

SAFETY EVALUATION BY THE OFFICE NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 178 AND 177

TO THE COMBINED LICENSE NOS. NPF-91 AND NPF-92, RESPECTIVELY

SOUTHERN NUCLEAR OPERATING COMPANY, INC.

GEORGIA POWER COMPANY

OGLETHORPE POWER CORPORATION

MEAG POWER SPVM, LLC

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VOGTLE ELECTRIC GENERATING PLANT UNITS 3 AND 4

DOCKET NOS. 52-025 AND 52-026

1.0 INTRODUCTION

By letter dated August 16, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19228A240) and supplemented by letter dated February 14, 2020 (ADAMS Accession No. ML20045D590), Southern Nuclear Operating Company (SNC) requested that the U.S. Nuclear Regulatory Commission (NRC) amend Vogtle Electric Generating Plant (VEGP) Units 3 and 4, Combined License (COL) Numbers NPF-91 and NPF-92, respectively. In particular, License Amendment Request (LAR) 19-014, "Tornado Missile Protection for Main Steam Vent Stacks and Wall 11," requested changes to the evaluation of the auxiliary building main steam safety valve (MSSV) vent stack openings and the auxiliary building Wall 11 openings for protection from tornado-generated missiles. SNC stated that the changes include the evaluation of horizontal missiles targeting the MSSV vent stacks, the evaluation of vertical missiles targeting the MSSV vent stack openings, and the evaluation of missiles targeting the auxiliary building Wall 11 openings. The LAR requested changes to the licensing basis documents for VEGP Units 3 and 4 in the form of departures from the plant-specific Design Control Document (DCD) Tier 2 information as incorporated into the Updated Final Safety Analysis Report (UFSAR). SNC stated that no change was made to Tier 1, Tier 2*, or COL information; that this change involves a revision to plant-specific Tier 2 information that meets the criteria for a license amendment under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, Appendix D, Section VIII.B.5.b(8), in that it was determined that the proposed change would result in a departure from a method of evaluation described in the plant-specific DCD used in establishing the design bases or in the safety analyses, and thus requires NRC approval for the Tier 2 departures.

In the February 14, 2020 supplement, SNC provided clarification to the design details of the added turbine building first bay missile barrier at elevation 100'. The supplement also clarified the design of missile barriers at elevation 117' 6". The NRC staff concluded that the supplement provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on October 22, 2019 (84 FR 56478).

2.0 REGULATORY EVALUATION

The requested amendment proposes changes to the evaluation of the auxiliary building MSSV vent stack openings and the auxiliary building Wall 11 openings for protection from tornado-generated missiles. The changes, related to tornado-generated missiles, include the evaluation of the MSSV vent stacks and impact from horizontal missiles, the evaluation of MSSV vent stack openings and impact from vertical missiles, and the evaluation of the potential impact of missiles on auxiliary building Wall 11 openings.

The requested amendment involves a departure from Tier 2 information requiring a license amendment under paragraph B.5.b; specifically, the departure from Tier 2 would result in a departure from a method of evaluation described in the plant-specific DCD used in establishing the design bases or in the safety analyses. Therefore, NRC approval is required prior to making the change to Tier 2 information.

The NRC staff considered the following regulatory requirements and guidance in reviewing LAR 19-014:

10 CFR Part 52, Appendix D, Section VIII.B.5.a, allows a licensee that references this appendix to depart from Tier 2 information, without prior NRC approval, unless the proposed departure involves a change to or departure from Tier 1 information, Tier 2* information, the Technical Specifications, or requires a license amendment under paragraphs B.5.b or B.5.c of the section.

The specific NRC technical regulatory requirements applicable to LAR 19-014 are the general design criteria (GDC) in Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." In particular, the technical regulatory requirements applicable to LAR 19-014 include the following GDC:

10 CFR Part 50, Appendix A, GDC 2, "Design bases for protection against natural phenomena," requires, in part, that structures, systems, and components (SSCs) important to safety be designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, tsunamis, and seiches, without loss of capability to perform their safety function.

