

SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

RELATED TO EXEMPTION AND AMENDMENT NO. 59

TO COMBINED LICENSE NO. NPF-93

AND LICENSE NO. NPF-94

SOUTH CAROLINA ELECTRIC AND GAS COMPANY

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

VIRGIL C. SUMMER NUCLEAR STATION UNITS 2 AND 3

DOCKET NOS. 52-027 AND 52-028

1.0 INTRODUCTION

By letter dated February 27, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14065A022) and supplemented by the letters dated July 9, 2014 (ADAMS Accession No. ML14192A036), September 25, 2014 (ADAMS Accession No. ML14268A544), August 20, 2015 (ADAMS Accession No. 15236A100), December 17, 2015 (ADAMS Accession No. ML15351A428), June 1, 2016 (ADAMS Accession No. ML16154A048) and November 17, 2016 (ADAMS Accession No. ML16323A034), South Carolina Electric and Gas Company on behalf of itself and the South Carolina Public Service Authority (both, hereafter, called the licensee) requested that the U.S. Nuclear Regulatory Commission (NRC) amend the combined licenses (COL) for Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3, COL Numbers NPF-93 and NPF-94, respectively, regarding the Annex and Radwaste Building Changes.

The proposed amendment (LAR 13-09) would revise the Updated Final Safety Analysis Report (UFSAR) in the form of departures from the incorporated plant-specific Design Control Document (DCD) Tier 2 information. The proposed amendment also involves related changes to plant-specific Tier 1 information, with corresponding changes to the associated COL Appendix C information to clarify the Inspections, Tests, Analyses and Acceptance Criteria (ITAAC) related to the Annex and Radwaste Building Changes. Specifically, the proposed License Amendment Request (LAR) would:

- (1) Update the annex building column line designations on affected Tier 1 Figures and Tier 2 Figure 3.7.2-19; and
- (2) Revise the radwaste building configuration including the shielding design and radiation area monitoring.

The licensee has also requested an exemption from the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, Appendix D, "Design Certification Rule for the AP1000 Design," Section III.B, "Scope and Contents," to allow a change to the corresponding portions of the certified information in Tier 1 of the generic DCD.¹

In order to modify the UFSAR (the plant-specific DCD) Tier 1 information, the NRC must find the licensee's exemption request included in its submittal for the LAR to be acceptable. The staff's review of the exemption request, as well as the LAR, is included in this safety evaluation.

The NRC staff issued an initial *Federal Register* notice of opportunity to request a hearing and a proposed No Significant Hazard Consideration Determination on April 15, 2014 (79 FR 21299). Letters dated July 9, 2014, September 25, 2014, August 20, 2015, December 17, 2015, June 1, 2016, and November 17, 2016, provided additional information that supplemented the LAR. This additional information did not expand the scope of the LAR and did not change the NRC staff's original proposed No Significant Hazard Consideration Determination.

2.0 REGULATORY EVALUATION

10 CFR 20.1101, "Radiation Protection Program" requires each licensee to develop, document, and implement a radiation protection program sufficient to ensure compliance with 10 CFR Part 20. It also requires that the licensee use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA).

10 CFR 50.48, "Fire protection," requires a fire protection plan that satisfies 10 CFR Part 50, Appendix A, GDC 3, "Fire Protection."

10 CFR 50.150, "Aircraft impact assessment," requires, in part, applicants to perform a design-specific assessment of the effects on the facility of the impact of a large, commercial aircraft. Using realistic analyses, the applicant identifies and incorporates into the design those design features and functional capabilities to show that, with reduced use of operator actions: (i) the reactor core remains cooled, or the containment remains intact; and (ii) spent fuel cooling or spent fuel pool integrity is maintained.

10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants," GDC 1, "Quality Standards and Records," provides, in part, that structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of safety functions to be performed.

10 CFR Part 50, Appendix A, GDC 2, "Design Bases for Protection Against Natural Phenomena," provides, in part, that structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes,

¹ While the licensee describes the requested exemption as being from Section III.B of 10 CFR Part 52, Appendix D, the entirety of the exemption pertains to proposed departures from Tier 1 information in the generic DCD. In the remainder of this evaluation, the NRC will refer to the exemption as an exemption from Tier 1 information to match the language of Section VIII.A.4 of 10 CFR Part 52, Appendix D, which specifically governs the granting of exemptions from Tier 1 information.

tornadoes, hurricanes, floods, tsunamis, and seiches without loss of capability to perform their safety functions.

10 CFR Part 50, Appendix A, GDC 3, "Fire Protection," requires, in part, structures, systems, and components important to safety to be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

10 CFR Part 50, Appendix A, GDC 4, "Environmental and Dynamic Effects Design Basis," provides, in part, 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-cooling accidents.

10 CFR Part 50, Appendix A, GDC 60, "Control of Releases of Radioactive Materials to the Environment," provides, in part, that the nuclear power unit design shall include means to control suitably the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation, including anticipated operational occurrences. Sufficient holdup capacity shall be provided for retention of gaseous and liquid effluents containing radioactive materials.

10 CFR Part 50, Appendix A, GDC 61, "Fuel Storage and Handling and Radioactivity Control," provides that the fuel storage and handling, radioactive waste, and other systems which may contain radioactivity shall be designed to assure adequate safety under normal and postulated accident conditions. These systems shall be designed (1) with a capability to permit appropriate periodic inspection and testing of components important to safety, (2) with suitable shielding for radiation protection, (3) with appropriate containment, confinement, and filtering systems, (4) with a residual heat removal capability having reliability and testability that reflects the importance to safety of decay heat and other residual heat removal, and (5) to prevent significant reduction in fuel storage coolant inventory under accident conditions.

10 CFR Part 50, Appendix A, GDC 63, "Monitoring Fuel And Waste Storage," provides that appropriate systems shall be provided in fuel storage and radioactive waste systems and associated handling areas (1) to detect conditions that may result in loss of residual heat removal capability and excessive radiation levels and (2) to initiate appropriate safety actions.

10 CFR Part 50, Appendix A, GDC 64, "Monitoring Radioactivity Releases," provides that means shall be provided for monitoring the reactor containment atmosphere, spaces containing components for recirculation of loss-of-coolant accident fluids, effluent discharge paths, and the plant environs for radioactivity that may be released from normal operations, including anticipated operational occurrences, and from postulated accidents.

10 CFR Part 52, Appendix D, Section VIII.A.4 states that exemptions from Tier 1 information are governed by the requirements of 10 CFR 52.63(b)(1) and 10 CFR 52.98(f). It also states that the Commission will deny such a request if the design change causes a significant reduction in plant safety otherwise provided by the design.

10 CFR 52.63(b)(1) allows the licensee to request an exemption from one or more elements of the certification information. The Commission may grant such a request only if it complies with the requirements of 10 CFR 52.7, which, in turn, points to the requirements listed in 10 CFR 50.12 for specific exemptions. In addition, 10 CFR 52.63(b)(1) states that, when considering the granting of an exemption, the Commission considers whether the special circumstances

present, which is required by 10 CFR 52.7, outweigh any decrease in safety that may result from the reduction in standardization caused by the exemption. Therefore, any exemption from the Tier 1 information certified by Appendix D to 10 CFR Part 52 must meet the requirements of 10 CFR 50.12, 52.7 and 52.63(b)(1).

10 CFR 52.98(f) states that any modification to, addition to, or deletion from the terms and conditions of a COL, including any modification to, addition to, or deletion from the ITAAC contained in the license, is a proposed amendment to the license. Appendix C of COLs NPF-93 and NPF-94 contains non-system design description, tables and figures that the licensee is proposing to modify. Therefore, the proposed change requires a license amendment.

Tier 1 Information is defined in 10 CFR Part 52, Appendix D Section II.D. 10 CFR Part 52, Appendix D Section II.D.3 lists ITAAC as part of the definition for Tier 1 information.

Section VIII.B.5.a of Appendix D of 10 CFR Part 52 requires NRC approval for a departure from Tier 2 information that involves a change to or departure from Tier 1 information. Because the proposed amendment request includes changes to Tier 2 information that involve changes to Tier 1 information NRC approval is required before making the Tier 2 changes addressed in this departure.

10 CFR Part 52, Appendix D, Section VIII.A.4 states that exemptions from Tier 1 information are governed by the requirements of 10 CFR 52.63(b)(1) and 10 CFR 52.98(f). It also states that the Commission will deny such a request if the design change causes a significant reduction in plant safety otherwise provided by the design.

10 CFR 73.55(a) requires that the licensee's security plans satisfy the requirements of 10 CFR 73.55.

10 CFR 73.55(b) provides, in part, that:

- (1) The licensee shall establish and maintain a physical protection program, to include a security organization, which will have as its objective to provide high assurance that activities involving special nuclear material are not inimical to the common defense and security and do not constitute an unreasonable risk to the public health and safety.
- (2) The physical protection program must protect against the design basis threat of radiological sabotage as stated in 10 CFR 73.1.

10 CFR 73.55(d) establishes requirements to describe a security organization, including the management system for oversight of the physical protection program. The security organization must be designed, staffed, trained, qualified, re-qualified, and equipped to implement the physical protection program as required by 10 CFR 73.55(b) and 10 CFR Part 73, Appendices B and C.

