause unacceptable structural failure of or interaction with seismic Category I items. See Section 17.7 for the Combined License applicant quality assurance program requirement. These quality requirements are applicable to the seismic Category II turbine building first bay building structure.

UFSAR Subsection 3.2.2.5, Equipment Class C - Revise the ninth bullet of the fourth paragraph to include new information in the locations shown below.

- Provide structures ~~and buildings~~ to protect Class A, B, and C structures, systems, and components from events such as internal/external missiles, seismic, ~~and~~ flooding, and the dynamic and environmental effects of pipe failures. Structures protecting equipment from nonseismic events are not required to be seismic Category I. An exception to this equipment Class C criterion is the equipment Class D barriers described in Table 3.5-1 that provide tornado missile protection. The seismic Category II turbine building first bay building structure also provides tornado missile protection for openings in Wall 11 as described in Table 3.5-1, and turbine building first bay building structure Wall 11.2 provides protection of Wall 11 from HELB loads resulting from postulated ruptures in main steam and main feedwater piping north of the turbine building first bay.

UFSAR Subsection 3.2.2.6, Equipment Class D - Revise the eighth paragraph to include new information in the locations shown below.

…The systems and components are not designed for seismic loads. However, when Class D structures, systems, and components are located near a Class A, B, or C structure, system, or component, the requirements for seismic Category II may apply. The tornado missile barriers in the turbine building first bay building structure identified in Table 3.5-1 are seismic Category II, equipment Class D.

UFSAR Table 3.2-1, Comparison of Safety Classification Requirements - Revise the AP1000 Code Letter C entry for the column labeled "RG 1.29 Seismic Design Reqmnts" to add a new Note 14 designation and add new Note 14 to the Notes under the table in the locations shown below.

C	SC-3	I(14)	3	1E	GROUP C	YES	YES(7)	(8)
D	NNS(2)	NA(9)(14)	NA(10)	(10)	GROUP D	NO(10)	YES(11)	(11)

14. The seismic Category II tornado missile barriers located on or within the turbine building first bay and identified in Subsections 3.2.2.5 and 3.2.2.6, and in Table 3.5-1 provide tornado missile protection for openings in auxiliary building Wall 11.

Part 1C Associated Licensing Basis Changes related to use of turbine building first bay Wall 11.2 as a HELB Barrier

UFSAR Subsection 3.6.1.1, Design Basis - Revise information in item J to include additional information in the location shown below.

J. Safety-related systems and components are used to mitigate the effects of postulated pipe ruptures. However, the seismic Category II wall separating the first bay of the turbine building from the main area of the turbine building (Wall 11.2) is credited with protecting the north wall of the auxiliary building (Wall 11) from high energy line break (HELB) loads ~~pipe whip effects~~ resulting from postulated ruptures in main steam and main feedwater piping north of the turbine building first bay. In addition, the turbine control and stop, moisture separator reheater 2nd stage steam isolation, and turbine bypass (steam dump) valves (which are not safety-related) are credited in single failure analyses to mitigate postulated steam line ruptures.

UFSAR Subsection 3.6.1.3.2, Protection Mechanisms - Revise to include additional information in the Barriers and Shields discussion as a new third paragraph shown below.

Outside the containment, the wall separating the first bay of the turbine building from the main area of the turbine building (Wall 11.2) is credited with protecting the north wall of the auxiliary building (Wall 11) from HELB loads ~~pipe whip effects~~ resulting from postulated ruptures in main steam and main feedwater piping north of the turbine building first bay. The wall is designed and analyzed for the loadings associated with the effects of postulated pipe ruptures in high energy lines north of the turbine building first bay in conjunction with the required load combinations identified in Subsection 3.8.4, and determined to meet the acceptance criteria contained in ACI 349-01 and AISC N690-1994.

COL Condition 2.D(12)(b) is also revised (since it references AP1000 DCD Rev. 19, Section 3.6.1.3.2) - Revise to include additional information as shown below. (The appropriate amendment number will need to be inserted upon approval and issuance of the amendment.)

(b) Before commencing installation of individual piping segments and connected components in their final locations, SNC shall complete the as-designed pipe rupture hazards analysis for compartments (rooms) containing those segments in accordance with the criteria outlined in the AP1000 DCD, Rev. 19, Sections 3.6.1.3.2 (as revised by Amendment No. ##) and 3.6.2.5, and shall inform the Director of NRO, or the Director's designee, in writing, upon the completion of this analysis and the availability of the as-designed pipe rupture hazards analysis reports.

