UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

RELATED TO EXEMPTION AND AMENDMENT NOS. 123 AND 122

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

SOUTHERN NUCLEAR OPERATING COMPANY, INC.

GEORGIA POWER COMPANY

OGLETHORPE POWER CORPORATION

MEAG POWER SPVM, LLC

MEAG POWER SPVJ, LLC

MEAG POWER SPVP, LLC

CITY OF DALTON, GEORGIA

VOGTLE ELECTRIC GENERATING PLANT UNITS 3 AND 4

DOCKET NOS. 52-025 AND 52-026

1.0 INTRODUCTION

By letter dated August 31, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17243A351), and supplemented by letters dated February 8 and March 9, 2018 (ADAMS Accession Nos. ML18040A487 and ML18067A648, respectively), the Southern Nuclear Operating Company (SNC) requested that the Nuclear Regulatory Commission (NRC) amend Vogtle Electric Generating Plant (VEGP) Units 3 and 4, Combined License (COL) Numbers NPF-91 and NPF-92, respectively. The License Amendment Request (LAR) 17-023 proposes to depart from Tier 2 information in the Updated Final Safety Analysis Report (UFSAR) (which includes the plant-specific design control document (DCD) Tier 2 information) and involves related changes to plant-specific Tier 1 (and associated COL Appendix C) information, and COL Appendix A, Technical Specifications (TS). Specifically, the requested amendment proposes changes to the plant-specific nuclear island non-radioactive ventilation system (VBS), the main control room emergency habitability system (VES), and post-accident operator dose analyses. These changes are proposed to maintain compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criterion (GDC) 19, "Control Room Habitability," which requires that main control room (MCR) personnel dose does not exceed 5 roentgen equivalent man (rem) total effective dose equivalent (TEDE) for the duration of a design basis accident (DBA).

SNC has also requested an exemption from the provisions of 10 CFR Part 52, Appendix D, "Design Certification Rule for the AP1000 Design," Section III.B, "Scope and Contents." The

requested exemption would allow a departure from the corresponding portions of the certified information in Tier 1 of the generic DCD.[1] In order to modify the UFSAR (the plant-specific design control document (PS-DCD)) Tier 1 information, the NRC must find SNC'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.

In letters dated February 8 and March 9, 2018, (ADAMS Accession Nos. ML18040A487 and ML18067A648), SNC provided additional information that supplemented the application. This information did not expand the scope of the application, and did not change the staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on October 24, 2017 (82 FR 49234).

2.0 REGULATORY EVALUATION

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

Appendix D, Section VIII.B.5.a to 10 CFR Part 52 allows an applicant or licensee who 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, or the Technical Specifications, or requires a license amendment under paragraphs B.5.b or B.5.c of the section.

10 CFR Part 52, Appendix D, VIII.C.6 states that after issuance of a license, "Changes to the plant-specific TS will be treated as license amendments under 10 CFR 50.90." 10 CFR 50.90 addresses the application for amendment of license, construction permit, or early site permit. The proposed LAR requires changes in the TS, and therefore an LAR is required to be submitted for NRC approval.

10 CFR 52.63(b)(1) allows the licensee who references a design certification rule to request NRC approval for an exemption from one or more elements of the certification information. The Commission may only grant such a request if it determines that the exemption will comply 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 to the factors listed in 10 CFR 52.7, the Commission shall consider whether the special circumstances 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 inspections, tests, analyses, or related acceptance criteria is a proposed amendment to the license. These activities involve a change to COL Appendix C Inspections, Tests, Analyses, and Acceptance

[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.

Criteria (ITAAC) information, with corresponding changes to the associated PS-DCD Tier 1 information. Therefore, a license amendment request is required.

10 CFR 50.34(f)(2)(vii) requires that licensees perform radiation and shielding design reviews of spaces around systems that may, as a result of an accident, contain accident source term radioactive materials, and design as necessary to permit adequate access to important areas and to protect safety equipment from the radiation environment.

10 CFR 50.36, Technical specifications (TS) imposes limits, operating conditions, and other requirements upon reactor facility operation for the public health and safety. In accordance with 10 CFR 50.36(b), the TS are derived from the analyses and evaluations in the safety analysis report. Consistent with 10 CFR 50.36(c), these TS contain items in the following categories, among others: (1) safety limits and limiting safety system settings; (2) limiting conditions for operation; (3) surveillance requirements; (4) design features; and (5) administrative controls.

10 CFR 50.55a(h)(3), "Safety Systems," requires Part 52 combined license holders to comply with Institute of Electrical and Electronics Engineers (IEEE) Standard (Std.) 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," and the correction sheet dated January 30, 1995. This LAR includes proposed changes to the protection and safety monitoring system (PMS) by adding two safety-related, MCR differential pressure transmitters (DPT) and associated logic to automatically initiate isolation of the MCR. This LAR also proposed changes to the numerical values of safety analysis limit (SAL) setpoints used to actuate nuclear island VBS supplemental filtration mode (SFM) and the main control room VES. Therefore, the regulatory requirements in 10 CFR 50.55a(h)(3) are considered in the safety evaluation.

10 CFR Part 50, Appendix A, GDC 13, "Instrumentation and Control," requires, in part, that instrumentation shall be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety. This includes those variables and systems that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems. This LAR proposes to add two safety-related, MCR DPTs and associated logic to the PMS. Therefore, this criterion is considered in the safety evaluation.

10 CFR 50, Appendix A, GDC 19, "Control Room," requires that a control room be provided from which actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain it in a safe condition under accident conditions, including loss-of-coolant accidents. Further, adequate radiation protection shall be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 0.05 Sievert (Sv) (5 rem) TEDE, for the duration of the accident.

10 CFR 52.47(a)(8) requires that the FSAR provide the information necessary to demonstrate compliance with any technically relevant portions of the Three Mile Island requirements set forth in 10 CFR 50.34(f), except paragraphs (f)(1)(xii), (f)(2)(ix), and (f)(3)(v).

10 CFR 52.79(a)(1)(vi), as it relates to technical information in final safety analysis report (FSAR) pertaining to the evaluation of the offsite radiological consequences of postulated accidents requires a demonstration that an individual located at any point on the exclusion area

boundary (EAB) for any 2-hour period following the onset of the postulated fission product release, would not receive a radiation dose in excess of 0.25 Sv (25 rem) TEDE, and an individual located at any point on the outer boundary of the low population zone (LPZ), who is exposed to the radioactive cloud resulting from the postulated fission product release (during the entire period of its passage) would not receive a radiation dose in excess of 0.25 Sv (25 rem) TEDE.

NUREG-0737, "Clarification of TMI Action Plan Requirements," and NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," (SRP) Section 12.3-12.4 provide additional guidance on acceptable methods of meeting these requirements. These documents indicate that post accident radiation zones should consider access to, stay time in, and egress from these vital areas. NUREG-0737 specifies that any area which will or may require occupancy to permit an operator to aid in the mitigation of or recovery from an accident is to be designated as a vital area. As specified, the plant should be designed so that the dose to an individual should not exceed the occupational dose criteria to perform the vital missions, including accessing and egressing from the areas.

NUREG-0800, SRP Section 2.3.4, "Short-Term Atmospheric Dispersion Estimates for Accident Releases" as it relates to atmospheric dispersion factors used for the assessment of consequences related to atmospheric radioactive releases to the control room.

NUREG-0800, SRP Section 6.4, "Control Room Habitability System," as it relates to the control room ventilation system and control building layout and structures.

Regulatory Guide (RG) 1.23, "Meteorological Monitoring Programs for Nuclear Power Plants," which includes guidance on the measurement and processing of onsite meteorological data for use as input to atmospheric dispersion models in support of plant operation.

RG 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," which provides guidance on appropriate dispersion models for estimating offsite relative air concentrations (χ/Q values) as a function of downwind direction and distance for various short-term time periods (up to 30 days) after an accident.

RG 1.183, "Alternative Radiological Source Terms for Evaluating Design-basis Accidents at Nuclear Power Reactors," which discusses the need to provide an evaluation of the radiological consequences of design basis accidents at emergency response facilities.

RG 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants," which discusses acceptable approaches for estimating short-term (i.e., 2 hours to 30 days after an accident) average χ/Q values near the buildings at main control room ventilation air intakes and at other locations of significant air in-leakage to the control room due to postulated design basis accident radiological airborne releases.