10 CFR 73.55(e) provides, in part, that each licensee shall identify and analyze site-specific conditions to determine the specific use, type, function, and placement of physical barriers needed to satisfy the physical protection program design requirements of 10 CFR 73.55(b), (1) The licensee shall: (i) Design, construct, install and maintain physical barriers as necessary to control access into facility areas for which access must be controlled or denied to satisfy the physical protection program design requirements of paragraph (b) of [10 CFR 73.55(b)].

10 CFR 73.55(i)(6)(i) provides that the licensee shall ensure that all areas of the facility are provided with illumination necessary to satisfy the design requirements of [10 CFR] 73.55(b) and implement the protective strategy.

10 CFR 73.55(k) requires, in part, that the licensee establish and maintain a properly trained, qualified and equipped security personnel required to interdict and neutralize threats up to and including the design-basis threat of radiological sabotage, defined in 10 CFR 73.1, to prevent significant core damage and spent fuel sabotage.

3.0 TECHNICAL EVALUATION

3.1 EVALUATION OF EXEMPTION

INTRODUCTION

The regulations in Section III.B of Appendix D to 10 CFR Part 52 require a holder of a COL referencing Appendix D to 10 CFR Part 52 to incorporate by reference and comply with the requirements of Appendix D, including certified information in Tier 1 of the generic AP1000 DCD.

As defined in Section II of Appendix D to 10 CFR Part 52, Tier 1 information includes ITAAC. Therefore, a licensee referencing Appendix D incorporates by reference all the ITAAC contained in the generic DCD. These ITAAC, along with the plant-specific ITAAC, were enumerated in Appendix C of the COL at its issuance. The proposed changes would depart from the plant-specific DCD by revising non-system based design descriptions in Section 3.3, "Buildings;" ITAAC Table 3.3-6, Items 4b, 4c, and 6b; ITAAC Table 3.5-5; and Figures 3.3-11A, 3.3-12 and 3.3-13. An exemption is needed because Section III.B of Appendix D to 10 CFR 52 requires a licensee to comply with the Tier 1 information of the generic AP1000 DCD.

In summary, the result of this exemption would be that the licensee can implement modifications to Tier 1 information described and justified in LAR 13-09 if and only if the NRC approves LAR 13-09. This exemption is permanent and limited in scope to the particular Tier 1 information specified.

As stated in Section VIII.A.4 of Appendix D to 10 CFR Part 52, an exemption from Tier 1 information is governed by the requirements of 10 CFR 52.63(b)(1) and 52.98(f). Additionally, pursuant to Section VIII.A.4 of Appendix D to 10 CFR Part 52, the Commission will deny an exemption request if it finds that the requested change to Tier 1 information will result in a significant decrease in safety. Pursuant to 10 CFR 52.63(b)(1), the Commission may, upon application by an applicant or licensee referencing a certified design, grant exemptions from one or more elements of the certification information, so long as the criteria given in 10 CFR 52.7 are met and that the special circumstances as defined by 10 CFR 52.12(a)(2) outweigh any potential decrease in safety due to reduced standardization.

Pursuant to 10 CFR 52.7, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 52. Regulations in 10 CFR 52.7 further state that the Commission's consideration will be governed by 10 CFR 50.12, "Specific exemptions," which states that an exemption may be granted when: (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) special circumstances are

present. Regulations in 10 CFR 50.12(a)(2) lists six special circumstances for which an exemption may be granted. It is necessary for one of these special circumstances to be present in order for NRC to consider granting an exemption request. The licensee stated that the requested exemption meets the special circumstances of 10 CFR 50.12(a)(2)(ii). That subsection defines special circumstances as when “[a]pplication of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule.” The staff’s analysis of each of these findings is presented below.

3.1.1 AUTHORIZED BY LAW

This proposed exemption would allow the licensee to implement approved changes to non-system based design descriptions in Section 3.3, “Buildings;” ITAAC Table 3.3-6, Items 4b, 4c, and 6b; ITAAC Table 3.5-5; and Figures 3.3-11A, 3.3-12 and 3.3-13. This exemption is permanent and limited in scope to particular Tier 1 information. Subsequent changes to the above listed Tier 1 information, or any other Tier 1 information, would be subject to full compliance by the licensee as specified in Section VIII.A.4 of Appendix D to 10 CFR Part 52. As stated above, 10 CFR 52.63(b)(1) and Section VIII.A.4 of Appendix D to 10 CFR Part 52 allow the NRC to grant exemptions from one or more elements of the certification information; therefore, the NRC staff has determined that granting of the licensee’s proposed exemption will not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission’s regulations. Therefore, as required by 10 CFR 50.12(a)(1), the staff finds that the exemption is authorized by law.

3.1.2 NO UNDUE RISK TO PUBLIC HEALTH AND SAFETY

The underlying purpose of Appendix D to 10 CFR 52 is to ensure that the licensee will construct and operate the plant based on the approved information found in the DCD incorporated by reference into the licensee’s licensing basis. The changes to the annex and radwaste buildings do not represent any adverse impact on their design functions or the systems, structures, and components therein and will continue to protect the health and safety of the public in the same manner. The annex and radwaste building changes do not introduce any new industrial, chemical, or radiological hazards that would represent a public health or safety risk nor do they modify or remove any design or operational controls or safeguards intended to mitigate any existing on-site hazards. These changes will not impact the ability of the structures to perform their design function. Because the changes will not alter the operation of any plant equipment or systems, these changes do not present an undue risk from existing equipment or systems. These changes do not add any new equipment or system interfaces to the current plant design. Furthermore, the proposed changes would 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. Accordingly and based on the foregoing reasons, these changes do not present an undue risk from any new equipment or systems. Therefore, as required by 10 CFR 50.12(a)(1), the staff finds that there is no undue risk to public health and safety.

3.1.3 CONSISTENT WITH COMMON DEFENSE AND SECURITY

This proposed exemption would allow the licensee to implement approved changes to non-system based design descriptions in Section 3.3, “Buildings;” ITAAC Table 3.3-6, Items 4b, 4c, and 6b; ITAAC Table 3.5-5; and Figures 3.3-11A, 3.3-12 and 3.3-13. This exemption is permanent and limited in scope to particular Tier 1 information. Subsequent changes to the

above listed Tier 1 information or any other Tier 1 information would be subject to full compliance by the licensee as specified in Section VIII.A.4 of Appendix D to 10 CFR 52. The proposed changes do not alter or impede the design, function, or operation of any plant structures, systems, or components (SSCs) associated with the facility's physical or cyber security and, therefore, do not affect any plant equipment that is necessary to maintain a safe and secure plant status. In addition, the proposed changes have no impact on plant security or safeguards. Therefore, based on the foregoing reasons, as required by 10 CFR 50.12(a)(1), the staff finds that the common defense and security is not impacted by this exemption.

3.1.4 SPECIAL CIRCUMSTANCES

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(ii), are present whenever application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule. The underlying purposes of the Tier 1 information are to ensure that the licensee will safely construct and operate the plant based on the certified information found in the AP1000 DCD, which was incorporated by reference into the licensee's licensing basis.

Proposed changes are being made to resolve inconsistencies in the column line designation between the annex building and the auxiliary building figures in the UFSAR. The proposed changes to the annex building column line designations will facilitate plant layout and construction by improving the accuracy of the plant layout figures, with no impact on the ability of these structures to perform as designed.

Additional changes are being made because the analysis of the radwaste building identified that a small amount of moderate activity waste would require a concrete slab too thick for the current structural design of the building to maintain adjacent areas at Zone I radiation levels. The proposed changes to the radwaste building would be made to provide for greater operator flexibility in handling of waste before and after packaging, to minimize the quantity of shielded bunkers required for storage of moderate and high activity waste to keep radiation doses to ALARA values, to allow temporary shielding to maintain acceptable radiation levels on the radwaste building roof, and to maintain portions of the radwaste building at radiation Zone I levels.

The above changes are necessary to enhance the ability of the licensee to construct the plant based on the information in the certified design, by clarifying the information found in non-system based design descriptions in Section 3.3, "Buildings;" ITAAC Table 3.3-6, Items 4b, 4c, and 6b; ITAAC Table 3.5-5; and Figures 3.3-11A, 3.3-12 and 3.3-13. If this exemption is not granted, and the proposed changes in the LAR are not allowed to be implemented, then the Tier 1 information would not conform to the UFSAR Tier 2 design descriptions, and the performance of the Tier 1 ITAAC would not accurately verify construction of the proposed design. Therefore, the staff finds that the special circumstances exist for granting an exemption from Tier 1 information as required by 10 CFR 50.12(a)(2)(ii).

3.1.5 SPECIAL CIRCUMSTANCES OUTWEIGH REDUCED STANDARDIZATION

This proposed exemption would allow the implementation of changes to non-system based design descriptions in Section 3.3, "Buildings;" ITAAC Table 3.3-6, Items 4b, 4c, and 6b; ITAAC Table 3.5-5; and Figures 3.3-11A, 3.3-12 and 3.3-13, which are proposed in the LAR. Key design functions of systems and components included in the annex building or the radwaste building associated with this request will continue to be maintained. Additionally, proposed

changes will resolve inconsistencies in the column line designations in the UFSAR and improve accuracy of plant layout figures. Furthermore, changes to the radwaste building will either maintain or reduce operational exposure to workers, complying with ALARA requirements of 10 CFR Part 20. Based on this, as required by 10 CFR Part 52.63(b)(1), the staff finds that the special circumstances outweigh the effects the departure has on the standardization of the AP1000 design.