Part 1D Associated Licensing Basis Changes related to use of the turbine building first bay as a protective structure for tornado missiles

UFSAR Subsection 3.5.2, Protection from Externally Generated Missiles - Revise to include additional information as three new paragraphs in the location shown below.

… Openings through these walls are evaluated on a case-by-case basis to provide confidence that a missile passing through the opening would not prevent safe shutdown and would not result in an offsite release exceeding the limits defined in 10 CFR 50.34. ~~The evaluation of site-specific hazards for external events that may produce missiles more energetic than tornado missiles is discussed in Subsection 2.2.1.~~

Where necessary, adjacent structures and/or missile barriers are used to protect openings in the nuclear island building structures. Building structures credited in this evaluation to protect openings in seismic Category I nuclear island building structures are seismic Category I or seismic Category II (see Subsection 3.2.1.1.2). As identified in Subsection 3.7.2, seismic Category II building structures are designed for the safe shutdown earthquake using the same methods and design stress limits as are used for seismic Category I structures. Seismic Category II building structures are also designed to withstand the design basis tornado loads, including missiles, in accordance with the loading combinations identified in Table 3.8.4-2.

Evaluation of the openings in the north wall of the auxiliary building (Wall 11) considered the protection provided by the seismic Category II turbine building first bay building structure and associated missile barriers, consistent with the provisions in Subsections 3.2.1.1.1, 3.2.1.1.2, 3.2.2.5, and 3.2.2.6. The seismic Category II turbine building first bay building structure and the missile barriers provided over the turbine building first bay large openings ~~(seven openings in Wall 11.2; three openings in Wall R)~~ are designed and analyzed to protect the openings in the north wall of the auxiliary building from the automobile missile described in Subsection 3.5.1.4. The turbine building first bay large opening missile barriers are located as follows:

- First bay compartment elevation 100′-0″
  - Four large opening missile barriers on Wall 11.2
- First bay compartment elevation 117′-6″
  - Two large opening missile barriers on Wall 11.2
  - One large opening missile barrier on Wall R
- First bay compartment elevation 135′-3″
  - One large opening missile barrier on Wall 11.2
  - One large opening missile barrier on Wall R
- First bay compartment elevation 148′-10″
  - One large opening missile barrier on Wall R

In accordance with the missile identification and protection criteria provided in Section 3.5, a realistic assessment of potential missile paths was conducted. Where the line of sight of a missile passing through a turbine building first bay building structure opening could potentially result in missile impact upon a Wall 11 opening, the missile was considered credible, and additional protection was provided or additional evaluation performed. As a result of this analysis, a missile barrier designed to stop the 8-inch artillery shell and 1-inch sphere missiles is provided within the interior of the turbine building first bay building structure, at elevation 117′-6″, northeast of MSIV Compartment B. Where the 1-inch diameter solid steel sphere or 8-inch artillery shell missiles were determined to have a line of sight to a Wall 11 penetration, analysis was performed to

confirm that there was no line of sight through the penetration, the contents of the penetration would prevent the missile from passing through Wall 11, or equipment required to achieve safe shutdown could not be adversely affected.

The steel tornado missile barriers located on or within the turbine building first bay are designed and analyzed in accordance with the barrier design procedures contained in Subsection 3.5.3 and applicable AISC N690 requirements.

The steel tornado missile barriers located on or within the turbine building first bay, identified in Table 3.5-1, are designed and analyzed in accordance with the barrier design procedures and ductility requirements contained in Subsection 3.5.3 and applicable AISC N690 requirements. The missile barriers are permanently anchored to the turbine building first bay or auxiliary building as applicable. Where anchored to concrete, the anchors conform with the anchorage requirements contained in Subsection 3.8.4.5.1. The configuration of the barriers is based on the lines of sight to be eliminated and the missile sizes pertinent to those lines of sight. The configuration also provides for functional requirements such as airflow, venting, and personnel access. Steel barrier designs are provided in both solid and grating-type configurations to address the required missile protection and functional requirements on a case-by-case basis. The missile protection provided for Wall 11 openings and penetrations is tabulated in Table 3.5-1. Protection of Wall 11 openings from external missiles is provided by the seismic Category II turbine building first bay building structure, the seismic Category II missile barriers located on or within the turbine building first bay building structure, ~~and~~ the seismic Category I Wall 11 doors, and the seismic Category I Wall 11 penetrations and spare penetration covers within missile lines of sight. For some missile paths, lines of sight are eliminated for the 8-inch artillery shell and 1-inch sphere missiles due to the depth of the grating-type barrier design.