3.0 TECHNICAL EVALUATION

3.1 EVALUATION OF EXEMPTION

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. Exemptions from Tier 1 information are governed by the change process in Section VIII.A.4 of Appendix D of 10 CFR Part 52. Because SNC has identified changes to plant-specific Tier 1 information, with corresponding changes to the associated COL Appendix C information resulting in the need for a departure, an exemption from the certified design information within plant-specific Tier 1 material is required to implement the LAR.

The Tier 1 information for which a plant-specific departure and exemption was requested relates to the MCR. The result of this exemption would be that the licensee could implement modifications to Tier 1 information to the UFSAR as well as departures from a PS-DCD Tier 2 table, and a COL Appendix C table. Pursuant to the provisions of 10 CFR 52.63(b)(1), an exemption from elements of the design as certified in the 10 CFR Part 52, Appendix D, design certification rule is requested for the involved Tier 1 information described and justified in LAR 17-023. This exemption is a permanent exemption 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, Section VIII.A.4 of Appendix D to 10 CFR Part 52 provides that the Commission will deny a request for an exemption from Tier 1 if it finds that the requested change will result in a significant decrease in the level of safety otherwise provided by the design. Pursuant to 10 CFR 52.63(b)(1), the Commission may grant exemptions from one or more elements of the certification information, so long as the criteria given in 10 CFR 52.7, which, in turn, references 10 CFR 50.12, are met and that the special circumstances, which are defined by 10 CFR 50.12(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. As 10 CFR 52.7 further states, 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 the public health and safety, and are consistent with the common defense and security; and (2) special circumstances are present. Specifically, 10 CFR 50.12(a)(2) lists six circumstances for which an exemption may be granted. It is necessary for one of these bases to be present in order for the NRC to consider granting an exemption request. SNC stated that the requested exemption meets the special circumstances of 10 CFR 50.12(a)(2)(ii). That subparagraph 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 these findings is presented below:

3.1.1 AUTHORIZED BY LAW

The requested exemption would allow the licensee to implement a revision to Tier 1, Tables 2.2.5-1 and 2.2.5-5 in the PS-DCD. This exemption is a permanent exemption limited in scope to particular Tier 1 information. Subsequent changes to Tier 1, Tables 2.2.5-1 and 2.2.5-5, or any other Tier 1 information would be subject to the exemption process specified in Section VIII.A.4 of Appendix D to 10 CFR Part 52 and the requirements of 10 CFR 52.63(b)(1). As stated above, 10 CFR Part 52, Appendix D, Section VIII.A.4 allows the NRC to grant exemptions from one or more elements of the Tier 1 information. The 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 52.7 and 10 CFR 50.12(a)(1), 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 a licensee will construct and operate the plant based on the approved information found in the DCD incorporated by reference into a licensee's licensing basis. The proposed exemption from the requirements of 10 CFR 52, Appendix D, Section III.B allows changes to elements of the PS Tier 1 DCD to depart from the AP1000 certified (Tier 1) design information. The PS Tier 1 DCD continues to reflect the approved licensing basis, and maintains a consistent level of detail with that which is currently provided elsewhere in Tier 1 of the PS-DCD. Because the changes to the MCR filter shielding and VBS supplemental filtration and MCR isolation signals maintain the design functions of the VES and VBS, the changed design continues to provide the protection of the health and safety of the public. These changes will not impact the ability of the systems or equipment to perform their design function. Because they 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. The description 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. 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, these changes do not present an undue risk from any new equipment or systems. Therefore, as required by 10 CFR 52.7 and 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

The proposed exemption would allow a change to elements of the MCR as presented in the Tier 1 Tables 2.2.5-1 and 2.2.5-5 in the PS-DCD, thereby departing from the AP1000 certified (Tier 1) design information. The change does not alter or impede the design, function, or operation of any plant structures, systems, or components associated with the facility's physical or cyber security and, therefore, does not affect any plant equipment that is necessary to maintain a safe and secure plant status. In addition, the changes have no impact on plant security or safeguards procedures. Therefore, as required by 10 CFR 52.7 and 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), are present, in part, 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 purpose of this Tier 1 information is to provide design information to ensure that the shielding beneath the MCR VES filter maintains the design functions of the VES, including demonstrating compliance with the control room habitability requirements of 10 CFR Part 50, Appendix A, GDC 19. The proposed change to incorporate a new signal to isolate MCR heating, ventilation, and air conditioning (HVAC) and sanitary drainage system penetrations through the MCR boundary if the MCR differential pressure is below the "Low" setpoint for more than 10 minutes supports the VBS design function to maintain sufficiently high positive pressure in the MCR envelop relative to the surrounding areas, thereby minimizing in-leakage into the

MCR in order to maintain compliance with GDC 19. The proposed changes to revise the nomenclature used for the VBS actuation signals for supplemental filtration mode and MCR isolation provides consistent application of the signal description nomenclature used throughout the plant's licensing basis and has no adverse effect on the ability of the VBS to perform its design functions. The changes do not impact the ability of any structures, systems, and components to perform their functions or negatively impact safety. These changes will enable the licensee to safely construct and operate the AP1000 facility consistent with the design certified by the NRC by clarifying the information mentioned above and found in Tier 1, Tables 2.2.5-1 and 2.2.5-5 of the PS-DCD.

Special circumstances are present in the particular circumstances discussed in LAR 17-023 because the application of the specified Tier 1 information is not necessary to achieve the underlying purpose of the rule. The proposed change implements changes to the shielding beneath the MRC VES filter, as presented in a Tier 1, Tables 2.2.5-1 and 2.2.5-5 in the PS-DCD. This exemption requests revisions to Tier 1, Tables 2.2.5-1 and Tables 2.2.5-5 that continue to demonstrate that the applicable regulatory requirements will be met. The changes to the shielding beneath the MCR VES filter maintain the design functions of the VES, and therefore ensure that the design can be implemented in accordance with the purpose of the rule. Therefore, for the above reasons, the staff finds that the special circumstances required by 10 CFR 52.7 and 10 CFR 50.12(a)(2)(ii) for the granting of an exemption from the Tier 1 information exist.

3.1.5 SPECIAL CIRCUMSTANCES OUTWEIGH REDUCED STANDARDIZATION

This exemption would allow the implementation of changes to Tier 1, Tables 2.2.5-1 and 2.2.5-5 in the PS-DCD. The design functions of the system associated with this request will continue to be maintained because the associated revisions to Tables 2.2.5-1 and 2.2.5-5 demonstrate that the applicable regulatory requirements will continue to be met. The proposed changes to the VES filter shielding and actuation signal, and to the name of the VES and VBS actuation signals, ensure the capability of the nonsafety-related VBS and safety-related VES to maintain habitability in the control room during accidents, as described in DCD Subsection 6.4, "Control Room Habitability Systems," and Subsection 9.4.1, "Nuclear Island Nonradiological Ventilation System," and meet the dose limit requirements of GDC 19. Although there is a small possibility that standardization may be slightly reduced by the granting of the exemption from the specified Tier 1 requirements, the proposed exemption adding shielding to the VES filter and an actuation signal for low MCR differential pressure will improve the reliability and effectiveness of the MCR and associated HVAC systems, to better allow the MCR and the VES to perform their intended functions with respect to radiological habitability. This will allow the applicant to construct the system as designed, consistent with the purposes of the rule while resolving inconsistencies in the UFSAR. These inconsistencies do not contribute to the benefits of standardization. Consequently, the safety impacts that may result from any reduction in standardization are minimal. Based on the foregoing reasons, as required by 10 CFR 52.7 and 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 Tier 1, Tables 2.2.5-1 and 2.2.5-5 in the PS-DCD. The exemption request proposes to depart from the certified design by allowing changes to the VES filter shielding design that will maintain the MCR's key design functions and will not impair the function of the VES or the MCR. The proposed change to add the MCR

"Low" differential pressure signal for VBS MCR isolation and VES actuation provides an automatic actuation to prevent the MCR from being outside the analysis assumptions. The proposed change to the VES actuation signal name does not affect the function of the VBS or VES, and, therefore, does not affect the function of the MCR. Because the proposed changes will ensure that the design functions for the VES and MCR are maintained and that the requirements of GDC 19 are met for all DBAs, there is no reduction in safety. The proposed changes will enable the VES and VBS to meet their design functions, and the proposed Tier 1 ITAAC changes will provide reasonable assurance that both the VES and VBS are constructed and will operate in conformity with the applicable design criteria, codes, and standards. Therefore, based on the foregoing reasons and as required by 10 CFR 52.7, 10 CFR 52.98(f), and 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

Pursuant to 10 CFR 52.98(c) and in accordance with 10 CFR 50.90, SNC requested an amendment to the COLs for VEGP, Units 3 and 4. The proposed amendment would revise the licensing basis information regarding the nuclear island non-radioactive VBS, the VES, and post-accident operator dose analyses. These changes are proposed to maintain compliance with GDC 19.