3.1.6 NO SIGNIFICANT REDUCTION IN SAFETY

This exemption would allow the implementation of changes to non-system based design descriptions in Section 3.3, "Buildings;" ITAAC Table 3.3-6, Items 4b, 4c, and 6b; ITAAC Table 3.5-5; and Figures 3.3-11A, 3.3-12 and 3.3-13 proposed in the LAR. The proposed changes to the annex building and radwaste building maintain the design margins of the internal containment structures. The proposed changes will not adversely affect the ability of the SSCs to perform their design functions, and the level of safety provided by the SSCs is unchanged; therefore, as required by 10 CFR Part 52, Appendix D, Section VIII.A.4, the staff finds that granting the exemption would not result in a significant decrease in the level of safety otherwise provided by the design.

3.2 TECHNICAL EVALUATION OF PROPOSED CHANGES

The NRC staff evaluated the proposed changes including assessing their implications for structural, engineering, fire protection, health physics, and security. The proposed changes consist of:

- (1) Updating the annex building column line designations on affected Tier 1 Figures and Tier 2 Figure 3.7.2-19; and
- (2) Revising the radwaste building configuration including the shielding design and radiation area monitoring. More specifically, the changes to the radwaste building configuration include:
 - The merging of the Waste Accumulation Room and the Packaged Waste Storage Room into a single room by removing the wall that originally separated these two rooms.
 - The addition of three bunkers in the proposed Waste Accumulation Room for the storage of moderate and high activity waste.
 - Changing the wall thickness of the walls associated with the original Packaged Waste Storage Room from 2' to 1'-4" and changing the wall thickness of the walls associated with the original Waste Accumulation Room in the bunker area from 1'-4" to 1'-8". This includes adding new shield walls to the south and north ends of the Monitor Tank Room.
 - Deletion of a radiation monitor due to the merging of the original Waste Accumulation Room and the Packaged Waste Storage Room into a single room.

The staff's evaluations are contained in the following sections.

3.2.1 STRUCTURAL ENGINEERING EVALUATION

In performing their technical evaluation related to the proposed changes to the annex and radwaste buildings, the staff considered Sections 3.7.2.8, and 3.8.4 of the current VCSNS UFSAR. The staff also considered portions of NUREG-1793, Supplement 2, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Plant Design," (ADAMS Accession No. ML112061231) and "Final Safety Evaluation Report for the VCSNS Units 2 & 3 Combined License Application," (ADAMS Accession No. ML110450305). The staff reviewed LAR 13-09 to evaluate the impact of the requested UFSAR changes on the integrity of the annex and radwaste buildings and systems and components and their effect on the seismic Category I structures located on the adjacent nuclear island (NI).

Annex Building

UFSAR, Section 3.7.2.8.1 provides a description of the annex building. The annex building is classified as a non-seismic structure except for a portion adjacent to the NI, which is outlined by column lines E-I.1 and 2-13. The annex building is located on the east side of the NI, adjacent to the auxiliary building, and separated by a gap of 4" from the NI. The boundary areas of the annex building are outlined by column line designation A-I.1 and 2-15.2 and is divided in two parts. The part of the building adjacent to the NI is a structural steel and reinforced concrete seismic Category II structure outlined by columns line E-I.1 and 2-13 (Table 3.2-2 Tier 2) and houses the control support area, non-Class 1E electrical equipment, and hot machine shop. The other part of the building area is outlined by columns line A-D and 8-13 and A-G and 13-16; this part of the building is classified as nonsafety-related structure.

The structural configuration of the annex building is shown in UFSAR Figure 3.7.2-19. The annex building is analyzed for the safe shutdown earthquake (SSE) for the six soil profiles described in Subsection 3.7.1.4. The annex and radwaste buildings are not seismic Category I structures; however, they are required to meet 10 CFR Part 50, Appendix A, GDC 1, GDC 2 and GDC 4.

Radwaste Building

The UFSAR Section 3.7.2.8.2 provides a description of the radwaste building. The radwaste building is a non-seismic structure located to the west side of the NI and the NI basemat. The radwaste building is a steel framed structure and houses the low-level waste processing and storage facility.

The radwaste building is classified as a non-seismic structure and designed to the seismic requirements of the Uniform Building Code, Zone 2A with an Importance Factor of 1.25.

3.2.1.1 Proposed changes to Annex Building (AB) column line designations

As described in the LAR, the licensee requests to change a column line designation from 10 to designation 10.05 that will be reflected on UFSAR Tier 2 Figure 3.7.2-19 (Sheets 2, 3, 5, 6, 7, and 8). The licensee justifies this change on the basis that it improves clarity and eliminates the inconsistency between annex and auxiliary buildings column lines. This update is proposed to align column line 10 between the annex and auxiliary buildings.

As described in the LAR, the licensee also requests to change a column line designation from 12 to designation 11.15 that will be reflected on UFSAR Tier 2 Figure 3.7.2-19 (Sheets 8). The licensee indicates that this change provides consistency with the column line designations in Figure 3.7.2-19 Sheets 1, 2, 3, 5, 6 and 7. The licensee further indicates that, because the column line changes in Tier 2 are also included in Tier 1, plant specific DCD Tier 1 Figures 3.3-11A, 3.3-12, and 3.3-13 are proposed to be changed to remove aforementioned column line designations for columns 6, 8, 10, 11.15, 13.2, 13.3, 14.1, 15.1, 15.2, A, B, C and D.

The staff performed a review of the annex building column line designation changes and finds that they are clerical and do not affect the structural design and integrity of the annex building. The staff also finds that the licensee is not departing from the method of design, analysis, codes, and standards as referenced in USFAR Subsection 3.8.4.2, such as the American Concrete Institute (ACI) 349-01 "Code Requirements for Nuclear Safety Related Concrete Structures" and ANSI/ANS N690 "Nuclear Facilities – Steel Safety-Related Structures for Design, Fabrication and Erection", and, therefore, the requirements of GDCs 1, 2, and 4 continue to be met. On this basis, the staff finds the proposed changes to the annex building to be acceptable.

3.2.1.2 Proposed Changes to Radwaste Building Configuration

In LAR 13-09, the licensee requests two changes to the configuration and layout of the radwaste building, which are discussed below.

The first change relates to the installation of three bunkers for moderate and high waste activities in the radwaste building. Specifically, the licensee proposes to modify the current Waste Accumulation Room configuration and layout by adding three bunkers for storage of moderate and high activity waste. The licensee justifies that a small amount of moderate activity waste (in two separate rooms) would require a concrete slab too thick for the current structural design of the building to maintain adjacent areas at Zone I radiation levels. The addition of bunkers allows the moderate or high activity level waste to be segregated from the remainder of the lower activity waste. This separation reduces operational exposure while workers handle low activity waste. Three bunkers with removable steel plates are proposed to be added for maximum flexibility. The shield walls near the three added bunkers are proposed to have a minimum concrete wall thickness of 1'-8".

The second change relates to the combination of the current Waste Accumulation Room and Packaged Waste Storage Room into a single room, identified as a proposed Waste Accumulation Room. The licensee provides the description of changes for the Packaged Waste Storage and Waste Accumulation Rooms. Based on both rooms' configuration, the licensee proposed to remove the partition wall between them to merge it in one bigger area named as the Waste Accumulation Room. The licensee justifies the proposed changes by indicating that, because waste before and after packaging will contain moderate or high activity waste, the new bunkers would be required in the proposed Waste Accumulation Room. However, if the two rooms are combined, as proposed in this amendment, greater operational flexibility is achieved with the larger bunker size and the number of required new bunkers will be reduced. As part of the merging of the two rooms, the minimum shield wall thickness for the walls associated with the original Packaged Waste Storage Room is changed from 2' to 1'-4" and the wall thickness of the walls associated with the original Waste Accumulation Room in the bunker area is changed from 1'-4" to 1'-8".

The staff performed a review of proposed changes to the radwaste building plan layout configurations and finds them acceptable, because the proposed changes, which continue to meet the design bases codes, do not significantly impact the seismic design basis requirements of the radwaste building.

Staff review of the shield walls near the three added bunkers finds that the decrease in thickness of the wall in Packaged Waste Storage Room (PWSR) from 2'-0 to 1'-4" is dictated by the radiation design thickness and does not affect the structural integrity of the wall. Staff review also finds that the licensee is not departing from the method of design, analysis, codes, and standards as referenced in USFAR Subsections 3.7.2.8, 3.8.4.2, and 3.8.5.4. On this basis, the staff finds the proposed changes to the radwaste layout configurations to be acceptable from the structural engineering aspects of the radwaste building.