The evaluation of site-specific hazards for external events that may produce missiles more energetic than tornado missiles is discussed in Subsection 2.2.1. Evaluation of turbine missiles is provided in Subsection 3.5.1.3. Evaluation of tornado missiles is provided in Subsection 3.5.1.4. Conformance with regulatory guide recommendations is provided in Appendix 1A.

UFSAR Subsection 3.5 - Revise to include new Table 3.5-1 as shown below.

Table 3.5-1 (Sheet 1 of 2)
EXTERNAL MISSILE PROTECTION PROVIDED FOR AUXILIARY BUILDING WALL 11 OPENINGS

Wall 11 Opening	Protected Room	Elevation	Missile[1]	Protection[2][3]
Room 12306 doorway	Valve/Piping Penetration Room	100'-0"	Sphere	Room 12306 Wall 11 door
			Artillery Shell	Room 12306 Wall 11 door
			Automobile	First bay building structure Wall 11.2 large opening missile barriers
Room 12404 vent	Lower MSIV Compartment B	117'-6"	Sphere	First bay building structure Wall 11.2 large opening missile barriers First bay interior missile barrier
			Artillery Shell	First bay building structure Wall 11.2 large opening missile barriers First bay interior missile barrier
			Automobile	First bay building structure Wall 11.2 large opening missile barriers
Room 12405 doorway	Lower VBS B&D Equipment Room	117'-6"	Sphere	Room 12405 Wall 11 door
			Artillery Shell	Room 12405 Wall 11 door
			Automobile	First bay building structure Wall 11.2 large opening missile barriers Wall R large opening missile barrier
Room 12406 vent	Lower MSIV Compartment A	117'-6"	Sphere	First bay building structure Wall 11.2 large opening missile barriers
			Artillery Shell	First bay building structure Wall 11.2 large opening missile barriers
			Automobile	First bay building structure Wall 11.2 large opening missile barriers Wall R large opening missile barrier
Room 12504 doorway	Upper MSIV Compartment B	135'-3"	Sphere	Room 12504 Wall 11 door
			Artillery Shell	Room 12504 Wall 11 door
			Automobile	First bay building structure Wall 11.2 large opening missile barrier
Room 12505 doorway	Upper VBS B&D Equipment Room	135'-3"	Sphere	Room 12505 Wall 11 door
			Artillery Shell	Room 12505 Wall 11 door
			Automobile	First bay building structure Wall 11.2 large opening missile barrier
Room 12506 doorway	Upper MSIV Compartment A	135'-3"	Sphere	Room 12506 Wall 11 door
			Artillery Shell	Room 12506 Wall 11 door
			Automobile	First bay building structure Wall R large opening missile barrier

Table 3.5-1 (Sheet 2 of 2)

EXTERNAL MISSILE PROTECTION PROVIDED FOR AUXILIARY BUILDING WALL 11 OPENINGS

Wall 11 Opening	Protected Room	Elevation	Missile[1]	Protection[2]
Wall 11 penetrations	Various	Various	Sphere	First bay building structure Pipe sleeves Penetration contents Spare penetration covers
			Artillery Shell	First bay building structure Pipe sleeves Penetration contents Spare penetration covers
			Automobile	First bay building structure Wall 11.2 large opening missile barriers Wall R large opening missile barriers

Notes:

1. Tornado missiles are defined in Subsection 3.5.1.4.
2. Turbine building first bay is a seismic Category II building structure. Wall 11 doors, Wall 11 penetration sleeves, and Wall 11 spare penetration covers that provide tornado missile protection are equipment Class C. Barriers in the turbine building first bay building structure that provide tornado missile protection are equipment Class D.
3. The materials of construction for the missile barriers installed on or within the turbine building first bay and on Wall 11 shall be steel as specified below, or steel with equal or better material properties:
   - Wall 11.2 and Wall R large opening missile barriers
     - grating bar, baseplate - ASTM A240
     - perimeter frame - ASTM A36 or ASTM A992
     - anchors - ASTM F1554, Gr. 105
   - First bay interior missile barrier
     - barrier plate - ASTM A240
     - barrier support frame - ASTM A500, Gr. B
     - anchors - ASTM A325 or ASTM A490, and ASTM F1554, Gr. 105 as required
   - Wall 11 missile doors
     - door plate - ASTM A240
     - embed plates - ASTM A572, Gr. 50
     - anchors - ASTM A1064
   - Wall 11 spare penetration covers
     - ASTM A240
   - Pipe sleeves
     - material shall be as specified for their penetration function