10 CFR Part 50, Appendix A, GDC 4, "Environmental and dynamic effects design bases," requires, in part, that SSCs important to safety 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 SSCs 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.

NRC Regulatory Guide (RG) 1.100, Revision 3, "Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants," endorses American Society of Mechanical Engineers (ASME) Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants," which is applied to the MSSVs used at VEGP Units 3 and 4.

RG 1.76, Revision 1, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants."

3.0 TECHNICAL EVALUATION

3.1 Mechanical Engineering Evaluation

LAR 19-014 specifies that 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. LAR 19-014 also states that there are no changes to the design, setpoints, lift pressure, or relief capacity of the MSSVs. LAR 19-014 indicates that there is no impact to the qualification or design conditions for the MSSVs.

To verify the acceptability of information in LAR 19-014, the NRC staff conducted a regulatory audit review of documentation supporting statements in LAR 19-014, which is designated as sensitive information and located in the Westinghouse Electric Company's (Westinghouse) electronic reading room (eRR). For the mechanical engineering audit, the NRC staff audited the documentation that provides technical support for LAR 19-014 analysis of the capability of the MSSVs to continue to perform their safety functions in consideration of tornado missile effects. In addition, the staff discussed the eRR documentation with SNC and its representatives. The audit report is listed in Section 7.0, "References," in this safety evaluation.

In accordance with AP1000 DCD Tier 2, Section 3.9.3.2.2, "Valve Operability," the licensee is qualifying the MSSVs in accordance with ASME QME-1-2007, as endorsed in RG 1.100, Revision 3. During the mechanical engineering audit, the NRC staff reviewed supporting documents for LAR 19-014 to verify that the ASME QME-1-2007 qualification for the MSSVs would not be modified by the proposed changes in LAR 19-014. For example, the staff reviewed Westinghouse Engineering and Design Coordination Report (E&DCR) APP-FSAR-GEF-069, "Class 1 Changes to Tornado and Hurricane Missile Line-of-Sight Evaluation, Barrier Designs and Missile Criteria," for design changes proposed in LAR 19-014, including demonstration that an alternative steam discharge path can be achieved without the availability of the MSSV vent stacks. The staff reviewed Westinghouse document APP-GW-N1-008, "AP1000 Design Criteria and Guidelines for Protection from Tornado and Hurricane-Generated Missiles," for potential impact on the MSSV performance. The staff also reviewed Westinghouse Calculation Note APP-1241-S3C-004, "Tornado Missile Impact Analysis of MSSV Vent Arm," which evaluated the stress generated in the MSSV branch connection and concluded that it will not exceed the yield strength of the material. Based on its audit review, the staff confirmed that the functional qualification of the MSSVs specified in ASME Standard QME-1-2007 will not be affected by the changes requested in LAR 19-014 and therefore remains acceptable.

The staff also evaluated the statement in LAR 19-014 that the projected increase in MSSV backpressure from crimping of the vent stack caused by a tornado missile would not cause sufficient backpressure to degrade MSSV capacity. To confirm this statement, the NRC staff

audited supporting documentation for LAR 19-014 to evaluate the potential effect on setpoints and capacity of the MSSVs from increased backpressure caused by damage from tornado missiles. In particular, the staff audited Westinghouse E&DCR APP-FSAR-GEF-069 and its separate attachment providing an MSSV backpressure calculation in the event that the vent stacks become blocked. The Westinghouse calculations supported the statement in LAR 19-014 that the projected increase in MSSV backpressure would not decrease MSSV capacity. Therefore, the staff concludes that the proposed changes related to MSSV backpressure from crimping of the vent stack caused by a tornado missile in LAR 19-014 will not adversely impact the performance of the MSSVs and that their response or failure will be in a safe condition. Based on the foregoing, the staff concludes that the application demonstrates that the proposed changes in LAR 19-014 maintain the design of the MSSVs, and that they continue to be designed to withstand the effects of natural phenomena or are protected from such phenomena, and they will continue to meet their design capacity. Therefore, LAR 19-014 is acceptable in regard to MSSV response to increased backpressure.