Conclusion

Based on the staff's technical evaluation, the staff finds that:

- The annex building column line designation changes are clerical and do not affect the structural design and integrity of the annex building. The staff also finds that the licensee is not departing from the method of design, analysis, codes and standards as referenced in USFAR Subsection 3.8.4.2, such as the ACI 349-01 and ANSI/ANS N690, and, therefore, the requirements of GDC 1 continue to be met. On this basis, the staff finds the proposed changes to be acceptable.
- The proposed changes to the radwaste building plan layout configurations do not impact the design of the radwaste building structure. On this basis, the staff finds the proposed changes to be acceptable.
- The decrease in thickness of the wall in the Packaged Waste Storage Room from 2'-0" to 1'-4" does not affect the structural integrity of the wall. Staff review also finds that the licensee is not departing from the method of design, analysis, codes, and standards, such as ACI 349-01, ANSI/ANS N690, and UBC 1997, as referenced in USFAR Subsections 3.7.2.8, 3.8.4.2, and 3.8.5.4. Therefore, the requirements of GDCs 1, 2, and 4 continue to be met. On this basis, the staff finds the proposed changes to the radwaste layout configurations to be acceptable.

For the reasons specified above, the staff finds the proposed changes included in the LAR are acceptable. Changes will not affect the analysis results and related conclusions presented in the UFSAR related to seismic design analysis. Consequently, the NRC staff concludes that there is reasonable assurance that the requirements of GDC 1, 2, and 4 of Appendix A to 10 CFR Part 50 will continue to be met. Therefore, the staff finds the proposed changes acceptable.

3.2.2 FIRE PROTECTION EVALUATION

The fire protection review of this LAR concerns changes to the fire area within the radwaste building whereas the changes to the annex building were clerical in nature. The primary purpose of this fire area is to confine the effects of fires to a single compartment, thereby minimizing the potential for adverse effects from fires on SSCs important to safety. The proposed change revises the COL regarding the plant structures and layouts by changing the

radwaste building configuration by merging the current Waste Accumulation Room and the Packaged Waste Storage Room into one room called the Waste Accumulation Room.

In the current design, as depicted in the AP1000 UFSAR Revision 19, Figure 9A-4, the current Waste Accumulation Room and the Packaged Waste Storage Room are separate fire zones within Fire Area 5031 AF 01. The Waste Accumulation Room is designated as Fire Zone 5031 AF 50351, and the Packaged Waste Storage Room is designated as Fire Zone 5031 AF 50352. The proposed change would merge the Waste Accumulation Room and Packaged Waste Storage Room into one room as depicted in the LAR Enclosure 4, page 12 of 15. This new room will be designated as the Waste Accumulation Room retaining Fire Zone 5031 AF 50351 and remain in Fire Area 5031 AF 01.

In the LAR, the licensee stated that the fire protection analysis is performed for each fire area using the methodology described in UFSAR Tier 2 Section 9A.2, "Fire Protection Analysis Method." This methodology follows the guidance of Branch Technical Position (BTP) Chemical Engineering Branch (CMEB) 9.5-1. The results of the analysis for the radwaste building are provided in UFSAR Tier 2 Subsection 9A.3.5, "Fire Protection Analysis Results, Radwaste Building." Merging these two rooms does not change the fire protection analysis conclusions provided in that subsection of the UFSAR. Neither the combustible material loading listed in UFSAR Table 9A-3, "Fire Protection Summary," nor the fire detection and suppression features described in UFSAR Subsection 9A.3.5 are affected by this change. Because the radwaste building, itself, is one fire area (5031 AF 01) and the overall radwaste building envelope is not changing, this activity does not change any fire area boundary. This activity only modifies fire zones. The radwaste building fire area is separated from the safety-related areas of the NI by a 3-hour fire barrier wall, which is unchanged by merging these two rooms.

The staff reviewed the licensee's analysis provided in the LAR and finds that merging the Waste Accumulation Room and the Packaged Waste Storage Room meets the guidance in BTP CMEB 9.5-1 because the merged room's fire hazard analysis was performed as indicated in UFSAR Tier 2 Section 9A.2. The radwaste building fire area boundary is unchanged in the UFSAR, and the radwaste building is still separated from the safety-related areas of the NI by a 3-hour fire barrier, which is unchanged by this activity.

Based on these findings the staff concludes that there is reasonable assurance that the requirements of 10 CFR 50.48 will continue to be met. Therefore, the staff finds the proposed change acceptable and continues to meet the requirements of GDC 3.

3.2.3 AIRCRAFT IMPACT ASSESSMENT

In the LAR, the licensee states that there is no impact on the aircraft impact assessment, because the number of barriers and the thickness of those barriers, as prescribed by Nuclear Energy Institute (NEI) 07-13, "Methodology for Performing Aircraft Impact Assessments for New Plant Designs," Revision 7, are unchanged by this activity.

The staff considered the AP1000 UFSAR Revision 19 Section 19F, "Malevolent Aircraft Impact," and finds that the merging of the Waste Accumulation Room and the Packaged Waste Storage Room does not affect any key design features credited in the aircraft impact assessment.

Based on this finding the staff concludes that there is reasonable assurance that the requirements of 10 CFR 50.150 will continue to be met. Therefore, the staff finds the proposed change acceptable.

3.2.4 HEALTH PHYSICS EVALUATION

Because the changes to the annex building are clerical in nature and, therefore, there are no radiation protection related consequences associated with those changes, this safety evaluation section discusses the changes to the radwaste building.

Those portions of LAR 13-09 that addressed changes to the radwaste building, including changes to the shielding design, radiation zones, and radiation area monitoring, were reviewed by the staff. Specifically, the staff reviewed these changes against the guidance contained in Regulatory Guide (RG) 8.8, "Information Relevant to Ensuring That Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable," Revision 3, and the requirements of 10 CFR 20.1101, which states that licensees shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. The staff also reviewed the changes against the criteria in RG 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants," Revision 2, and other guidance as discussed in this section.

As discussed in Section 3.2.1.2 above, the licensee proposed to make several configuration changes to the radwaste building. These changes include the following:

- The merging of the Waste Accumulation Room and the Packaged Waste Storage Room into a single room, designated as the Waste Accumulation Room, by removing the wall that originally separated these two rooms.
- The addition of three bunkers in the proposed Waste Accumulation Room for the storage of moderate and high activity waste as described in LAR 13-09, the waste stored in the bunkers, which is referred to as moderate and high activity waste in the LAR and this Safety Evaluation Report (SER), includes steam generator blowdown and condensate polishing system resins, miscellaneous contaminated components, etc., which would result in dose rates of less than 100 mrem/hour in the general waste accumulation room area, outside the bunkers, without shielding on the front of the bunkers (as described in the LAR and proposed UFSAR markups). The waste stored in the bunkers also does not include fuel, chemical and volume control system resins or liquid radwaste management system resins, which are not analyzed as being stored in the bunkers and the UFSAR prohibits from being stored in the bunkers without additional analysis. Nor does it include high activity filters (with contact dose rates greater than 100 mrem/hour), which are specified as being stored in the auxiliary building in the UFSAR.
- Changing the wall thickness of the walls associated with the original Packaged Waste Storage Room from 2' to 1'-4" and changing the wall thickness of the walls associated with the original Waste Accumulation Room in the bunker area from 1'-4" to 1'-8". The licensee also proposed adding new shield walls to the south and north ends of the Monitor Tank Room, which is located in the radwaste building.
- Deletion of a radiation monitor due to the merging of the Waste Accumulation Room and the Packaged Waste Storage Room into a single room.

For the change described in the first bullet above, the licensee proposed to remove the wall separating the existing Packaged Waste Storage Room from the Waste Accumulation Room and to designate the new larger area as the Waste Accumulation Room. The licensee stated that this change would provide greater flexibility in handling waste before and after packaging by providing a larger area to perform these operations. This proposed reconfiguration of the radwaste building would also permit the licensee to segregate the moderate and high activity level wastes from the remainder of the lower activity wastes by storing these wastes in three proposed shielded bunkers added to the proposed Waste Accumulation Room. The expanded Waste Accumulation Room would remain as a Zone IV (less than or equal to 100 mrem/hr (1.0 mSv/hr)) area. The licensee stated that the quantities of solid and liquid radioactive material being processed in the radwaste building and the method of control for processes for treating that material are unchanged by the proposed building modifications.

As explained in more detail below, the staff finds the merging of the two rooms to be acceptable for the following reasons: 1) merging of the existing Packaged Waste Storage Room and the Waste Accumulation Room into a larger room designated as the Waste Accumulation Room provides greater operational flexibility for the licensee to perform waste handling operations; 2) combining the two rooms into one room allows for the addition of the three shielded bunkers in the proposed Waste Accumulation Room for the storage of moderate and high activity wastes, which will reduce the operational exposure of the workers in the Waste Accumulation Room when they are working with low activity waste and will maintain portions of the radwaste building at radiation Zone I levels, in compliance with the ALARA requirements of 10 CFR Part 20; 3) provision of an area radiation monitor in the Waste Accumulation Room area performs the same function as the single monitor that was initially provided in the single rooms; and 4) provision of adequate shielding in the room maintains dose rates in the surrounding areas ALARA. For these reasons, the staff finds the licensee's responses to be consistent with the requirements of 10 CFR Part 20 and GDC 61.