Southern Nuclear Operating Company

Vogtle Electric Generating Plant (VEGP) Units 3 and 4

ND-16-0557

Enclosure 3

Voluntary Response to NRC January 22 and February 25, 2016 Public Meetings Questions on SCANA LAR 14-02.

(LAR-15-021S1)

(This Enclosure consists of 11 pages, including this cover page.)

Point 1: The Auxiliary building is located on the Nuclear Island and houses some of the systems and components that are required to perform safety functions during different plant states. These safety related systems and components are protected from external hazards generated missiles by the exterior walls and roof of the Auxiliary building. The North wall of the Auxiliary Building is on grid line 11 and henceforth is identified as "Wall 11." The License Amendment Request (LAR) LAR-14-02 in Section 2, para 3, describing the protective functions of Wall 11 identifies a series of loads that were considered in the structural design of Wall 11. Wall 11 also serves as the south wall of the Turbine Building located outside the nuclear island adjacent to the Auxiliary Building. The first bay of the Turbine building is between Wall 11 and the wall North of Wall 11. This wall is located on grid 11.2 and henceforth identified as "Wall 11.2." The first bay of the Turbine building including Wall 11.2 and Wall R is designed as Seismic Category II. Both are designed to the same codes and load combinations as used for the design of Wall 11 which is designated as Seismic Category I. The design codes are specified in UFSAR Section 3.8 and conform to relevant regulatory requirements.

The staff review requires a summary, using the format of Table 3.8.4-2, with the values of loads (lbs. / sq. ft.) used in each load combination case that was used in the design of Wall 11 and Wall 11.2

Response to Point 1:

The LAR was supplemented with a summary of how UFSAR Table 3.8.4-2 loads are used for Wall 11 and the turbine building first bay to help the NRC in confirming that all code requirements are met. The information was also summarized in 2 tables and added to the LAR.

Please note also that a few clarifications should be made where Point 1 discusses the first bay location and configuration. Wall 11 is not the south wall of the turbine building first bay. While Wall 11 "encloses" portions of the first bay, Wall 11 is not part of the first bay structure, which is independent from the auxiliary building. The second clarification is that Wall 11.2 is part of (and the north wall of) the turbine building first bay.

For changes to the LAR, see **Enclosure 1 pages 17, 18-20, 47 and 48**.

For a review of exact load values, the calculations containing the loads can be made available to the NRC for an audit.

Point 2: The LAR states that Wall 11, Wall 11.2 and Wall R are also evaluated to resist all design basis tornado missiles.

The staff review requires a summary of the missile impact evaluations that consider both two way and one way wall load dispersion per ACI 349 and show that the demand "wall thickness" was determined for the worst load combination, meeting ACI 349 requirements.

Response to Point 2:

The LAR was supplemented with the clarification that both one way and two way load dispersion was used in order to show that the demand for wall thickness was based on the worst load combination.

For changes to the LAR, see **Enclosure 1 pages 53 and 55**.

Point 3: To provide protection from missile entry through the openings on Wall 11 the applicant has used a number of barriers to prevent such an event. The doors on Wall 11 provide protection against all but the tumbling automobile missile.

The staff review requires a summary of the methodology used and the results of the calculations performed to establish that the doors provide acceptable protection against the design basis missiles.

Point 4: In addition for protections against tornado generated missiles the applicant has used missile barriers to prevent the influence of any potential missile impact beyond Wall 11.2 and Wall R.

The staff review requires the location of each of these barriers in the FSAR and a description of the critical characteristics of the barrier showing their location with respect to column lines. In addition, the review requires that the applicant should provide a summary of the barrier evaluation and resulting design details.

Response to Point 3 & 4:

The LAR was supplemented with additional information concerning the Wall 11 and the turbine building first bay barriers. The added information consists of the general barrier location, safety classification, material, general size, and specification. This additional information is also presented in a table, which summarizes the barrier characteristics, as well as four SUNSI barrier location figures.