For protection from externally generated missiles, openings through walls are evaluated on a case-by-case basis to provide confidence that a missile passing through the opening would result in a safe condition. In particular, SNC analyzed this type of event to ensure that it would not prevent safe shutdown and would not result in an offsite release exceeding the dose guidelines defined in 10 CFR 50.34, "Contents of applications; technical information." The SNC analyses performed for the proposed changes in LAR 19-014 demonstrate that the systems required for safe shutdown will remain capable of performing this function in the event of a tornado because postulated missiles will not impair their function, as discussed in Section 3.2 of this SE. The staff further concludes that overpressure protection of the main steam line is achieved by an alternate vent path, which is described in LAR 19-014, Section 2.1. Accordingly, the staff concludes that the requested amendment will not impair the MSSV function of Main Steam System (MSS) overpressure protection, even if the vent stacks are blocked, because there is an alternate vent path that supports this function.

As discussed above, the SNC analyses performed for the proposed changes in LAR 19-014 demonstrate that the main steam isolation valve compartments (compartments may be composed of 1 or more "rooms") will not overpressurize if steam is released from the main steam line into the compartment. Accordingly, the staff concludes that the proposed changes in LAR 19-014 do not affect the ability of the MSSVs to accommodate the effects of the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant-accidents, to perform their function. Therefore, the staff finds that the proposed changes in LAR 19-014 do not affect the MSSV's compliance with the requirements of 10 CFR Part 50, Appendix A, GDC 4 and are therefore acceptable in this regard.

In its mechanical engineering review documented above, the NRC staff did not identify any adverse impacts to the ASME Standard QME-1-2007 qualification of the MSSVs or any adverse impact to the performance of the MSSVs from increased backpressure as a result of tornado missiles as described in LAR 19-014. The staff concludes that the proposed changes in LAR 19-014 comply with the requirements of 10 CFR Part 50, Appendix A, GDC 2 related to withstanding the effects of natural phenomena. Accordingly, based on this review, the staff finds that even with the changes proposed in LAR 19-014, the MSSVs will continue to meet 10 CFR Part 50, Appendix A, GDC 2 and GDC 4, by the application of ASME Standard QME-1-2007, as accepted in RG 1.100, Revision 3, and, therefore, the LAR is acceptable with respect to these issues.

3.2 Structural Engineering Evaluation

UFSAR Section 3.5.2, "Protection from Externally Generated Missiles," states that systems required for safe shutdown are protected from the effects of 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 1 nuclear island structures. Section 3.8.4, "Other Category I Structures," of the UFSAR describes the design requirements for the shield building and auxiliary building. The walls and roof have been designed as Seismic Category I in the AP1000 certified design in accordance with American Concrete Institute (ACI) 349-01, "Code Requirements for Nuclear Safety Related Concrete Structures." The external building walls and roof are reinforced concrete. Openings through these walls are evaluated on a case-by-case basis to justify the protection from externally generated missiles. The licensee requested a license amendment that proposes changes to the evaluation of auxiliary building MSSV vent stack openings and the auxiliary building Wall 11 openings for protection from tornado-generated missiles. The LAR proposed changes to Note 14 in UFSAR Table 3.2-1, "Comparison of Safety Classification Requirements"; UFSAR Section 3.5.2; UFSAR Table 3.5-1, "External Missile Protection Provided for Auxiliary Building Wall 11 Openings"; and UFSAR Section 10.3.2.2.2, "Main Steam Safety Valves." These changes involve revision to plant-specific Tier 2 information. The staff evaluation for each missile type and detailed UFSAR change follows:

- MSSV Vent Stacks – Impact from 1 inch steel sphere:

The licensee stated that a horizontal missile could impact the side of the main steam vent stacks. The licensee's analysis shows that 0.0214 inch is the minimum steel thickness needed to prevent perforation from the impact of a 1 inch steel sphere travelling at 105 mph postulated velocity, one of the postulated tornado missiles described in UFSAR Section 3.5.1.4, "Missiles Generated by Natural Phenomena." The nominal thickness of the vent stack is 0.375 inch, which is greater than the analyzed 0.0214 inch minimum thickness necessary to prevent vent stack perforation. The staff performed an audit to verify the analysis results. Therefore, no perforation is expected and structural integrity of the stack is maintained. Similarly, a vertical missile could enter through the top of the main steam vent stacks, travel down the stacks, and impact the MSSV discharge elbow. The licensee stated that the analysis shows that 0.0214 inch is the minimum steel thickness required to prevent perforation. The elbow is 0.365 inch thick steel and the drip pan is 0.25 inch thick steel. The elbow and the drip pan steel thickness exceed the minimum thickness of 0.0214 inch necessary to prevent perforation. The licensee specified the minimum thickness in their design which is based on the material properties. The staff verified the calculation of necessary material thickness for the elbow and drip pan in the audit. Therefore, the staff concludes that the licensee's analysis is acceptable and structural integrity is maintained for the MSSV stacks.

- MSSV Vent Stacks – Impact from 275 lb, 8 inch artillery shell:

The licensee stated that an 8 inch artillery shell horizontal missile could strike the main steam vent stacks. Impact to the vent stack could cause deformation or crimp the stack. The licensee's analysis shows that if all vent stacks became damaged from crimping, an alternative steam discharge path still exists. The alternative steam discharge will fill the Main Steam Isolation Valve (MSIV) compartments before discharging to the other building areas. SNC analyzed the effects of the alternative

steam discharge pathway and concluded that venting through the alternative vent path increases sub-compartment pressure to 5.6 psid (from room to outside environment). As indicated in Section 3.3, "Plant Systems Evaluation," below, the staff verified SNCs sub-compartment pressure. This sub-compartment pressure is below the designed differential pressure of 6.5 psid for the wall, per UFSAR Section 3H.5.1.3, and does not challenge the structural integrity of the MSIV compartment wall. Accordingly, the staff concludes that the pressure loads remain unchanged for the compartment walls.

Similarly, SNC stated that an 8 inch artillery shell vertical missile could clear the edges of the stacks and continue down the center line of the stack. Because of the pipe configuration and the change in direction of the missile, the kinetic energy in this scenario is reduced by 85 percent and vertical velocity is reduced 90 percent. In another scenario, if the missile strikes the stack at the farthest edge relative to the MSSV, the missile will be stopped by the vent material, and remain at the top end of the MSSV discharge elbow. The kinetic energy of the missile is reduced 98 percent and the vertical velocity is reduced 100 percent. The staff audited the licensee's kinetic energy calculations of the missile in the eRR for both scenarios. The staff verified that the 8 inch artillery shell missile kinetic energy would be reduced as stated in the application, and with those reductions in kinetic energy, the main steam line remains intact and is therefore acceptable.

- MSSV Vent Stacks – Impact from large deformable debris (represented by 4000 lb automobile):

NRC Standard Review Plan Section 3.5.1.4 states that an automobile missile should be considered at all elevations up to 30 feet above all grade levels within 0.5 mile of the facility structures. This is consistent with UFSAR Section 3.5.1.4. However additional requirements were added in the DCD to consider the impact of such a missile originating up to 193 feet (approximately) above plant grade elevations within 0.5 mile of facility structures. The licensee stated that for the VEGP Unit 3 and 4 plant, the grade level elevation is 220 ft. Within 0.5 mile of VEGP Unit 3 and 4, the highest grade elevation at which automobiles would normally be parked is 247 ft, in a parking area located near office building 301 southeast of the site. Therefore, at this site, an automobile missile would be considered 30 feet above grade (at 247 ft) at 277 ft. The licensee noted that there are elevations above 247 ft within 0.5 mile of VEGP Unit 3 and 4, however, these locations, as shown in a sensitive plant topographical map identified as Figure 1-1 in Enclosure 3 of the LAR, would not contain automobiles or other large equipment. Other VEGP Unit 1 and 2 parking lots are located greater than 0.5 miles from facility structures.