On page 13 of this SE, the second bullet refers to the addition of three shielded bunkers in the enlarged Waste Accumulation Room. These bunkers are used for the storage of moderate and high activity waste and allow this waste to be segregated from the lower activity wastes, which will be stored outside of the bunkers in the Waste Accumulation Room. The addition of three shielded bunkers will reduce the exposure of workers in the remaining portions of the Waste Accumulation Room when they are working with low activity waste and will also serve to maintain portions of the radwaste building that are adjacent to the Waste Accumulation Room at radiation Zone I (less than or equal to 0.25 mrem/hr (0.25E-2 mSv/hr)) levels, which is consistent with the ALARA requirement in 10 CFR Part 20.

In order to obtain more detailed information relating to the use of these proposed bunkers, the staff requested that the licensee provide the following additional information to assist the staff in its review of this LAR: the types of wastes that would be stored in each of the three bunkers (Question 1), a description of the shielding provided by the walls of the bunkers to ensure that the doses to personnel working outside the bunkers in the Waste Accumulation Room are maintained ALARA (Question 2), a description of the additional temporary bunker shielding that can be used to reduce doses to personnel working outside the bunkers in the Waste Accumulation Room (Question 3) (ADAMS Accession No. ML14125A297).

In Supplements 1 and 2 to LAR 13-09, dated July 9, 2014 (ADAMS Accession No. ML14192A036), September 25, 2014 (ADAMS Accession No. ML14268A544), and Supplement 1 to Revision 1, dated June 1, 2016 (ADAMS Accession No. ML16154A048), the licensee responded to these questions. The licensee stated that the three proposed bunkers

would be used for the storage of moderate and high activity packaged or unpackaged waste and there is no distinction between the three bunkers as to the type of radioactive waste that may be stored in any particular bunker. Removable shield plates are provided for the openings of the bunkers for ALARA purposes. This portable shielding, which consists of steel plates (six-inch thick roof plates and multiple layered one-inch thick door plates), can be placed on the top and the open sides (the front) of the bunkers to provide additional shielding to supplement the shielding provided by the bunker walls. However, the licensee stated that the use of additional bunker shielding is not necessary to maintain the radiation levels in worker occupied areas in the radwaste building and adjacent plant yard areas. The licensee stated that the additional bunker shielding is not necessary because these areas are categorized as Zone I to Zone IV, which is defined in the proposed revision to UFSAR Figure 12.3-1 (sheet 14), if the waste stored in the bunkers has a surface dose rate less than or equal to 100 mrem/hr (1.0 mSv/hr). The licensee further stated that, while the use of the additional bunker shielding plates is not necessary to maintain the designated radiation levels in the worker occupied areas in the radwaste building, use of the shield plates on the fronts of the bunkers, when high-level wastes are being stored in the bunkers, will significantly reduce exposure to personnel working in the adjoining areas of the Waste Accumulation Room.

In Supplement 1 to Revision 1 to LAR 13-09, the licensee stated that the radiation levels on the radwaste building roof could conceivably be as high as radiation Zone IV (less than or equal to 100 mrem/hr) when higher activity waste is stored in the bunkers. Since an earlier version of the LAR (Supplement 1, dated July 9, 2014) stated that the radiation levels on the radwaste building roof do not exceed radiation Zone II (less than or equal to 2.5 mrem/hr), the staff requested (ADAMS Accession No. ML16179A377) that the licensee evaluate what effect this potential increase in the direct dose from the radwaste building roof would have on the dose to the maximally exposed individual at the plant boundary. In Supplement 2 to Revision 1 to LAR 13-09, dated November 17, 2016 (ADAMS Accession No. ML16323A034), the licensee indicated that when the waste is stored in the bunkers, using the design basis source terms in the monitor tanks and waste storage areas (including the bunkers) and the design basis shielding, the dose rate on the roof is less than 8 mrem/hour, corresponding to radiation Zone III conditions. Based on this, the licensee considered the dose to a member of the public (at the site boundary) to be insignificant.

In order to confirm that the dose at the site boundary would be insignificant, the staff performed a calculation using MicroSkyshine Version 2. Using this program to estimate the dose, the staff calculated a dose at the site boundary (approximately 0.5 miles away) of much less than 1 mrem in a year. In accordance with Standard Review Plan (SRP) Section 11.4, if the offsite dose is less than 1 mrem per year, it is not likely to result in the limits of 40 CFR Part 190, as implemented under 10 CFR 20.1301(e), to be exceeded. Based on this, the staff found the licensee's response to be acceptable.

SRP Section 11.4-A, "Design Guidance for Temporary Storage of Low-Level Radioactive Waste," SECY 94-198, "Review of Existing Guidance Concerning the Extended Storage of Low-Level Radioactive Waste" and Generic Letter 81-38, "Storage of Low-Level Radioactive Waste at Power Reactor Sites" indicate that gases generated from stored radiological material could potentially result in flammable or explosive conditions and that the possibility of such conditions should be evaluated. In addition, RG 1.189 indicates that the design should minimize fires and explosions, including those that could be associated with the release of radioactive material and exposure to workers. RG 1.189 also indicates that the fire hazard analysis should include explosion-prevention measures in areas subject to potentially explosive environments from flammable gases or other potentially energetic sources, including ion exchange columns.

Therefore, in a August 21, 2014, teleconference (ADAMS Accession No. ML14248A344) with the licensee, the staff requested further clarification on how the licensee would prevent the possibility of flammable and explosive conditions within the bunkers if the bunkers were used for the storage of medium and high activity waste. The licensee indicated that spent demineralizer resins would not be stored in the bunkers and that there was no risk of flammable/explosive conditions developing inside the bunkers because none of the material being stored in the bunkers would create a potential of generating flammable/explosive gases. However, in Revision 1 of the LAR, the licensee did not provide any information indicating that resins would not be stored in the bunkers or any information explaining why flammable/explosive gases were not a concern. Instead, the response indicated that, since the changes proposed in the LAR do not signify an increase in source terms, gas generation and the possibility of flammable or explosive conditions is not a concern. However, the bunkers were not part of the radwaste building design included in the original UFSAR. Therefore, the response was unacceptable because it was still unclear to the staff what types and quantities of radioactive waste would be included in the bunkers and if flammable/explosive gases could be generated within the bunkers. It was also unclear how the licensee would prevent a potential fire or explosion from occurring (for example, it was unclear if the bunkers were vented to allow the escape of potential gases to the general radwaste building atmosphere or if other controls would be used to limit gas buildup).

In Revision 1, Supplement 1 of the LAR, dated June 1, 2016 (ADAMS Accession No. ML16154A048), the licensee indicated that there is a potential for radiolytic hydrogen gas generation inside of the bunkers. The licensee specified that they would limit the hydrogen gas concentration within the bunkers to less than 5 volume-percent hydrogen in air, as specified in NUREG/CR-6673, "Hydrogen Generation in TRU Waste Transportation Packages." Likewise, the licensee calculated the hydrogen concentration within the bunkers due to radiolytic hydrogen gas generation, based on storing different quantities of steam generator blowdown and condensate polishing resin within the bunker in waste storage drums (the storage of higher activity resins such as liquid waste management system and chemical and volume control system resins were not considered in the analysis. In addition, the storage of resins in high integrity containers was not considered in the analysis). The source terms for the components are conservatively based on an assumed 0.25 percent failed fuel fraction coincident with primary to secondary leakage of 300 gallons/day. The activity accumulated in the resin reflected one cycle of operation. The licensee determined that the maximum amount of condensate polishing and steam generator blowdown resin could be stored in a bunker for 6 months without exceeding the 5 volume-percent hydrogen limit. However, NUREG/CR-6673 is specifically for waste transportation packages and the lower flammability limit for hydrogen under any condition is 4 volume-percent. Therefore, it was unclear why the 5 volume-percent of hydrogen limit was appropriate for inside of the bunkers. In addition, the response did not provide any information regarding the potential concentrations of other flammable/explosive gases that could be generated other than hydrogen or any information regarding the potential for other processes resulting in gas generation such as biological or chemical processes. As a result, the staff issued Question 11 requesting that the licensee address these questions.

In a November 17, 2016, response to Question 11 (ADAMS Accession No. ML16323A034), the licensee indicated that the concentration limit for hydrogen would be 4 volume-percent. The licensee recalculated the hydrogen concentrations in the bunker based on several different configurations of steam generator blowdown and condensate polishing resins based on 1-year of operation. The results show that the bounding amount of resins could be stored in a bunker for one year without exceeding the 4 volume-percent hydrogen concentration limit. The

licensee indicated that the scenario provided in the previous response that limited the storage time to 6 months would not be generated in one year of operation because it assumes that both steam generator blowdown units (resin and membranes) were loaded with the design basis source term (both units had been fully operated for one year) and that the design basis condensate polishing resin generated in a year would also be stored in the same bunker. The licensee indicated that they believe this scenario is not credible because both units of steam generator blowdown resin would not be expected to be fully operated with the maximum source term after one year of operation. The licensee also calculated a required bunker free volume of 423 cubic feet in the response, based on the storage of steam generator blowdown and condensate polishing demineralizer resins. However, the staff was unable to verify the validity of the equation and parameters used to calculate this free volume percentage. Therefore, in an audit, which is discussed below, the staff requested to review this equation and how it was derived.