For details on the methodology, the LAR points to the barrier design procedures contained in UFSAR subsection 3.5.3 and the related calculations can be made available to the NRC via an audit.

For changes to the LAR text, see **Enclosure 1 pages 26-27, 50-58, 60, Enclosure 2 page 13, 15, and 17-19, and Enclosure 4.**

Point 5: On page 40, Part 1C of Updated Enclosure 1 – Supplement to License Amendment Request: Wall 11 Design Related Changes (LAR 14-02 S1), it states that, "In accordance with the pipe break criteria in UFSAR subsection 3.6.2.5, breaks are postulated at every fitting for piping that has not been seismically analyzed. For breaks in high energy piping postulated to occur in the nonseismic portion of the turbine building (north of Wall 11.2) with the potential for impacting Wall 11, bounding pipe whip and jet impingement loads are applied to Wall 11.2 as a result of the bounding postulated breaks." The staff noted that Subsection 3.6.2.1.1.3 of AP1000 DCD states that terminal ends and intermediate fittings are postulated for piping that has been seismically analyzed.

The staff review requires clarification on whether terminal ends, if any, are considered in the determination of the bounding postulated breaks for those nonseismic piping. If not, clarification is necessary to justify why terminal ends are excluded from the consideration.

The staff review also requires the detailed information regarding how the bounding dynamic effects (i.e., pipe whip and jet impingement loads) resulting from the bounding postulated breaks are determined, demonstration that the pertinent DCD methodologies are appropriately implemented in determining the resulting bounding dynamic loads on the Wall 11.2.

Response to Point 5

The LAR was supplemented to provide the clarification that terminal ends are considered for the bounding of postulated breaks.

For changes to the LAR text, see **Enclosure 1 page 44**.

For a review of the analysis details associated with the bounding of postulated breaks, the PRHA calculation containing the information can be made available to the NRC for an audit.

Point 6: On page 15, Part 1D of Updated Enclosure 2 – Supplement to Proposed Changes to Licensing Basis Documents (LAR 14-02 S1), there are proposed changes to UFSAR Subsection 3.6.1.1 and 3.6.1.3.2 discussing pipe whip effects resulting from postulated ruptures in main steam and main feedwater piping, but no mention of jet impingement loads. What is the basis for excluding jet impingement loads?

Response to Point 6

The LAR was clarified with respect to the application of jet impingement loads, by clarifying that all HELB loads were taken into consideration, in a manner consistent with the methodology approved by the NRC during the AP1000 DCD certification.

For changes to the LAR text, see **Enclosure 1 pages 7, 24, 33, 40, 44, 45, 66, and 69, and Enclosure 2 page 14.**

Response to Additional NRC comments

In addition to the Points above discussed in the January 22 public meeting, the NRC provided 11 comments during the public meeting on February 25, 2016, after review of draft LAR NND-16-0056 (ML16055A344). The comments were provided verbally and have been reiterated below:

1. With respect to the Wall 11 rebar, clearly differentiate design or detail design from rebar detailing:

- Updates were made throughout the LAR to better outline changes related to the reinforcement detailing and development.

- Note that the portions of the LAR describing the NRC approved AP1000 design and design basis requirements or loadings, requested changes to the main steam penetration anchorage design, requested removal of the Wall 11 upper vent openings, or reference made to Figure 3H.5-5 as a depiction of the critical section reinforcement design are not affected by these changes.

For changes to the LAR text, see **Enclosure 1 pages 2-4, 6, 8-10, 12-13, 15-17, 20-24, 27-28, 38, 40, 63-64, 66, and 69-71, and Enclosure 2 pages 2, 3, and 6.**

2. The wording describing the Wall 11 design being contingent on the Wall 11.2 design need to be clarified:

- Updates were made throughout the LAR to clarify that the credit of Wall 11.2 (for HELB) and the turbine building first bay (for tornado missiles) are the design changes proposed to protect Wall 11 openings from tornado missiles, and Wall 11 against postulated breaks in the turbine building north of Wall 11.2.