Several of the changes proposed by SNC have been previously reviewed and approved as changes to the AP1000 standard design by the NRC as part of other recent COL applications (e.g., William States Lee III Nuclear Station (WLS), Units 1 and 2, Levy Nuclear Plant (LNP), Units 1 and 2, etc.). In addition to the departures included in these COL applications, other changes have been identified and are proposed for incorporation into the plant-specific licensing bases. Each of the proposed changes in this LAR are, therefore, categorized by SNC as either "Previously Approved Changes" (i.e., included in the recent COL applications as precedent) or "Additional Changes" (i.e., not included in the recent COL applications).

By letter, dated February 12, 2016 (ADAMS Accession No. ML16049A411), Duke Energy Carolinas (DEC) submitted a voluntary exemption and design change description for departure from the AP1000 DCD, Revision 19, to address the main control room dose analyses in support of the NRC's review of the WLS, Units 1 and 2, Docket Nos. 52-018 and 52-019, COL Application (COLA). DEC's February 12, 2016, letter incorporated the information previously submitted by Duke Energy Florida, LLC (DEF), in response to NRC's Requests for Additional Information on this subject in the COLA for the LNP, Units 1 and 2 docket, Docket Nos. 52-029 and 52-030. For simplicity, only the most recent COLA for which this activity has been approved (i.e., WLS, Units 1 and 2, Docket Nos. 52-018 and 52-019) is cited by SNC as precedent throughout this VEGP, Units 3 and 4, LAR, although it is understood that the references to the WLS departure and approval were based on information originally approved for LNP.

The proposed changes categorized as "Previously Approved Changes" in this VEGP, Units 3 and 4, LAR were included in the scope of the WLS departure submittals and supplemental correspondence on this subject. Accordingly, SNC incorporates by reference the information previously submitted by DEC on the WLS docket. The information incorporated by reference in this LAR includes the technical evaluation of the changes regarding the main control room dose analyses, which was approved by the staff in Section 21.2, "Main Control Room Dose Departure," of the Final Safety Evaluation Report (FSER) for the WLS COL (ADAMS Accession No. ML16137A123).

SNC also provided some updates for clarity to a portion of the previously approved changes to the AP1000 design information incorporated by reference. These changes are noted as "Updates to the Previously Approved Changes."

For informational purposes, SNC stated that a number of changes included in the WLS departure submittal were previously approved and implemented by earlier licensing actions on the VEGP, Units 3 and 4, docket (e.g., Amendment No. 52, approval of SNC LAR-16-001, Core Reference Report Incorporation).

In addition to the changes previously reviewed on the WLS docket, SNC also requested approval of other changes related to the main control room dose analyses, which were identified following DEF's submittal of the Request for Additional Information (RAI) responses for LNP. These proposed changes are referred to as "Additional Changes" in this LAR and are completely described and evaluated without reference to the precedent cited for departures that were previously approved on the WLS docket.

3.2.1 Previously Approved Changes

To ensure that the staff's findings on standard content documented in the safety evaluation report (SER) for the reference COL application (LNP Units 1 and 2) were equally applicable to VEGP Units 3 and 4 LAR, the staff undertook the following reviews:

- The staff compared the LNP COL FSAR, Revision 9, to the VEGP, Units 3 and 4, LAR. In performing this comparison, the staff considered changes made to the VEGP, Units 3 and 4, UFSAR resulting from RAIs related to the LAR.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

Evaluation of Site Specific Content Related to Standard Content

The pertinent site-specific information that affects the DBA dose analyses supporting the proposed incorporation by reference of previously approved changes to the AP1000 certified design is the site characteristic short-term (accident) atmospheric dispersion factor (χ/Q) values. In LNP FSER Section 21.2 (ADAMS Accession No. ML16068A418), the staff found that the revised DBA dose analyses in support of LNP DEP 6.4-1 were appropriately incorporated by reference in the LNP FSAR because the LNP site characteristic accident χ/Q values are less than the site parameter accident χ/Q values used in the revised DBA dose analyses in LNP DEP 6.4-1, which are the same χ/Q values listed in the AP1000 DCD as site parameter accident χ/Q values.

The VEGP Units 3 and 4, site characteristic accident χ/Q values are, however, different than the AP1000 DCD site parameter accident χ/Q values. Although this LAR proposes changes to the control room accident χ/Q values, the remainder of the VEGP site characteristic accident χ/Q values are unchanged by this LAR. For each of the DBAs, the VEGP Units 3 and 4, site characteristic χ/Q values for each time averaging period, including those revised in the LAR, are less than the comparable design reference χ/Q values used both in the AP1000 DCD and the revised DBA dose analyses supporting the previously approved changes, as incorporated by reference from the WLS COL. Because the result of the radiological consequences analysis for a DBA during any time period of radioactive material release from the plant is directly

proportional to the χ/Q for that time period, and because the VEGP Units 3 and 4 site characteristic χ/Q values are less than the comparable AP1000 design reference χ/Q values for all time periods and all accidents, the VEGP Units 3 and 4, site-specific estimated total dose at the EAB, LPZ, and the MCR for each DBA is, therefore, less than the generic revised estimated total dose at the same receptor location for each DBA. This is consistent with the analysis in support of the previously approved changes.

Because the staff finds that the revised DBA dose analyses are appropriately incorporated by reference by comparison of the VEGP Units 3 and 4 site characteristic accident χ/Qs to the values used in the revised DBA dose analyses supporting the previously approved changes for LNP and WLS, any site-specific differences in the values are not relevant.

3.2.1.1 Changes Impacting MCR Dose for DBAs

SNC's proposed changes impacting MCR personnel dose evaluations for DBAs presented in UFSAR Section 6.4 and UFSAR Chapter 15 are included below. All these changes to the AP1000 certified design, including revised DBA radiological consequence and control room radiological habitability analyses, were previously approved in the review of LNP DEP 6.4-1, as discussed in Section 21.2 of the FSER for the LNP, Units 1 and 2, and are incorporated by reference for VEGP Units 3 and 4.

- Account for MCR HVAC filter source

  The radiological dose analyses were revised to include direct radiation contributions from filters in the VES and VBS HVAC systems during DBA events. This change is incorporated by reference. More details of the staff's previous evaluation of this change can be found in LNP FSER, Chapter 21.2, Sections B.1 and B.2. The analysis of the direct radiation dose contribution from HVAC filters evaluates the dose to control room operators through gamma streaming from radioactive material captured on the HVAC filters, and considers the shielding effect of the control room and surrounding structures design. There are no inputs or assumptions in the calculation of direct radiation dose to the control room operators that are affected by site-specific factors, therefore the staff finds acceptable the incorporation by reference of the previously approved analysis of the contribution of direct radiation dose from HVAC filters to the control room radiological habitability analysis.

- Add shielding to the VES filter in the operator break room

  Shielding is added around the filters and is accounted for as input to the revised analysis of the direct radiation dose contribution from HVAC filters incorporated by reference. More details of the staff's previous evaluation of this change can be found in LNP FSER, Chapter 21.2, Sections B.1 and B.2. For the purpose of estimating the direct radiation exposure to MCR operators from radioactive material absorbed onto the charcoal media, the previously approved analysis assumed 100 percent absorption of iodine. As such, the analysis is conservative and the staff finds acceptable the incorporation by reference of the previously approved analysis of the contribution of direct radiation dose from HVAC filters to the control room radiological habitability analysis.

- Increase VES HVAC filter absorber efficiency to 90 percent

  In order to partially offset increases in calculated MCR personnel dose due to consideration of direct radiation from VES filter media and other corrections, the VES

filter efficiency for organic iodine is increased from 30 to 90 percent. Based on the AP1000 detailed design, RG 1.52, Revision 2, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems In Light-Water-Cooled Nuclear Power Plants" allows a maximum of 95 percent assigned credit for activated carbon decontamination efficiencies for a 2-inch bed.