In the response, the licensee proposed updating the UFSAR to specify that the hydrogen concentration is limited to 4 volume-percent in air inside the bunkers and that there is no risk of radiolytic hydrogen gas generation inside the bunkers within the stated assumptions. Therefore, the analyzed quantities of resin can be stored inside an unventilated bunker for one year, as long as the total volume and activity of resins do not exceed the quantities specified in the bounding calculations and the materials stored within the bunkers are consistent with the stated assumptions. In the response, the licensee also proposed updating the UFSAR to specify that in addition to hydrogen, the licensee considered the possible generation of methane gas, but it was found not to be a credible source because the AP1000 condensate polishing and steam generator blowdown systems utilize resin beads, which do not have a cellulose component that could support the growth of bacteria and methane production. The updated UFSAR also specifies that the generation of flammable gases by processes such as biodegradation, decomposition, and waste material interaction due to chemistry was determined to not be credible based on the waste forms intended for storage in the AP1000 bunkers. As a result, during operation, the UFSAR requires the licensee to ensure that the contents of materials in the bunkers will not result in conditions that could result in biological or chemical related gas generation. In addition, the licensee must ensure that the volume, activity, and storage time do not exceed the bounding quantities analyzed, unless a new analysis is performed to demonstrate that the hydrogen concentration in the bunker air space will not exceed 4 volume-percent hydrogen in air. Finally, the licensee also indicated in the response that, while the specific procedures to control the storage of material in the bunkers have not been developed yet, the procedures will be under the umbrella of the radiation protection program which is discussed in UFSAR Section 12AA and Table 13.4-201.

The staff held an audit with the licensee related to their calculations on hydrogen concentrations in the bunkers and the required free volume in the bunker (ADAMS Accession Nos. ML16305A426 and ML16362A445 for audit plan and report). During the audit, the staff requested that the applicant provide the maximum heat load inside the bunkers. Using this information and the information provided in the Request for Additional Information response, the staff validated the applicant's calculation by performing an independent calculation (with an effective G value of 1.7 molecules per 100 eV, a bunker free volume of 423 cubic feet, and a 1-year storage time period) and estimated a hydrogen concentration inside the bunkers of less than 4 volume-percent, which is consistent with the applicant's conclusions. Since the staff's confirmatory calculation also estimates a hydrogen concentration of less than 4 volume-percent, the staff finds the applicant's calculations to be acceptable.

The staff accepts the response and changes made in the LAR as they relate to the potential flammable/explosive gas generation inside of the bunkers based on the following:

- The volume, activity, and storage time and types of materials that can be stored in the bunkers are limited by the UFSAR. If these limitations are not exceeded, the hydrogen gas concentration inside of the bunkers is limited to less than 4 volume-percent hydrogen, which is less than the flammability limit for hydrogen. Based on the waste forms specified as being stored within the bunker, staff agrees that hydrogen is the most credible source of flammable/explosive gas generation.
- The UFSAR specifies that the licensee must perform a new evaluation if conditions exist that could result in the 4 volume-percent being exceeded or if conditions exist that were not analyzed. For example, if the volume or activity in the bunker exceeds the quantities analyzed or if the waste is going to be stored in the bunker for greater than the timeframe analyzed, the applicant must perform a new evaluation.
- The UFSAR specifies that there is no possibility of generation of flammable gases by processes such as biodegradation, decomposition, and waste material interaction due to chemistry, based on the waste forms that will be stored within the bunkers. Therefore, per this information in the UFSAR, the licensee must ensure that the bunkers do not contain materials that could result in these processes being contributors to gas generation.
- The calculations assume a G-value of 1.7 molecules per 100 eV, which is consistent with the G-value specified in NUREG/CR 6673 for resins. The response also specifies that the resin will be stored in 55 gallon drums, with a G value of 0, and materials that may have higher G-values (such as polyethylene liners or epoxy coating inside the 55 gallon drums) are expected to be small contributors to hydrogen generation due to their "low mass fraction." Since the response specifies that the resin will be stored in drums, with a G-value of 0 (instead of a polyethylene container or other container with a high G-value) and there will be a low mass fraction of materials with a higher G-value in the resin, the staff finds the use of a G-value of 1.7 to be acceptable.
- The staff performed a confirmatory calculation for validation of the licensee's calculation and estimated a hydrogen concentration of less than 4 volume-percent.

Based on the above, as it relates to the potential for flammable and explosive gases, the staff determined that the changes proposed in Revision 1 of LAR 13-09 (with Supplements 1 and 2) are acceptable.

On page 13, the third bullet refers to proposed wall thickness changes in various portions of the Waste Accumulation Room. LAR 13-09 states that because the Packaged Waste Storage Room and the Waste Accumulation Room will be merged into a single larger Waste Accumulation Room, and the moderate and high activity wastes will be segregated in three new shielded bunkers, the shield walls associated with the original Packaged Waste Storage Room can be reduced in thickness from 2' to 1'-4". In addition, the thickness of the walls associated with the original Waste Accumulation Room in the bunker area will be increased from 1'-4" to 1'-8" to account for the higher level waste stored in the bunkers. To ascertain whether the proposed decrease in the wall thickness in parts of the proposed Waste Accumulation Room

could result in increased dose rates in adjacent areas, the staff issued Question 4 (ADAMS Accession No. ML14125A297).

In Supplement 1 to LAR 13-09, the licensee responded to Question 4, verifying that they had performed a shielding calculation to determine the dose rates in the areas adjacent to the Waste Accumulation Room from waste with a surface dose rate of 100 mrem/hr (1.0 mSv/hr) within the Waste Accumulation Room. Even with the reduced wall thickness in portions of the Waste Accumulation Room, the resulting dose rates in the areas adjacent to the Waste Accumulation Room (the Mobile Systems Facility, the corridor on the northern edge of the Waste Accumulation Room, and the Waste Monitor Tank Room) were within the specified zone designations specified in the UFSAR Figures for the current design. The staff, therefore, finds these changes in wall thickness in the Waste Accumulation Room to be acceptable since they did not result in an increase in the radiation zone designations for areas adjacent to the Waste Accumulation Room. Therefore, the staff finds the licensee's response to Question 4 to be acceptable.

In addition to the configuration changes to the radwaste building described above, the staff noted that the licensee had added new shield walls on the south and north ends of the Waste Monitor Tanks Room. The staff issued Question 8 to the licensee to request additional information on these proposed changes (ADAMS Accession No. ML14125A297).

In Supplement 1 to LAR 13-09, the licensee responded to Question 8 by stating that, if the plant were to operate with significant fuel failures (design basis conditions), the licensee would utilize the monitor tanks located in the auxiliary building rather than the tanks located in the radwaste building. In the event that this higher activity water would need to be stored in the radwaste building monitor tanks, the licensee proposed to add additional shield walls on the south and north ends of the Monitor Tanks Room to ensure that the radiation zones in the south yard area and the hallway to the heating, ventilation, and air conditioning Equipment Room (on the north side of the Monitor Tanks Room) are maintained as radiation Zone I areas. The licensee stated, however, that updated calculations for the Waste Monitor Tanks source terms indicate that, during normal operations, the Waste Monitor Tanks would contain only mildly activated water, which would be a fraction of the activity that the tanks would contain for design basis conditions. The staff finds the addition of these shield walls to be acceptable to maintain dose rates to areas to the south and north of the Monitor Tanks Room as radiation Zone I areas in the event that the source terms in the Waste Monitor Tanks increased due to significant fuel failures. Therefore, the staff finds the licensee's response to Question 8 to be acceptable.

On page 13 of this SE, the fourth bullet refers to the proposed deletion of an area radiation monitor. The current design of the radwaste building has two area radiation monitors (both of these monitors are the same type of monitor and have the same design requirements), one in the Packaged Waste Storage Room and one in the Waste Accumulation Room. These area radiation monitors are used to monitor the dose rates in each of these two rooms where radwaste packaging and storage operations would have been conducted. With the proposed removal of the wall separating these two rooms and incorporation of the Packaged Waste Storage Room into a single larger space labeled the Waste Accumulation Room, the licensee proposes to eliminate one of these area monitors. The licensee will relocate the other monitor to a central location in the newly combined room to ensure that all areas of the combined room are adequately monitored, as they were when there was a monitor in each of the separate rooms. The staff finds the proposed deletion of this area radiation monitor to be acceptable since the remaining monitor will be relocated to provide radiation monitoring of personnel

working in the enlarged Waste Accumulation Room. The remaining monitor can provide appropriate coverage for the proposed Waste Accumulation Room.

In addition to the evaluation of each individual change discussed above, the changes to the radwaste building as a whole were reviewed within the context of RG 1.143, Revision 2. The UFSAR indicates that the applicant complies with RG 1.143, Revision 2. Regulatory Position C.5.1 of RG 1.143 states, "for a given structure housing radwaste processing systems or components, if the total design basis unmitigated radiological release (considering the maximum inventory) at the boundary of the unprotected area is greater than 500 millirem per year or the maximum unmitigated exposure to site personnel within the protected area is greater than 5 rem per year, the external structures are classified as RW-IIa." Since the AP1000 radwaste building is classified as RW-IIc (a classification less stringent than RW-IIa), the inventories of radioactive materials in this building should be managed and controlled in a way that will not result in these dose criteria being exceeded. RG 1.143 also provides radionuclide limits for individual components, and the UFSAR initially indicates that the inventory of each individual monitor tank and mobile processing system will be limited to the A2 quantities in 10 CFR Part 71 as part of meeting the guidance of RG 1.143.