For changes to the LAR text, see **Enclosure 1 pages 3-5, 14, 24, 26-28, 31, 38, 44-46, 49, 62, and 66-71, and Enclosure 2 page 13.**

3. The discussion of Tier 2 changes involving Tier 2* need to be clarified as to what the Tier 2 changes are:

- Updates were made where necessary in the LAR to point the reader to text providing the detail pertaining to the Tier 2 changes.

- Note that generally, LAR Enclosure 1, Parts 1B, 1C and 1D focus on the Tier 2 changes, while Part 1A focuses on the Tier 2* changes.

For changes to the LAR text, see **Enclosure 1 pages 4, 5, and 27**

4. The higher pressure of 6.5 psi listed in Enclosure 1 table 1 of the draft LAR appears to the NRC as though the LAR requests the new pressure to be approved, this should to be clarified or deleted if applicable:

- The mention of 6.5 psi has been removed, and the LAR does not request approval of this value.

For changes to the LAR text, see **Enclosure 1 page 19**

5. In the draft LAR the statement appearing after Enclosure 1 Table 1 mentioning governing load combination “3 and 7” as well as “5 and 7” needs to be clarified or deleted if applicable:

- The LAR was updated to delete the identification of governing load combinations from both Table 1 (Wall 11 load definition table) and Table 2 (Wall 11.2 load definition table)

For changes to the LAR text, see **Enclosure 1 pages 19 and 48.**

6. The NRC would like the LAR to confirm and state if it is the case, that there is no impact to any VBS doors from HELB or Tornado loading.

- The LAR was updated to clarify that these doors are not impacted by HELB or tornado loading in Parts 1B and 1C

For changes to the LAR text, see **Enclosure 1 pages 46, 53, and 54.**

7. To help the NRC assess the barrier's technical requirements such as ductility, the licensee is requested to:

a) Provide barrier/anchoring material with specific grade (i.e. ASTM material)

- The LAR was updated to clarify the ASTM material grade for the barriers in Part 1D and the UFSAR markups to Subsection 3.5.2.

For changes to the LAR text, see **Enclosure 1 pages 55- 58, and Enclosure 2 pages 16 and 18.**

b) To clarify the permanent nature of the barriers, which would require a 50.59 evaluation if they are to be removed/repair/replaced during plant operation

- The LAR was updated to stress the permanent nature of the barriers in Part 1D and the UFSAR markups to Subsection 3.5.2.

For changes to the LAR text, see **Enclosure 1 pages 52 and 56, and Enclosure 2 page 16.**

8. Discuss applicable anchoring code in the LAR

- The LAR Part 1D and the UFSAR markups to Subsection 3.5.2, were updated to point to the anchorage requirements discussed in UFSAR 3.8.4.5.1.

For changes to the LAR text, see **Enclosure 1 pages 52 and 56-58, and Enclosure 2 page 16.**

9. Correct compartment A to B and west to east in Table 3 Row 4

- The corrections were made

For changes to the LAR text, see **Enclosure 1 page 58.**

10. Revise the word “proceedings” to “hearings” in the LAR.

- The change was made as follows, “proceedings” was changed to “NRC..review” because the NRC “hearings” did not take place at the time the mentioned 2010 RAI was addressed.

For changes to the LAR text, see **Enclosure 1 page 31.**

11. Revise “dynamic effects” to “dynamic and environmental effects” in the LAR

- Updates were made throughout the LAR to change “dynamic effects” to “dynamic and environmental effects” where the LAR discusses evaluation of Wall 11.2 as a HELB barrier, or the design of Wall 11.

- Note that select portions of the LAR did not require these changes. In particular portions of the LAR stating that Wall 11.2 is credited for protecting Wall 11 against HELB loads. This is because Wall 11.2 is not needed to protect Wall 11 from environmental effects of pipe ruptures postulated north of Wall 11.2 (pressure, temperature), given that Wall 11 is already evaluated for the more severe environmental conditions associated with postulated ruptures in the first bay.

For changes to the LAR text, see **Enclosure 1 pages 7, 11, 17, 21, 26, and 44-46, and Enclosure 2 page 13.**

Southern Nuclear Operating Company

Vogtle Electric Generating Plant (VEGP) Units 3 and 4

ND-16-0557

Enclosure 4

Supplement to Request for License Amendment Regarding Wall 11 Changes

(LAR-15-021S1)

Note: The following pages in this enclosure contain Security-Related Information and should be withheld from public disclosure under 10 CFR 2.390(d).

(This Enclosure consists of 3 pages, including this cover page.)