The previously approved revised MCR dose analyses, as incorporated by reference for VEGP Units 3 and 4, apply the 90 percent efficiency for activated carbon decontamination; and the change approved previously from 30 to 90 percent VES filter efficiency for organic iodine. The staff's previous review and approval of this change can be found in the LNP FSER, Chapter 21.2, Section B.4.1.

Although SNC references changes to the MCR dose analysis with respect to an increase in the filter efficiency assumption for organic iodine, SNC proposed site-additional updates to these previously approved changes. SNC stated that because VEGP Units 3 and 4, licensing bases comply with RG 1.52, Revision 3, a change to the filter efficiency assumption beyond that cited in the recent COLA submittals is supported. RG 1.52, Revision 3, allows a maximum of 95 percent assigned credit for activated carbon decontamination efficiency for a two-inch bed. The MCR dose analyses incorporated by reference by SNC conservatively assumes 90 percent decontamination efficiencies for elemental and organic iodine. SNC also noted that the change from 30 to 90 percent VES filter efficiency for organic iodine was not reflected in the previous submittals as a markup to the COL FSAR, Appendix 1A, in the description of RG conformance for RG 1.52. As such, this change is proposed to VEGP Units 3 and 4, UFSAR, Appendix 1A, for RG 1.52 as part of this LAR update. The staff finds these LAR updates acceptable as the analysis dose results do not change significantly because organic iodine is not a large contributor to radiological release and subsequent dose.

- Revise names of actuation signals (High-1 and High-2) and adjust numerical values of SAL setpoints used to actuate the VBS SFM and VES

  SNC incorporated by reference previously approved changes pertaining to the radiation monitor setpoint values to ensure VES actuation and VBS SFM actuation occurs for any radiological release event that could result in MCR personnel doses in excess of GDC 19. This change also implements a nonsafety-related High-1 signal to actuate VBS SFM (gaseous, particulate, or iodine) and the exiting safety-related High-2 signal to actuate VES (iodine or particulate) in a manner that ensures High-2 would only be reached if VBS SFM was not functioning properly or insufficiently. This change is incorporated by reference, and staff finds it acceptable. Description of the staff's previous evaluation of this change can be found in LNP FSER, Chapter 21.2, Sections B.3 and B.4.2.

3.2.1.2 Large Break Loss of Coolant Accident (LBLOCA) Dose Consequence Changes

The following previously approved changes incorporated by reference impact the LBLOCA dose evaluations presented in UFSAR, Section 6.4 and Subsection 15.6.5.

- Recalculate values for sky-shine and direct radiation

  Existing UFSAR doses account for shielding from direct and skyline radiation based on the AP600 design even though the AP1000 does not include the presence of such

shielding. To maintain compliance with GDC 19, SNC incorporated by reference previously approved changes that ensure that radiological sources are accounted for and modeled accurately. The added dose incurred by this change is partially offset by other changes. There are no inputs or assumptions in the calculation of direct radiation dose to the control room operators that are affected by site-specific factors, therefore, the staff finds acceptable the incorporation by reference of the previously approved analysis of sky-shine and direct radiation dose. Description of the staff's previous evaluation of this change can be found in LNP FSER, Chapter 21.2, Section B.1.

- Refine treatment of in-containment refueling water storage tank iodine evolution/re-evolution in the loss-of-coolant accident (LOCA) dose analysis

  In order to partially offset increases in the calculated dose to MCR personnel because of revision of the contribution due to direct radiation from HVAC filters and other corrections, SNC incorporated by reference previously approved changes to the containment elemental iodine removal coefficient and the iodine re-evolution modeling in containment for the LOCA radiological consequence analysis. The changes incorporated by reference include increasing the water/vapor partition factor for elemental iodine to 10, changing the timing associated with the conversion of elemental iodine to organic iodine, and increasing the passive containment elemental iodine deposition removal coefficient from 1.7/hr to 1.9/hr. Description of the staff's previous evaluation of these changes can be found in LNP FSER, Chapter 21.2, Sections B.5.1 and B.5.2. The previously approved change in the passive containment elemental iodine deposition removal coefficient was calculated using a revised assumed containment deposition surface area based on an updated detailed design calculation. These changes affect the estimated radiological release to the environment, and therefore affect the offsite dose results at the EAB and LPZ, in addition to the MCR dose. Based on the refined approaches and calculations for iodine partition factor of 10, and the updated design information on containment disposition area that form the basis for these changes, the staff agrees with the approach and finds them acceptable.

3.2.1.3 Main Steam Line Break (MSLB) Dose Consequences Changes

The following previously approved changes incorporated by reference impact the MSLB dose evaluations presented in UFSAR, Section 6.4 and Subsection 15.1.5

- Increase initial water mass in faulted loop and increase steam released in faulted and impact loop

  To provide a conservative dose for both offsite and MCR, the Hot Zero Power initial mass was retained, a bounding release rate was modeled until 300 seconds and any remaining activity was released thereafter. These changes affect the estimated radiological release to the environment and therefore affect the offsite dose results at the EAB and LPZ, in addition to the MCR dose. Description of the staff's previous evaluation of these changes can be found in the LNP FSER, Chapter 21.2, Section B.5.3. This change provides conservative dose to both offsite and MCR, the staff finds it acceptable.

- Reduce allowable specific activity of secondary side coolant

The TS Limiting Condition for Operation (LCO) 3.7.4 limit for secondary coolant iodine activity concentration is revised from 0.1 µCi/g dose equivalent (DE) I-131 to 0.01 µCi/g DE I-131. In the previous approval of the MSLB radiological consequence analysis, which was incorporated by reference by SNC, the staff verified that this change to the secondary coolant iodine activity concentration was included as an input. This change affects the estimated radiological release to the environment and, therefore, affects the offsite dose results at the EAB and LPZ, in addition to the MCR dose. Description of the staff's previous evaluation of this change can be found in LNP FSER, Chapter 21.2, Section B.5.4. The staff finds this proposed update acceptable based on the prior analysis.

3.2.1.4 Rod Ejection Accident (REA) Dose Consequence Changes

The following previously approved changes incorporated by reference impact the REA dose evaluations presented in UFSAR, Section 6.4 and Subsection 15.4.8.

- Reduce allowable specific activity of secondary side coolant

  The REA dose analysis results are updated by assuming the secondary coolant iodine activity concentration is increased from 0.1 µCi/g DE I-131 to 0.01 µCi/g DE I-131. In the previous approval of the REA radiological consequence analysis, which was incorporated by reference by SNC, the staff verified that this change to the secondary coolant iodine activity concentration was included as input. This change affects the estimated radiological release to the environment, and therefore affects the offsite dose results at the EAB and LPZ, in addition to the MCR dose. Description of the staff's previous evaluation of this change can be found in LNP FSER, Chapter 21.2, Section B.5.4. The staff finds this proposed update acceptable based on the prior analysis.

- Increase passive containment elemental iodine deposition removal coefficient

  The passive containment elemental iodine deposition removal coefficient is increased from 1.7/hr to 1.9/hr based on an updated detailed design calculation. These changes affect the estimated radiological release to the environment, and therefore, affect the offsite dose results at the EAB and LPZ, in addition to the MCR dose. Description of the staff's previous evaluation of this change can be found in LNP FSER, Chapter 21.2, Section B.5.2. The staff finds this proposed update acceptable based on the prior analysis.

- Increase in alkali metal partition coefficient

  The moisture carryover from the ruptured loop and intact loop steam generators is increased to 0.35 percent and is the basis for the alkali metal partition coefficient analysis assumption. This change affects the estimated radiological release to the environment, and therefore, affects the offsite dose results at the EAB and LPZ, in addition to the MCR dose. Description of the staff's previous evaluation of this change can be found in LNP FSER, Chapter 21.2, Section B.5.6. The staff finds this proposed update acceptable based on the prior analysis.

- Decrease time to reach elemental iodine decontamination factor limit

In the previously approved updated REA radiological consequence analysis, as incorporated by reference by SNC, the time to achieve the decontamination factor (DF) limit of 200 for removal of elemental iodine was reduced to 2.78 hours, based on the increase in the passive containment elemental iodine deposition removal coefficient from 1.7/hr to 1.9/hr, as described above.