LAR 13-09 did not specify that the changes would result in an increased source term in the building. However, LAR 13-09 merged the former Waste Accumulation Room and the Packaged Waste Storage Room into one room, called the Waste Accumulation Room. The licensee added a note indicating that the radiation zones for the monitoring tank room could be as high as Zone IV if a higher than expected failed fuel percentage occurs (while the UFSAR initially indicated this area was Zone II). Also, the licensee added a note indicating that dose rates could be locally exceeded near spent filter cartridge storage or disposal drums and added bunkers to the Waste Accumulation Room. These changes, along with others, indicated a potential for a greater source term in the radwaste building than was in the initially approved design and potentially greater than what RG 1.143 specifies. However, the LAR did not contain any information regarding how the changes were in accordance with the SSC classifications and design criteria of RG 1.143 nor did it describe how the quantity of waste will be controlled in the radwaste building, in accordance with RG 1.143. Therefore, the staff issued Question 6 requesting that the licensee provide this information (ADAMS Accession No. ML14125A297).

In Supplement 1 to LAR 13-09 (see ADAMS Accession No. ML14192A036, response to Question 6), the licensee indicated that none of the changes to the LAR will result in an increased source term in the radwaste building and indicated that this is demonstrated by the fact that there are no changes to any of the already approved source term values provided in UFSAR Tables 11.4-1 through 11.4-9. However, while these tables provide maximum waste generation and shipping rates for the plant, they do not provide specific limitations for the radioactivity stored in the radwaste building. The licensee also documented that adding the note indicating that the dose rates in the Waste Accumulation Room could be locally exceeded is not the result of an increased source term but instead was added to allow for the possible situation where operators could arrange higher activity filters or other radioactive waste storage containers in such a way as to locally exceed a radiation zone in the Waste Accumulation Room of the radwaste building. The staff agrees that the addition of this note does not necessarily indicate that there will be additional radioactive material in the building. However, the remainder of the response did not provide adequate justification that the changes would not result in higher quantities of radioactivity in the radwaste building or adequately describe how radioactivity will be controlled in accordance with RG 1.143.

Therefore, during several teleconferences with the licensee (ADAMS Accession Nos. ML162229A385 and ML16309A409), the staff requested that the licensee provide additional information to show that the changes would not result in exceeding the radioactivity limits associated with RG 1.143 and to describe how, with the changes made, the criteria in RG 1.143 would be met. In Supplemental Responses 2 and 3, dated September 25, 2014, and August 20, 2015 (ADAMS Accession Nos. ML14268A544 and ML15236A100) and in Revision 1 of the LAR (ADAMS Accession No. ML15351A428), the licensee provided additional information on compliance with RG 1.143. Since the licensee incorporated all relevant information provided in Supplemental Responses 2 and 3 into Revision 1, Revision 1 is the only document referenced in the remainder of this SER discussion.

Revision 1 of the LAR indicated that none of the changes made in the LAR were the result of, or will result in, an increased radionuclide source term in the radwaste building and that the changes allow for better ALARA practices. The licensee indicated that the footnote that indicated that the monitor tanks could be Zone IV if there is higher than expected failed fuel, was added to the UFSAR because the zoning for the monitor tank rooms was initially based on a source term with expected monitor tank concentrations, instead of the design basis inventory (based on an assumed 0.25 percent of fuel failure), upon which shielding and zoning is supposed to be based. The licensee provided a reference to information from the AP1000 UFSAR DCD review that supports this conclusion. Therefore, the addition of this note is not the result of a change in monitor tank operation or the expectation to increase the source term in the tank, but, instead, provides the design basis zoning for the monitor tank room, which is consistent with the SRP and therefore is acceptable.

In Revision 1 of the LAR, the licensee also proposed updating UFSAR Sections 11.2.1.2.5.2 and 13.5.2.2.5 to limit the amount of radioactivity in each monitor tank and each mobile system to less than the A_2 limits specified in Appendix A to 10 CFR Part 71. In addition, the licensee stated in the UFSAR that they would limit the radionuclide inventory associated with any other equipment located in the radwaste building to less than the A_2 limits specified in Appendix A to 10 CFR Part 71. The UFSAR updates also indicated that transfer or package of spent media from a mobile radwaste processing system located in the radwaste building is procedurally controlled, so that the spent media is included with the inventory of the mobile system from which it was removed, until the media is packaged or moved to the auxiliary building for packaging.

The licensee specified in the UFSAR that they would develop operating procedures prior to initial fuel load that will ensure that the total cumulative radioactive inventory of all unpackaged wastes located in the radwaste building (including the waste in the monitoring tanks, mobile processing systems, and any additional equipment, as well as any other unpackaged waste in the radwaste building) will be limited consistent with the RG 1.143, Revision 2 dose acceptance criteria. Specifically, the licensee's procedures will ensure that the total cumulative radioactive inventory contained in unpackaged wastes (including liquid waste, wet waste, solid waste, gaseous waste, activated or contaminated metals and components, and contaminated waste present at any time in the radwaste building) is limited. Therefore, an unmitigated release, occurring over a two hour time period, would not result in a dose of greater than 100 millirem at the protected area boundary or an unmitigated exposure, occurring over a 2 hour time period, would not result in a dose of greater than 5 rem to site personnel located 11 feet from the total cumulative radioactive inventory. The unmitigated, unshielded worker dose is calculated at

11 feet from the total cumulative radionuclide inventory in the radwaste building because unlimited worker occupancy workstations and low dose rate waiting areas are located no closer than 11 feet from a mobile radwaste processing system or a radwaste monitor tank.

Conclusion

Based on the above, staff has reasonable assurance that the quantities of radioactive material in the radwaste building, as well as its individual components, will be limited in accordance with the RG 1.143, Revision 2 criteria, given the safety classification RW-IIc assigned to the radwaste building. The staff finds the licensee's response to Question 8 to be acceptable. Therefore, staff determined that the above described changes proposed in Revision 1 of the LAR are acceptable.

3.2.5 SECURITY PLAN EVALUATION

3.2.5.1 Introduction

In UFSAR Section 13.6, the licensee describes its security plans, which consist of the "Physical Security Plan" (PSP), "Training and Qualification Plan" (T&QP), and "Safeguards Contingency Plan" (SCP). The licensee also incorporates by reference the standard AP1000 design that includes design of physical protection systems within the design of the vital island and vital structures, as described in the Westinghouse Electric Company, AP1000 DCD, including Technical Report (TR) 49, "AP1000 Enhancement Report (APP-GW-GLR-062)," TR 94, "AP1000 Safeguards Assessment Report, Revision 5 (APP-GW-GLR-66)," and TR 96, "Interim Compensatory Measures Report (APP-GW-GLR-067)." The documents incorporated by reference and the security plans are Safeguards Information and are withheld from public disclosure pursuant to 10 CFR 73.21.

Section 13.6 of the UFSAR describes the physical protection program and physical protection systems that are not addressed within the scope of the standard AP1000 design for meeting the NRC performance and prescriptive requirements for physical protection stated in 10 CFR Part 73, "Physical Protection of Plants and Materials." Section 13.6 of the licensee's UFSAR incorporates by reference Section 13.6 of the AP1000 DCD, Revision 19.

The NRC staff considered Section 13.6 of the licensee's UFSAR, Units 2 and 3 security plans, and TR 94, to ensure that the combination of the UFSAR, security plans, and TR 94 represent the complete scope of information relating to this review topic. The NRC staff's review confirmed that the information in the LAR and material incorporated by reference provided the required information for the physical security review.

In the LAR, Enclosure 12, Section 3 the licensee identified several bullet items that the licensee's assessment regarding the impact of the changes to the annex building column lines and the radwaste building configuration as described in the LAR on Physical Security were summarized.

3.2.5.2 Physical Barrier

The following requirements are established in 10 CFR 73.55(e): "Each licensee shall identify and analyze site-specific conditions to determine the specific use, type, function, and placement of physical barriers needed to satisfy the physical protection program design requirements of

10 CFR 73.55(b),” (1) The licensee shall: (i) “Design, construct, install and maintain physical barriers as necessary to control access into facility areas for which access must be controlled or denied to satisfy the physical protection program design requirements of paragraph (b) of [10 CFR 73.55(b)].”

In bullet point 1 of Section 3 of Enclosure 12 to the LAR, “Physical Security Evaluation,” the licensee states that “The proposed changes have no effect on any pathways or barriers credited by the Physical Security Plan.”

The staff reviewed changes to the annex building column lines and the radwaste building configuration as described in the LAR for its effect on the implementation of the site-specific physical protection program. The staff confirmed that the proposed changes have no effect on any physical barriers credited by the PSP and therefore, do not result in any adverse changes to physical barriers. Since no changes to the licensee’s security plans are required, the requirements of 10 CFR 73.55(e), as stated in the licensee’s security plans, will continue to be met; the proposed change described in the LAR (bullet point 1) is therefore acceptable.

3.2.5.3 Security Organization

In bullet point 2 of Section 3 of Enclosure 12 to the LAR, Physical Security Evaluation, the licensee states that “No addition, change or deletion of a security position is requested.”