Given the Vogtle site-specific topography and site layout, the staff determined that there is limited line of sight to the main steam vent stacks. As shown in LAR 19-014, Enclosure 1, Figure 1-2, "AP1000 Plant Building Arrangement," and Table 1-1, "Site Grade and Structure Elevations," the surrounding structures exceed the elevation of the auxiliary building roof low point and will provide protection to the main steam stacks. Further, the staff determined that the surrounding buildings and the Passive Containment Cooling Ancillary Water Storage Tank are above the elevation and these structures are evaluated for the automobile missiles, including large debris. Based on above discussion of the site topography and review of the missiles' impact on the main steam stacks, the staff concludes that the main steam vent stack's structural integrity remains intact because of the site grade, elevation in the Enclosure 3 (security-related

information), Figure 1-2, and Table 1-1, and surrounding building arrangements demonstrated that the missile will not reach the vent stack, and therefore the proposed changes are acceptable.

3.2.1 Evaluation of Missile Barrier Removal and New Barrier

The primary design function of the missile barriers affected by LAR 19-014 is to protect Wall 11 openings from a postulated automobile missile as described in UFSAR Section 3.5.1.4. LAR 19-014 proposes to remove the turbine building first bay large opening missile barriers from Wall 11.2 and Wall R. The licensee stated that the further review of the turbine building first bay large opening missile barriers, the barrier protection function, is not required based on missile trajectory. Further, to support the proposed removal of these turbine building first bay large opening missile barriers, SNC takes credit for the structures, equipment, and components in the turbine building and annex building to break up an automobile missile into smaller pieces or slow it down. SNC indicates that breaking up or slowing down an automobile missile will dissipate its kinetic energy to the extent its kinetic energy will be below both the kinetic energy of the 1 inch steel sphere and 8 inch artillery shell.

The licensee analysis shows that either an automobile missile would have to travel a highly tortuous path through the turbine building or annex building to reach the turbine building first bay and auxiliary building Wall 11, or would not have line of sight to reach the turbine building first bay openings. The buildings are highly congested with structures, equipment, and components, which SNC credits as stopping the deformed automobile from entering the turbine building first bay openings. SNC's analysis of a tortuous path shows that an automobile missile would break into large pieces debris (i.e., no smaller than 16.4'x 6.6'x 4.2'). SNC concluded that these large pieces of debris would disintegrate before reaching the turbine building first bay. The SNC analysis also indicates that larger pieces that may break off (e.g., engine) will be stopped by the tortuous path or ricochet; therefore, they do not reach the turbine building first bay. Examples of the tortuous paths are shown in LAR 19-014 Enclosure 1, Table 2-1, "Line of Sight Mitigation Features," and proprietary Enclosure 3, Figures 2-2, 2-4, and 2-8. The staff reviewed the tortuous path information in Enclosure 3, Figures 2-1 thru 2-6 of the LAR, and determined that the path to turbine building first bay from the exterior is tortuous and would function to break up and stop an automobile missile.

Additionally, the licensee stated that there is no line of sight for a shell or sphere missile to pass through turbine building Wall 11.2 or Wall R large openings and impact safe shutdown equipment. Hence, SNC would revise UFSAR Table 3.5-1 to remove credit for the large opening missile barriers for the shell and sphere missiles and instead take credit for the turbine building first bay and annex building structures, equipment, and components preventing a line of sight path to safe shutdown equipment.

The LAR proposes to add a new missile barrier at the door in auxiliary building Wall 11, at elevation 100 ft., between auxiliary building room 12306 and the turbine building first bay. The auxiliary building Wall 11 door of the room cannot be credited as a missile barrier, as the door is credited for steam venting purposes. Since the door is part of the alternate steam venting path described above, it may be open during a steam relief scenario and cannot be assumed to be closed. Therefore, a missile barrier is necessary in front of the door to eliminate the line of sight into auxiliary building room 12306 to safe shutdown related equipment.