SNC noted that although this revision is not explicitly described in the precedent COLA submittal, the change in the time it takes to achieve the elemental iodine DF limit was included as a proposed markup to FSAR Table 15.4-202 from the precedent COLA submittal to ensure that the previously approved analysis parameters are reflected in the FSAR. Therefore, SNC proposed a revision to UFSAR Table 15.4-4 to reflect the time to reach the elemental iodine DF limit for the REA analysis. The staff finds this proposed update acceptable based on the prior analysis.

3.2.1.5 Steam Generator Tube Rupture (SGTR) Dose Consequence Changes

The following previously approved changes incorporated by reference impact the SGTR dose evaluations presented in UFSAR, Section 6.4 and Subsection 15.6.3.

- Reduce allowable specific activity of secondary side coolant

  The SGTR dose analysis results are updated by assuming the secondary coolant iodine activity concentration is increased from 0.1 µCi/g DE I-131 to 0.01 µCi/g DE I-131. In the previous approval of the SGTR radiological consequence analysis, which was incorporated by reference by SNC, the staff verified that this change to the secondary coolant iodine activity concentration was included as input. This change affects the estimated radiological release to the environment and therefore affects the offsite dose results at the EAB and LPZ, in addition to the MCR dose. Description of the staff's previous evaluation of this change can be found in LNP FSER, Chapter 21.2, Section B.5.4. The staff finds this proposed update acceptable based on the prior analysis.

- Increase alkali metal partition coefficient

  The moisture carryover from the ruptured loop and intact loop steam generators increased to 0.35 percent and is the basis for the alkali metal partition coefficient analysis assumption. This change affects the estimated radiological release to the environment, and therefore affects the offsite dose results at the EAB and LPZ, in addition to the MCR dose. Description of the staff's previous evaluation of this change can be found in LNP FSER, Chapter 21.2, Section B.5.6. The staff finds this proposed update acceptable based on the prior analysis.

3.2.1.6 Locked Rotor Accident (LRA) Dose Consequence Charges

The following previously approved changes incorporated by reference impact the LRA dose evaluations presented in UFSAR, Section 6.4 and Subsection 15.3.3.

- Reduce allowable specific activity of secondary side coolant

  The LRA dose analysis results are updated by assuming the secondary coolant iodine activity concentration is increased from 0.1 µCi/g DE I-131 to 0.01 µCi/g DE I-131. In the previous approval of the LRA radiological consequence analysis, which was incorporated by reference by SNC, the staff verified that this change to the secondary

coolant iodine activity concentration was included as input. This change affects the estimated radiological release to the environment, and therefore affects the offsite dose results at the EAB and LPZ, in addition to the MCR dose. Description of the staff's previous evaluation of this change can be found in LNP FSER, Chapter 21.2, Section B.5.4. The staff finds this proposed update acceptable based on the prior analysis.

- Increase alkali metal partition coefficient

  The moisture carryover from the ruptured loop and intact loop steam generators increased to 0.35 percent and is the basis for the alkali metal partition coefficient analysis assumption. This change affects the estimated radiological release to the environment, and therefore affects the offsite dose results at the EAB and LPZ, in addition to the MCR dose. Description of the staff's previous evaluation of this change can be found in LNP FSER, Chapter 21.2, Section B.5.6. The staff finds this proposed update acceptable based on the prior analysis.

3.2.1.7 General Changes

In addition to the changes above, , some general changes that were not previously approved are incorporated in updated MCR dose calculations. These changes are corrections based on updated design information or identification of non-conservatisms. These general changes include:

- Recalculate MCR volume and MCR HVAC volume, which are used as input to the updated post-accident MCR occupancy dose analyses. The volume of MCR and Control Support Area (CSA) is updated based on refined design information to 1.158E+05 ft^3 and rounded off to use 1.2E+05 ft^3 as input to the dose analyses. This updated change is attributed to rounding off and results in a negligible change in the dose consequence analysis. Therefore, the staff finds the change to the volume used as dose analysis input acceptable.

- The values for the switchover time from VBS normal operation to VBS SFM and the response time to actuate the VBS SFM currently reported in the UFSAR have been determined to be non-bounding. Therefore, system-level requirements are developed for switchover and response times, which account for sample transport time, radiation detector response time, instrumentation and control response times, and VBS/VES equipment actuations. The dose analyses for cases considering VBS SFM are revised to include a longer delay time between the point at which airborne radioactivity in the control room reaches the High-1 setpoint concentration and when the VBS SFM is operational than were previously approved. The dose analyses for cases considering VES are revised to include a longer response time between the point at which High-2 setpoint is reached and when the VES is operational than that was previously approved. Description of the staff's previous evaluation of this change can be found in LNP FSER, Chapter 21.2, Section B.4.2. Based on system-level requirements and updated information on response times, the staff finds the modeling of the initiation times for the VBS SFM and the VES reflects the design. Therefore, the staff finds acceptable the minor revisions to already approved changes.

- To address a potential inaccuracy of the damper positioning, the VBS outside air intake flow rate has been recalculated and a nominal outside flow air flow rate of 1320 cfm is used in operator dose calculations. This change is consistent with the changes

previously approved in the precedent COLA submittals. This change is based on refined calculations for the determination of nominal outside intake flow, and therefore the staff finds it acceptable.

- The VBS ancillary fan MCR air intake flow rate is increased from 1700 cfm, which had been specified as a minimum in the detailed design to 1900 cfm in order to add conservatism. This value accounts for uncertainty by increasing the nominal flow rate by 10 percent and is rounded off conservatively. Therefore, the staff finds it acceptable.

- Several changes to dose analysis assumptions which support the reduction in allowable specific activity of secondary side coolant that have been approved and included in precedent COLA markups, but were not individually discussed in the description of departures and exemption requests in the precedent submittals, are included for clarity and completeness. These changes include a decrease in the primary-to-secondary leak rate, a decrease in the total secondary side water mass, a decrease in the total makeup water feed rate, an increase to the steam generator steam fraction, and recalculation of the secondary side activity (both liquid and steam). These changes have been previously approved and the staff finds SNC's proposed clarification of these changes acceptable.

3.2.1.8 Clarification/Consistency/Editorial Changes

SNC presented clarifying notes and some editorial changes to UFSAR Sections 15.6.5.3.5, 15.1.5.4.6, and 15.6.5.3.8.2 as noted on page 14 of Enclosure 1 of the August 31, 2017 LAR submittal, and the staff agrees that they are editorial in nature and finds that they do not affect the results of the DBA radiological consequence and control room radiological habitability analyses. Therefore, the staff finds them acceptable.

3.3 Additional Changes

The following are the additional proposed changes by SNC that have not been previously reviewed or approved by the NRC in recent COLAs.

3.3.1 Changes to Support the AP1000 Main Control Room

The following changes support MCR occupancy with respect to VES and VBS considerations as well as other changes concerning MCR leak-tightness considerations and MCR pressurization considerations across UFSAR Chapters 1, 3, 6, 7, 9, 11, 12, and 14, COL Appendix C (and plant-specific Tier 1 information, TS, and associated TS bases.

- Proposed changes to address VBS loss of flow events (VES actuation on low differential pressure)

  SNC identified that the failure of non-safety VBS supply side components leading to loss of flow (for radiation events when ac power is available) could lead to an isolation of the VBS radiation monitors and would require a manual action to initiate the VES to remain with the GDC 19 limits. The VBS postulated failure sequence is not addressed by a specific UFSAR Chapter 15 analysis and must either be analyzed as less limiting or eliminated. Therefore, SNC proposed a conservative design change to align UFSAR text which requires automatic actuations for events described in Chapter 15. As such, with the proposed change, MCR Isolation and Air Supply Initiation shall be initiated on Low MCR Differential Pressure for 10 minutes, in addition to the existing Loss of Battery

Charger Input Voltage for 10 minutes actuation. This proposed change would provide an automatic actuation to prevent the MCR from being outside the analysis for any DBA radiation protection concern. The MCR dose analyses already account for a case where the MCR isolation and air supply initiation was delayed to 10 minutes post-accident, therefore the dose analyses remain bounding. The staff finds this proposed change to add VES actuation on low differential pressure acceptable with respect to the radiological consequences of DBAs.

- Proposed changes to update VBS Ancillary fan location in post-accident access figures.