The provisions of 10 CFR 73.55(d) establish requirements to describe a security organization, including the management system for oversight of the physical protection program. The security organization must be designed, staffed, trained, qualified, re-qualified, and equipped to implement the physical protection program as required by 10 CFR 73.55(b) and 10 CFR Part 73, Appendices B and C.

The staff reviewed the licensee’s description changes to the annex building column lines and the radwaste building configuration as described in the LAR for its effect on the implementation of the site-specific physical protection program. The licensee’s description in Sections 4 and 4.1 of the PSP is consistent with the acceptance criteria in Subsection 13.6.1 of the SRP. Therefore, the staff finds that there is reasonable assurance that the licensee’s description provided in the LAR does not require any changes to the licensee’s security plans. Since no changes to the licensee’s security plans are required, the requirements of 10 CFR 73.55(d), as stated in the licensee’s security plans, will continue to be met; the proposed change described in the LAR (bullet point 2) is therefore acceptable.

3.2.5.4 Illumination

In bullet point 3 of Section 3 of Enclosure 12 to the LAR, Physical Security Evaluation, the licensee states that “No lighting change is requested.”

The provisions of 10 CFR 73.55(i)(6) require, in part, that all areas of the facility are provided with illumination necessary to satisfy the design requirements of 10 CFR 73.55(b) and to implement the protective strategy.

The staff reviewed the licensee’s description changes to the annex building column lines and the radwaste building configuration as described in LAR 13-09 R1 for its effect on the implementation of the site-specific physical protection program, which is in accordance with the Commission regulations at 10 CFR 73.55(i)(6) and 73.55 (b) and with the SRP acceptance

criteria. The staff confirmed that the proposed changes do not adversely change security lighting. The proposed changes are acceptable, and the high assurance requirement of 10 CFR 73.55 will continue to be met.

3.2.5.5 Response Requirement

In bullet point 4 of Section 3 of Enclosure 12 to the LAR, Physical Security Evaluation, the licensee states that “The proposed changes do not involve the responses to the external fighting positions.”

The provisions of 10 CFR 73.55(k) require, in part, that the licensee establish and maintain a properly trained, qualified and equipped security personnel required to interdict and neutralize threats up to and including the design-basis threat of radiological sabotage, defined in 10 CFR 73.1, to prevent significant core damage and spent fuel sabotage.

The staff confirmed that the proposed change in bullet point 4 of the LAR does not result in the addition, deletion, or relocation of a security response position as described in the PSP.

Therefore, the staff finds that there is reasonable assurance that the licensee’s description provided in the LAR does not require any changes to the licensee’s security plans. Since no changes to the licensee’s security plans are required, the requirements of 10 CFR 73.55(k), as stated in the licensee’s security plans, will continue to be met; the proposed change described in the LAR (bullet point 4) is, therefore, acceptable.

3.2.5.6 Protective Strategy – Ingress Pathways and Associated Timelines

In Section 3 of Enclosure 12 of the LAR, Physical Security Evaluation, Bullet 5, the licensee states “The column line changes have no effect on either response or adversary timelines.”

The staff reviewed the licensee’s description changes to the annex building column lines and the radwaste building configuration as described in LAR 13-09 R1 for its effect on the implementation of the site-specific physical protection program. The staff confirmed that the changes proposed in the LAR would have no effect on ingress pathways to vital areas and would have no effect on the pathways, and associated timelines, used by security force personnel to reach external security response positions as described in TR-94. Therefore, the staff finds that there is reasonable assurance that the licensee’s description provided in the LAR does not require any changes to the licensee’s security plans. Since no changes to the licensee’s security plans are required, the requirements of 10 CFR 73.55(f), 10 CFR 73.55(k)(8), 10 CFR 73.55(b), Section II B, Appendix C, 3(c)(v) of 10 CFR Part 73, as stated in the licensee’s security plans, will continue to be met; the proposed change described in LAR 13-09 (bullet points 1 and 5) is, therefore, acceptable.

3.2.5.7 Physical Security – ITAAC

In Section 3 of Enclosure 12 of the LAR, “Physical Security Evaluation,” the licensee addressed how the proposed change in the LAR related to the PS-ITAAC. The licensee stated that “the review confirmed that the proposed changes do not affect any of the existing ITAAC related to physical security.”

The staff confirmed that the proposed changes describe in Reference 1, “Physical Security Evaluation,” does not impact any of the existing PS-ITAAC.

Conclusion

Based on the technical evaluations above, the staff finds that the proposed changes to the annex and radwaste building included in the LAR and the supporting analysis provided in the LAR, the staff concludes that there is reasonable assurance that the requirements of 10 CFR Part 50, Appendix A, GDC 1, 2, 4, 60, 63 and 64, 10 CFR 50.48, 10 CFR 50.150 and 10 CFR 73.55(b), will continue to be met. Therefore, the staff finds the proposed changes to be acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission regulations in 10 CFR 50.91(b), the designated South Carolina State official was notified of the proposed issuance of the amendment. The State of South Carolina official had no comment.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20, *Standards for Protection Against Radiation*. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite. Also, there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (*Federal Register*, 79 FR 21299 (April 15, 2014)). Additional information provided by letters dated July 9, 2014, September 25, 2014, August 20, 2015, December 17, 2015, June 1, 2016, and November 17, 2016 did not change the NRC staff's original proposed No Significant Hazard Consideration Determination. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

Because the exemption is necessary to allow the changes proposed in the license amendment, and because the exemption does not authorize any activities other than those proposed in the license amendment, the environmental consideration for the exemption is identical to that of the license amendment. Accordingly, the exemption meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment needs to be prepared in connection with the issuance of the exemption.

6.0 CONCLUSION

The NRC staff has determined that pursuant to Section VIII.A.4 of Appendix D to 10 CFR Part 52, the exemption (1) is authorized by law, (2) presents no undue risk to the public health and safety, (3) is consistent with the common defense and security, (4) is a special circumstance that outweighs the reduction in standardization, and (5) does not significantly reduce the level of safety at the licensee's facility. Therefore, the staff grants the licensee an exemption from Tier 1 information specified by the licensee.

The Commission has concluded, based on the considerations discussed in Section 3.2 and staff's confirmation that these changes do not change an analysis methodology, or assumptions that there is reasonable assurance that: (1) the health and safety of the public will not be

endangered by operation in the proposed manner, (2) there is reasonable assurance that 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. Therefore, the staff finds the changes proposed in this license amendment acceptable.

7.0 REFERENCES

1. License Amendment Request 13-09 and Exemption – letter from South Carolina Electric and Gas Company dated February 27, 2014 (ADAMS Accession No. ML14065A022), supplemented by letters dated July 9, 2014 (ADAMS Accession No. ML14192A036 and September 25, 2014 (ADAMS Accession No. ML14268A544), August 20, 2015 (ADAMS Accession No. 15236A100), December 17, 2015 (ADAMS Accession No. ML15351A428), June 1, 2016 (ADAMS Accession No. ML16154A048) and November 17, 2016 (ADAMS Accession No. ML16323A034).
2. Virgil C. Summer Nuclear Station (VCSNS) Updated Final Safety Analysis Report (UFSAR), Revision 1, dated July 11, 2013 (ADAMS Accession No. ML13217A253).
3. AP1000 Design Control Document, Revision 19, dated June 13, 2011 (ADAMS Accession No. ML11171A087).
4. U.S. Nuclear Regulatory Commission, "Final Safety Evaluation Report for Combined Licenses for Virgil C. Summer Nuclear Station, Units 2 and 3," Volume 1, NUREG-2153, dated September 30, 2013 (ADAMS Accession No. ML13275A125).
5. U.S. Nuclear Regulatory Commission, NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Plant Design," Supplement 2, dated August 5, 2011 (ADAMS Accession No. ML112061231).
6. U.S. Nuclear Regulatory Commission, NUREG-0800, Standard Review Plan, Branch Technical Position (BTP) 9.5-1 CMEB July 1981 (ADAMS Accession No. ML070660454).
7. U.S. Nuclear Regulatory Commission, NUREG-0800, SRP Section 11.4, "Design Guidance for Temporary Storage of Low Level Radioactive Waste," Appendix 11.4-A, March 2007 (ADAMS Accession No. ML070710397).
8. SECY 94-198, "Review of Existing Guidance Concerning The Extended Storage Of Low-Level Radioactive Waste, Nuclear Regulatory Commission, August 1, 1994 (ADAMS Accession No. ML071640462).
9. Generic Letter 81-38, "Storage of Low-Level Radioactive Waste at Power Reactor Sites", Nuclear Regulatory Commission, November 10, 1981.
10. NUREG/CR-6673 "Hydrogen Generation in TRU Waste Transportation Packages, February 2000, (ADAMS Accession No. ML003723404).

The following documents contain security-related or safeguards information and are not publicly available:

1. NEI 03 12, "Template for the Security Plan, Training and Qualification Plan, Safeguards Contingency Plan, and Independent Spent Fuel Installation Security Program," Revision 6.
2. AP1000 DCD, including Technical Report (TR) 49, "AP1000 Enhancement Report," TR-94, "AP1000 Safeguards Assessment Report," and TR-96, "Interim Compensatory Measures Report."