The staff performed an audit as part of its review of LAR 19-014 to confirm SNC's evaluation for the new barrier design is in accordance with American Institute of Steel Construction, AISC

N690-1994, "Specification for Safety-Related Steel Structures for Nuclear Facilities," code and meets UFSAR Section 3.5.3, "Barrier Design Procedures," requirements. Also, the missile barrier concrete anchors are designed in accordance with American Concrete Institute, ACI 349-01, Appendix B, and UFSAR Section 3.8.4.5.1, "Supplemental Requirements for Concrete Structures." During the audit, the staff audited the results the Engineering and Design Coordination Report, APP-2100-GEF-011, Revision 0, "Addition of Steel Tornado Missile Barrier in the Turbine Building 1st Bay, EL. 100'-0," that is a new barrier design evaluation for the 8 inch artillery shell missile and solid steel 1 inch diameter sphere missile. The staff verified that SNC has applied the correct methodology to the barrier design to meet AISC N690-94 and ACI 349 code requirements.

The staff audited the results in the report (APP-2100-GEF-011, Revision 0) for the minimum target thicknesses to prevent penetration of the 8 inch artillery shell and 1 inch solid steel sphere missile. The interaction ratio (IR) calculated for the minimum thickness vs. provided thickness is 0.82 and 0.05 for the 8 inch shell and 1 inch sphere, respectively. These interaction ratios are well below 1.0, and therefore comply with AISC N690-1994. Therefore, neither missile will not perforate the barrier. The bending stress interaction ratio calculated for the barrier plate is 0.91, which is also less than 1.0. Further, the strength ratio for welded connections at the support plates considering the governing maximum reaction is 0.31, which is less than 1.0. The barrier support plates anchors are qualified in accordance with ACI 349-01. Based on the foregoing, the staff concludes that the missile barrier removal and new barrier design is acceptable because it meets design codes as described in this section.

3.3 Plant Systems Evaluation

GDC 2, in part, requires that SSCs important to safety shall be designed to withstand the effects of natural phenomena, such as tornadoes and hurricanes, without loss of capability to perform their safety functions. GDC 4, in part, requires that SSCs important to safety shall be appropriately protected against the effects of missiles that may result from events and conditions outside the nuclear power unit.

With respect to protection of SSCs from missiles generated by tornadoes and extreme winds, the staff reviews the design of nuclear power facilities. If a design conforms to the guidance in RG 1.76, Revision 1, Positions C.1, "Design-Basis Tornado Parameters," and C.2, "Design-Basis Tornado-Generated Missile Spectrum," the staff considers the design in compliance with GDC 2 and GDC 4. In NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," the staff concluded that the AP1000 design meets the requirements of GDCs 2 and 4 with respect to protection against the effects of natural phenomena such as tornadoes and tornado-generated missiles.

UFSAR Section 3.5.2 states that 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, and 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 dose guidelines defined in 10 CFR 50.34. In the case of LAR 19-014, the openings are identified as the MSSV stacks and Wall 11 openings. This safety evaluation (SE) reviews the analyses performed by the licensee to demonstrate that tornado missiles will not prevent important to safety SSCs from performing their safety function or achieving and maintaining safe shutdown.

LAR 19-014 proposes changes that revise design basis information in the UFSAR by changing the evaluation of the auxiliary building MSSV vent stack openings and the auxiliary building Wall 11 openings for protection from tornado-generated missiles. The scope of review for this SE includes verification that the missile spectrum used in the licensee evaluation is appropriate, based on guidance provided in RG 1.76, and confirmation that SSCs important to safety can withstand tornado missiles or are protected against them by the nuclear island structure. Protection from tornado missiles will provide assurance that plant SSCs important to safety will be available to perform their safety functions during and following an extreme wind event, and assure compliance with GDC 2.

As described in UFSAR Section 10.1.2, "Protective Features," MSSVs are provided on both main steam lines, in accordance with ASME Code, Section III. The pressure relief capacity of the MSSVs is such that the energy generated at the high-flux reactor trip setting can be dissipated through the system. The design capacity of the MSSVs is equal to or exceeds 105 percent of the nuclear steam supply system (NSSS) design steam flow at an accumulation pressure not exceeding 110 percent of the main steam system (MSS) design pressure. Overpressure protection of the main steam line is a safety-related function. The MSSV stacks are not safety-related but are currently identified as components required to mitigate consequences of an accident and to establish and maintain safe shutdown conditions following a design basis tornado or hurricane event, thus requiring protection from tornado and hurricane-generated missiles in accordance with GDC 4.