  LAR 17-023 proposes a revised methodology for calculating doses to operators following an accident. LAR 17-023 Enclosure 4, "Proposed Changes to the Licensing Basis Documents, (withheld Information, in accordance with 10 CFR 2.390(d)), depicts the personnel travel path from the Annex Building into the "Elec. Penet. Room Division A," room identification number 12412. Room 12412 is identified as a Radiation Zone VII. AP1000 DCD Tier 2, Revision 19, Figure 12.3-2 (Sheet 1 of 15) "Radiation Zones, Post-Accident Legend" identifies that the maximum design dose rate in a Radiation Zone VII area is greater than 10 rem/hour (hr) and ≤ 100 rem/hour (hr). This travel path is not shown on AP1000 DCD Tier 2, Revision 19, Figure 12.3-2 (Sheet 7 of 15) "Radiation Zones, Post-Accident Nuclear Island, Elevation 117'6"."

  Because of the dose rates that may be present in a Radiation Zone VII area, a small amount of time in the area could challenge the applicable radiation exposure limits stated in 10 CFR 50.34(f)(2)(vii). The amount of time for the task (aka mission) is dependent on the travel time to the area, the type of task to be performed, the assumed radiological conditions (e.g., airborne activity), and the time needed to exit the area.

  To facilitate staff understanding whether the information in the application is sufficient to make appropriate regulatory conclusions with respect to compliance with 10 CFR 52.47(a)(8) and 10 CFR 50.34(f)(2)(vii), in RAI 9383 Question 06.04-3, dated January 30, 2018, the staff asked SNC to describe how LAR 17-023 addresses the: (1) specific requirement to perform radiation and shielding design reviews of spaces around systems that may, as a result of an accident, contain accident source term radioactive materials; (2) design features that permit adequate access to important areas and to protect safety equipment from the radiation environment; (3) justification for the apparent change to the post-accident mission travel path, including the purpose of the mission, number of times the mission may need to be performed; and (4) evaluation of the mission dose and results including the methods, models, and assumptions used for determining the exposure estimate.

  In the response to RAI 9383, Question 06.04-3, dated February 8, 2018, SNC stated that the purpose of the changed mission was to reflect the relocation of the MCR ancillary fans. SNC stated that these fans were conceptually envisioned to be located in the MCR, but due to space constraints the fans were relocated to Room 12412. SNC stated that in their view this modification does not create a new post-accident vital area action, and only reflects a refinement in the location and travel path of a previously identified and described vital area action. Therefore, only minimal changes are proposed in LAR-17-023 to convey the details of this design change because conceptually the action and its associated justification are not affected, and only the location of the equipment is changed. However, the staff noted that AP1000 DCD, Revision 19, Section 12.4.1.8, "Post-Accident Actions," does not list Room 12412 (the electrical penetration room) as one of the areas that require post-accident access.

SNC's response included Table 3-2 "Results of Radiation Protection Calculations for Operator Dose to Access and Transport Retrieving the MCR Ancillary Fans in Postulated Post-Accident Conditions," which provided values of assigned protection factor (APF) which correspond to the use of an air-line fed full face respirator or a self-contained breathing apparatus (SCBA). Because there are no design provisions for providing air to an air-line fed full face respirator, the staff, in discussions with SNC, ascertained that to limit radiation exposure from airborne radioactive materials, an SCBA would have to be worn by the personnel performing the task. The staff noted that based on manufacturer data, the listed time to needed to accomplish the mission appeared to be inconsistent with the amount of air available in the SCBA air bottle.

As part of an audit, documented in an audit summary dated April 3, 2018 (ADAMS Accession No. ML18072A318), the staff reviewed the methods, models, and assumptions used by SNC to calculate the dose from the inhalation of airborne radioactive materials expected to be received by plant personnel relocating the ancillary fans following an accident. The staff determined that respiratory protection devices are required to accomplish the task within the limits of 10 CFR 50.34(f)(2)(vii). Because SNC does not have an installed breathing air system and has not applied to the Commission for the use of an APF greater than 1 for sorbent cartridges as protection against airborne radioactive gases and vapors (e.g., radioiodine), the only other available option to limit the inhalation of radionuclides was the use of SCBAs. The use of respiratory protection equipment to satisfy the requirement of 10 CFR 50.34(f)(2)(vii) is not identified in DCD Subsection 12.4.1.8 "Post-Accident Actions." In the supplement dated March 8, 2018, SNC modified FSAR, Section 12.4.1.8, to add the statement "The analyses include the assumption that the appropriate respiratory protection equipment is used to maintain radiation exposure within the exposure limits." The addition of this statement clarifies the need to include respiratory protection to ensure that summation of external and internal radiation exposure for the task stays within the limits of 10 CFR 50.34(f)(2)(vii). 10 CFR Part 20 Appendix A Section II.b, "Self Contained Breathing Apparatus (SCBA)," describes a method of controlling radiation exposure due to vapors (e.g., radioiodines) through the use of APFs within the range of values described in SNC's dose analysis, therefore the staff finds this response acceptable.

SNC's response contained in the supplement dated February 9, 2018, included Table 3-1 "Inputs and Assumptions Used to Assess Operator Dose for the Vital Area Action of Retrieving the MCR Ancillary Fans in Postulated Post-Accident Conditions." The dose rate for Room 12412 was listed as 0.09 rem/hr at 70 hours following the accident. The staff noted that this reduced dose rate did not appear to be consistent with the reduction in activity as described in the AP1000 DCD, Revision 19, Table 12.2-20, "Core Melt Accident Source Strengths in Containment Atmosphere as a Function of Time." Also, Room 12411 (the corridor outside of Room 12412 and the MCR), which is farther away from the source of post-accident radiation, has a listed dose rate that is nearly a factor of 10 higher than that listed in Room 12412.

As part of the audit, the staff reviewed the methods, models, and assumptions used by SNC to calculate the direct dose expected to be received by plant personnel relocating the ancillary fans following an accident. The staff was able to determine that the dose

rate for Room 12411 shown in Table 3-1 in the supplement dated February 9, 2018, was due to radiation shine from the electrical penetrations in Room 12421 “Non 1E Equipment/Penetration Room,” and not Room 12412, thus providing assurance that the ancillary fans were not stored in an area directly adjacent to penetration. From information reviewed by the staff during the audit, the staff was able to determine that the location where the ancillary fans are stored is well away from the direct radiation streaming paths from the containment through the electrical penetrations into Room 12412 that are shown on “AP1000 Design Control Document, Figure 1.2-9 Nuclear Island General Arrangement Plan at Elevation 117′-6″ with Equipment,” Revision 19. The result is that the radiation field present at the location of the ancillary fans would be much lower than the maximum dose rate within Room 12412.

The staff also reviewed the method used by SNC to decay correct the radiation field within Room 12412. SNC stated that they used the ratio of the dose rates in the MCR at the peak value of radioactive materials early in the accident (at approximately 1.97 hrs) and the dose rates in the MCR at about 70 hrs to perform the decay adjustment of the dose rate in Room 12412. SNC stated that one part of the basis for selection of this method was that the post-accident radiation spectrum would change with time, thus improving the relative efficiency of the shielding material. The staff acknowledged that the change in radiation spectrum as it traversed the shielding material would make the shielding material more effective. However, the staff determined through independent calculations that the adjustment resulting from this factor would be much less than that assumed by SNC.

When performing the calculation to compare the dose rate ratios at 1.97 hrs and 70 hrs noted above, the staff used the energy spectra described in AP1000 DCD, Revision 19, Table 12.2-20. SNC stated that another part of the basis for the apparent difference in the post-accident dose rate adjustments made by SNC and the staff was that because of some additional removal mechanisms identified in the precedence cited in LAR-17-023 (i.e., the changes to the AP1000 standard design previously reviewed and approved by the NRC as part of recent COL applications for WLS Units 1 and 2, and LNP Units 1 and 2). The activity values used by SNC were lower than those shown in DCD, Table 12.2-20 and not reflected in the plant specific FSAR. Revisions to the source term as used by SNC in the above analysis should be reflected in the next annual update to the FSAR as required by 10 CFR 50.71(e).

However, based on the above discussion regarding respiratory protection equipment, the margin between the total calculated dose (dose resulting from the inhalation of radionuclides and direct dose), and the limits used to assess compliance with 10 CFR 50.34(f)(2)(vii), the methods used by SNC to determine the direct dose (as described above) were adequate for the purposes of this evaluation. The staff notes that the adjustment methods used by SNC in this instance may not be conservative in other analyses where less margin is available. As described above, the staff finds that SNC’s proposed change related to relocating the MCR Ancillary Fans is acceptable.

- Removal of VBS radiation monitoring sample return line

  Through discussions with SNC during the aforementioned audit, the staff determined that the MCR particulate-iodine and noble gas continuous airborne radioactivity (CAM) monitors were located outside of the MCR habitability envelope. Because of the location of the CAMs, there is no impact on the concentration of airborne radioactive materials within the MCR boundary. Because of the relatively low flow rate of the CAM sample

pumps, the staff expects there to be a negligible impact on the concentration of airborne radioactive materials in areas of the plant not protected by ventilation filter systems. Therefore, staff finds this change acceptable.

- Clarification/Editorial Changes

  Additional editorial changes are made for clarification in UFSAR Chapter 7, Sections 7.3.1.2.17 and 7.3.1.5.2; Table 7.3-1, and Figure 7.2-1, as noted on page 18 of Enclosure 1 of the August 31, 2017 LAR submittal. These changes are not technical in nature but are only proposed for clarity and consistency. Based on the editorial nature of these changes, the staff finds them acceptable.

3.3.2 VBS Inleakage Optimization

The following changes pertain to VBS inleakage optimization and propose updates to COL Appendix C (and plant-specific Tier 1) information and UFSAR Chapters 1, 2, 9, and 15.

- Revising the atmospheric dispersion factors for the control room HVAC intake

  AP1000 standard plant χ/Q values used for unfiltered VBS inleakage are revised for use as site parameters in the design reference DBA radiological consequence analyses, referenced by SNC in this LAR. The staff finds that the AP1000 standard plant design values continue to bound the VEGP Units 3 and 4 and site-specific χ/Q values. Therefore, the staff finds this proposed change acceptable.

- Revising the MCR HVAC System Nominal Air Flowrates

  The proposed change would lower the VBS flowrate by 10 percent as conservative action to ensure that the effect of uncertainty in the air intake flowrate is evaluated in the MCR dose analysis. This change activity proposes to make the current VBS flowrate a minimum value during startup testing. This allows use of the nominal VBS flowrate in the MCR dose analysis. Therefore, staff finds this acceptable as this change is consistent with RG 1.183 guidance on control room outside air intake modeling in the dose analysis.

- Increasing Credited Filter Efficiency

  SNC proposed to increase filter efficiency from 90 to 99 percent for elemental and organic iodine. This change aligns the analysis with RG 1.140 methodology by increasing the credited charcoal bed iodine filter efficiency from 90 to 99 percent. The previously approved MCR radiological habitability analysis incorporated by reference assume a 90 percent efficient filter for airborne activity concentration in the control room, which is conservative for the contribution to the dose to MCR personnel due to airborne releases, which is the major contributor to the overall dose to MCR personnel. For calculation of the VBS filter loading source strength, SNC assumed 100 percent of the non-noble gas activity entering MCR HVAC intake to be collected on the filter. Therefore, the staff finds that the proposed change would not vary the source strength used for determining the direct dose to the operators from the filter. The change in resulting MCR personnel dose due to proposed change in filter efficiency mainly effecting organic iodine content is minimal with respect to the direct radiation dose because the organic iodine is only a fraction contributing to total MCR dose, and

therefore, the increased filter efficiency would reduce the concentrations of non-noble gas airborne radioactive material, resulting in lower MCR operator dose due to the inhalation of radioactive material, and would not exceed the calculated 5 rem MCR personnel dose value. As such, the staff finds this change acceptable.

- Clarification to UFSAR, Table 15.6.5.-2 (Sheet 3 of 3)

  As noted on page 19 of Enclosure 1 of the August 31, 2017, LAR submittal, SNC added clarification notes to the cited table, which have no technical impact on the dose consequence analyses. The staff finds these changes acceptable.

3.3.3 Clarification/Consistency/Editorial Changes

Adding to the above proposed additional changes, some clarifications and editorial changes are proposed for clarity and consistency pertaining to UFSAR, Figure 6.4-1, changes in VES/VBS SFM actuation nomenclature, and UFSAR, Subsection 6.4.4, applicability of storage/ transportation of radioactive material. These clarification and editorial changes are proposed for UFSAR Sections 6.4.2.1, 6.4.4, Table 7.3.1, and Figure 7.2-1, as noted on pages 22 and 23 of Enclosure 1 of the August 31, 2017, LAR submittal. The staff finds these clarification and editorial changes acceptable.

3.3.4 Fuel Handling Accident (FHA) Analysis Conformance with RG 1.183

In Enclosure 1 to LAR-17-023, SNC describes proposed additional changes not previously reviewed or approved by the NRC in recent COLAs. In Item O – "FHA Analysis Conformance with RG 1.183," SNC proposes to revise UFSAR Tier 2 Subsection 15.7.4.2, "Release Pathways," to add the following paragraph:

> In the case of a single bundle dropped and lying horizontally on top of the spent fuel racks, there may be less than 23 feet of water above the top of the fuel bundle and the surface of the water, indicated by the width of the bundle. The fuel handling accident analysis bounds the case of a single bundle lying horizontally on top of the spent fuel racks by demonstrating that the overall decontamination factor of 200 is valid for pool depths of 21.5 feet.

The staff reviewed SNC's assessment that the licensing basis FHA radiological consequence analyses remains bounding and continues to conform to RG 1.183. The FHA radiological consequence analysis in the VEGP Units 3 and 4 FSAR, Section 15.7.4 states that the overall pool scrubbing DF for iodine is assumed to be 200, consistent with the guidance in RG 1.183. The overall pool scrubbing DF of 200 was found acceptable to the staff in the review of the Westinghouse Electric Company (Westinghouse) AP1000 design certification FHA radiological consequence analysis, which was incorporated by reference in the VEGP Units 3 and 4 FSAR. See NUREG-1793, Initial Report, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," Section 15.3.7, "Radiological Consequences of a Fuel-Handling Accident," for discussion of the staff's evaluation of the FHA analysis.

RG 1.183, Appendix B, Regulatory Position 2, "Water Depth," states:

> If the depth of water above the damaged fuel is 23 feet or greater, the decontamination factors for the elemental and organic species are 500 and 1, respectively, giving an overall effective decontamination factor of 200 (i.e., 99.5% of the total iodine released from the damaged rods is retained by the water). This

difference in decontamination factors for elemental (99.85%) and organic iodine (0.15%) species results in the iodine above the water being composed of 57% elemental and 43% organic species. If the depth of water is not 23 feet, the decontamination factor will have to be determined on a case-by-case method (Ref. B-1).

RG 1.183, Reference B-1, "Evaluation of Fission Product Release and Transport," NRC Staff Technical Paper, G. Burley, October 1971, (ADAMS Accession No. ML16357A003), provides the basis for assumptions on iodine decontamination in water for the FHA as stated in RG 1.183. The Burley paper used empirical data from Westinghouse Topical Report WCAP-7518-L, "Radiological Consequences of a Fuel Handling Accident," June 1970, as part of the basis for its formulation of assumed pool scrubbing DFs for elemental and organic iodine and the overall effective iodine DF. In Topical Report WCAP-7518-L, Westinghouse described their use of an experimental test program to evaluate the extent of iodine removal from gas released from a damaged irradiated fuel assembly by the water in the spent fuel pool. As staff noted in an appendix to the SER related to Task Interface Agreement 99-03 regarding potential non-conservative assumptions for the FHA at the McGuire Nuclear Station (Accession No. ML993340503), it can be inferred from a reading of the Burley paper that the staff had concerns with the analytical method used by Westinghouse. Topical Report WCAP-7815-L was not approved for use in licensing submittals. However, there is precedent for the staff finding a re-evaluation of the iodine DF assumptions with respect to fuel rod internal gas pressure using experimental data and formulations in Topical Report WCAP-7518-L acceptable, as discussed in the final safety evaluation (ADAMS Accession No. ML041270102) of Westinghouse Topical Report WCAP-16072-P-A, "Implementation of Zirconium Diboride Burnable Absorber Coatings in CE Nuclear Power Fuel Assembly Designs."

With respect to further staff clarification on the iodine DF assumption in the FHA radiological consequence analysis, on March 7, 2006, the NRC issued Regulatory Issue Summary (RIS) 2006-04, "Experience with Implementation of Alternative Source Terms." Item 8 addressed the iodine DF assumptions in Appendix B to RG 1.183 to clarify that an overall iodine DF of 200 is achieved when the DF for elemental iodine is 285, not 500.