LAR 19-014 presents the results of SNC's analysis performed to determine what effects tornado missile impacts on the MSSV stacks or through the MSSV stack openings would have on "important to safety" SSCs, and the ability of the plant to establish and maintain safe shutdown conditions. In the LAR, the licensee states that it analyzed the MSIV upper compartments (rooms 12504 and 12506), which have 24 MSSV vent stack openings in the roof (12 per main steamline). The licensee also provided information on the tornado missile spectra used in the analysis. The licensee indicated that the results of its analysis demonstrate that a tornado missile impact on or through the MSSV vent stacks does not affect safe shutdown, and therefore the MSSV vent stacks are not required to be protected from tornado and hurricane-generated missiles. The licensee's conclusion is based on its analysis of the vent stacks, VEGP Units 3 and 4 site topography, and arrangement of surrounding buildings.

To evaluate the acceptability of the licensee conclusion regarding the need for tornado missile protection for the MSSV vent stacks presented in LAR 19-014, the NRC staff reviewed the Technical Evaluation provided in the LAR and then conducted an audit of the supporting documentation in the eRR. The objective of the staff's review was to determine if the proposed changes to the evaluation on how the plant provides protection from tornado-generated missiles for the auxiliary building MSSV vent stack openings and auxiliary building Wall 11 opening will affect SSCs important to safety and the plant's ability to achieve and maintain safe shutdown.

The licensee's analysis examined the effect that three representative missiles would have on the plant based on horizontal missile strikes on the main steam vent stacks. The representative missiles used in the analysis included a 1 inch steel sphere traveling at 105 mph, a 275 pound 8 inch artillery shell traveling at a horizontal velocity of 105 mph or vertical velocity of 74 mph, and a 4000 pound automobile traveling at a horizontal velocity of 105 mph or a vertical velocity of 74 mph. The staff finds that the spectrum of missiles acceptable, because the missiles considered in the analysis in terms of missile type and

associated energy spectrum conform to RG 1.76, Revision 1, and the VEGP Units 3 and 4 design basis (UFSAR Section 3.5.1.4).

The licensee analysis results showed that in the event of a horizontal impact on the vent stacks by a 1 inch steel sphere, the flow discharge area would not be affected and that full operability of the vent stack would be maintained. However, the analysis results for horizontal impact from the 8 inch artillery shell or an automobile missile show that deformation creating an opening or crimping of the vent stack could be caused by such impact.

The licensee analysis shows that if crimping of the stacks occurs, even if the main steam vent stacks became damaged enough to crimp them all, an alternative steam discharge path exists. The alternative steam discharge path would utilize the opening between the main steam vent stack and the stack drip pan. The steam would fill the MSIV compartments before discharging through the MSIV door openings (between rooms 12504/12506 and the turbine building first bay), the Valve/Piping Penetration room door opening in Wall 11 (between room 12306 and the turbine building first bay) and MSIV pressure relief/flood panel. This alternative discharge path ensures the safety-related function to relieve the main steam pressure can be accomplished even if the main steam vent stacks are not open.

The staff reviewed the licensee supporting documents and confirmed that if the vent line was completely obstructed due to tornado missile impacts, the vent pipes are open at the bottom and an alternate steam discharge path would exist. Since the alternative discharge path would result in steam discharge to the MSIV compartment, the staff also reviewed the impact that the introduction of the discharge steam would have on the environmental conditions in the MSIV rooms. This was done to confirm that if the alternate path is utilized, SSCs required for safe shutdown are environmentally qualified.

The licensee indicated in Enclosure 1, Section 2.1.3.1 of the LAR that the alternate release path has no impact to equipment qualification because the upper MSIV compartment's (rooms 12504 and 12506) temperature and pressure are bounded by a main steam line break, and that there are no safety-related SSCs in the turbine building first bay. The staff confirmed this information based on its audit of the supporting information, specifically Westinghouse Letter LTR-CRA-15-1888, "Effect of MSSV Steam Release to MSIV Room Due to Missile for AP1000 Plants."

As discussed in Section 3.2 of this SE, vertical missiles that enter through the top of main steam vent stacks will not cause sufficient damage to MSSVs to prevent them from providing the necessary pressure relief for the main steam line, thus fulfilling their overpressure protection function. In addition, as discussed in Section 3.2.1 of this SE, because of deformation and loss of kinetic energy in travel through the turbine building, the 4000 pound automobile is not a credible missile on the auxiliary building Wall 11. Further, sufficient missile protection is provided for auxiliary building Wall 11 and the roof vents that protect the systems required for safe shutdown from the effects of externally generated missiles.

Based on the foregoing, the staff finds that a tornado missile impact on or through the MSSV vent stacks does not affect safe shutdown, and therefore the MSSV vent stacks are need not be protected from tornado-generated missiles. The staff also finds that conditions in the MSIV rooms resulting from MSSV discharge through the alternative steam discharge path has no impact on "important to safety" SSCs' ability to perform their safety-related functions or

establish and maintain safe shutdown of the plant. Therefore, the staff finds the proposed changes in LAR 19-014 acceptable, and finds that the plant will be in compliance with GDCs 2 and 4 with respect of tornado missile protection.

Evaluation Summary

The NRC staff has reviewed the licensee analysis of missile protection for the auxiliary building Wall 11 openings and roof vents. Based on its technical review, which is documented above in this SE, the NRC staff concludes that sufficient missile protection is provided for the auxiliary building Wall 11 and roof vents. Also, the staff reviewed the licensee's new barrier design. The barrier is designed for missile protection in accordance with the Tier 2 design bases concrete code ACI 349-01 and steel code AISC N690, and the NRC staff finds that the proposed amendment meets relevant code provisions. Therefore, the systems required for safe shutdown are protected from the effects of externally generated missiles. Accordingly, the requirements of GDC 2 and GDC 4 of 10 CFR Part 50, Appendix A, and Appendix D to 10 CFR Part 52 will continue to be met. Therefore, the NRC staff finds SNC request for license changes in LAR 19-014 to be acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Georgia State official was notified of the proposed issuance of the amendment on February 14, 2020. The State official had no comments.

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. The 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, and that 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 84 FR 56478, dated October 22, 2019. 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.

6.0 CONCLUSION

The NRC staff has concluded, based on the considerations discussed in Section 3 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. Vogtle Electric Generating Plant Units 3 and 4, License Amendment Request 19-014, "Tornado Missile Protection for Main Steam Vent Stacks and Wall 11 (LAR-19-014)," August 16, 2019, ADAMS Accession No. ML19228A240.
2. Vogtle Electric Generating Plant Units 3 and 4, License Amendment Request 19-014, Supplement 1, "Tornado Missile Protection for Main Steam Vent Stacks and Wall 11 (LAR-19-014S1)," February 14, 2020, ADAMS Accession No. ML20045D590.
3. *Code of Federal Regulations*, Title 10, "Energy," Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants."
4. NRC Regulatory Guide 1.100, Revision 3, "Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants," September 2009, ADAMS Accession No. ML091320468.
5. NRC Regulatory Guide 1.76, Revision 1, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," March 2007, ADAMS Accession No. ML070360253.
6. NRC Audit Report, "Audit Report Related to License Amendment Request (LAR) 19-014 – Tornado Missile Protection for Main Steam Vent Stacks and Wall 11," December 18, 2019, ADAMS Accession No. ML19338C151.
7. Vogtle Electric Generating Plant Units 3 and 4, "Issuance of Amendment Re: Wall 11 Design Related Changes (LAR 15-021)," August 3, 2016, ADAMS Accession No. ML16201A308.
8. Combined License NPF-91 for Vogtle Electric Generating Plant Unit 3, Southern Nuclear Operating Company, ADAMS Accession No. ML14100A106.
9. Combined License NPF-92 for Vogtle Electric Generating Plant Unit 4, Southern Nuclear Operating Company, ADAMS Accession No. ML14100A135.