In light of this background, the staff asked for additional information to support SNC's assertion that the RG 1.183, Appendix B assumption of an effective iodine DF equal to 200 remains bounding for the case where the damaged fuel assembly is resting on top of the spent fuel pool racks, with less than 23 feet of water depth above the release point to provide for iodine scrubbing. By letters dated February 9, 2018 and March 8, 2018, SNC provided supplements to the LAR to clarify that the release location for damaged fuel lying on top of the spent fuel racks results in an assumed water depth of 21.5 feet and show that there is sufficient conservatism in the basis of the iodine effective DF value of 200 such that it remains bounding for the release from damaged fuel lying on top of the spent fuel pool racks. SNC provided additional information to describe the technical basis for using Topical Report WCAP-7518-L to determine the level of conservatism in the RG 1.183 Appendix B assumptions on iodine decontamination and justify that the current licensing basis FHA analysis assumption of an overall iodine DF of 200 remains bounding for the water depth above the damaged fuel lying on top of the spent fuel pool racks.

SNC's assessment of the level of conservatism associated with the elemental iodine DF of 500 for release pressure and water depth uses the same experimental data and formulations for elemental iodine DF from Topical Report WCAP-7518-L and the same logic for evaluation of the level of conservatism in the iodine DF assumption as was previously evaluated by the staff in

the context of fuel rod pressure, as discussed in the final safety evaluation of Westinghouse Topical Report WCAP-16072-P-A. In its discussion, including portions marked as proprietary, SNC shows that the elemental iodine DF is calculated to be greater than 285 at the assumed water depth of 21.5 feet using the characteristics of a release from the fuel rod at a pressure of 1500 psig. As the staff stated in RIS 2006-04, for RG 1.183 an overall iodine DF of 200 is achieved when the DF for elemental iodine is 285. Therefore, staff concluded that the overall iodine DF of 200 is supported by SNC's assessment and SNC has concluded that the overall iodine DF remains conservative for the postulated scenario where a dropped fuel assembly is lying horizontally on top of the spent fuel pool racks, at a release depth of approximately 21.5 feet. The staff has determined that SNC used pertinent information from WCAP-7518-L to evaluate the conservatism of the overall iodine DF assumption for the FHA radiological consequence analysis and has shown that the assumption is conservative for 21.5 feet of water depth. Therefore, the staff finds reasonable assurance that the licensing basis FHA radiological consequence analysis conforms to the guidance in RG 1.183 and remains bounding for all postulated release locations from dropped fuel. As such, the staff also finds that the FHA offsite radiological consequences continue to meet the requirements of 10 CFR 52.79(a)(1)(vi) and the control room radiological consequences continue to meet the requirements of GDC 19.

Conclusion:

The staff concludes that the relevant information presented in the VEGP Units 3 and 4, LAR regarding improvements to MCR post-accident radiological consequences is acceptable and meets the regulatory requirements and guidance discussed in Section 2 of this SER. The staff concludes the following:

- Based on the evaluations described above, staff has reasonable assurance that the revised DBA radiological consequence analyses as described in the LAR continue to meet the 10 CFR 52.79(a)(1)(vi) dose criteria and the offsite dose acceptance criteria, as given in SRP 15.0.3 and RG 1.183 for these accidents.

- Based on the evaluations described above, staff has reasonable assurance that the VES, under High-2 radiological conditions as described in the revised UFSAR, Section 6.4, and Chapter 15, and the LAR, can mitigate the dose in the MCR following DBAs to continue to meet the dose acceptance criterion specified in GDC 19.

- If available, the non-safety-related VBS as described in the revised UFSAR, Sections 6.4 and 9.4.1, and the LAR, can mitigate the dose in the MCR following DBAs to be within 0.05 Sv (5 rem TEDE).

- There is reasonable assurance that the additional mission to relocate the ancillary fans can be performed within 0.05 Sv (5 rem) TEDE, consistent with 10 CFR 50.34(f)(2)(vii).

3.4 Evaluation of Atmospheric Dispersion Estimates

SNC's LAR uses an updated set of atmospheric dispersion factors (also known as χ/Q values and relative concentrations) to evaluate post-accident radiological consequences for the MCR. The staff reviewed SNC's new atmospheric dispersion analyses as described below.

3.4.1 Meteorological Data

In support of the atmospheric dispersion analysis presented in the August 31, 2017 LAR, SNC used the existing hourly onsite meteorological data from January 1, 1998, through December 31, 2002, the same dataset used during the VEGP Units 3 and 4 early site permit (ESP) and COL reviews. The meteorological data was formatted for the ARCON96 atmospheric dispersion code (NUREG/CR-6331, Revision 1, "Atmospheric Relative Concentrations in Building Wakes" (ADAMS Accession No. ML17213A187)) to calculate updated χ/Q values for the MCR. This format contained hourly data on wind speed, wind direction, and atmospheric stability class taken from the 10-m and 60-m levels of the onsite meteorological tower.

The staff previously completed a detailed review related to the acceptability and representativeness of the hourly meteorological data using the methodology described in NUREG-0917, "Nuclear Regulatory Commission Staff Computer Programs for Use with Meteorological Data" (ADAMS Accession No. ML12061A136) as part of the VEGP ESP review (ADAMS Accession No. ML090130038). Based on this review, the staff considers the onsite meteorological database suitable for use in the atmospheric dispersion analyses to support this LAR.

3.4.2 Onsite Control Room Atmospheric Dispersion Estimates

In support of the LAR, SNC used the ARCON96 computer code to estimate χ/Q values for the MCR for potential accidental releases of radioactive material. RG 1.194 endorses the ARCON96 model for determining χ/Q values to be used in the design basis evaluations of control room radiological habitability.

The ARCON96 code estimates χ/Q values for various time-averaged periods ranging from 2 hours to 30 days. The meteorological input to ARCON96 consists of hourly values of wind speed, wind direction, and atmospheric stability class. The χ/Q values calculated through ARCON96 are based on the theoretical assumption that material released to the atmosphere will be normally distributed (Gaussian) about the plume centerline. A straight-line trajectory is assumed between the release points and receptors. The diffusion coefficients account for enhanced dispersion under low wind speed conditions and in building wakes.

The hourly meteorological data are used to calculate hourly relative concentrations. The hourly relative concentrations are then combined to estimate concentrations ranging in duration from 2 hours to 30 days. Cumulative frequency distributions, prepared from the average relative concentrations and the relative concentrations that are exceeded no more than five percent of the time for each averaging period, are determined.

The dispersion coefficients used in ARCON96 have three components. The first component is the diffusion coefficient, as discussed in NUREG/CR-6331. The other two components are corrections to account for enhanced dispersion under low wind speed conditions and in building wakes. These components are based on analysis of diffusion data collected in various building wake diffusion experiments under a wide range of meteorological conditions. Because the dispersion occurs at short distances within the plant's building complex, the ARCON96 dispersion parameters are not affected by nearby topographic features such as bodies of water. Therefore, the staff finds SNC's use of the ARCON96 dispersion parameter assumptions consistent with the guidance provided in RG 1.194 and finds it acceptable.

SNC provided the following as necessary input to ARCON96:

- Onsite Hourly Meteorological Data: 1998 through 2002

- The following Tables from Enclosure 3 (Proposed Changes to the Licensing Basis Documents) of the LAR submittal:
    - Revised UFSAR Tier 2 Table 15A-7: Control Room Source/Receptor Data for Determination Of Atmospheric Dispersion Factors
    - Revised UFSAR Tier 2 Figure 15A-1: Site Plan with Release and Intake Locations for VEGP

Two receptor (i.e., air intake) points, the control room HVAC intake and control room door, were modeled for the following eight release points:

- containment shell
- auxiliary building fuel handling area blowout panel
- radwaste building truck staging area door
- steam vent
- power-operated relief valve (PORV)/safety valves
- condenser air removal stack
- plant vent
- PCS air diffuser

The staff confirmed SNC's atmospheric dispersion estimates by running the ARCON96 computer model and obtaining similar results (i.e., values on average within ± 0.88 percent). Both the staff and SNC used a ground-level release assumption for each of the release/receptor combinations as well as the source-receptor distances provided in LAR Enclosure 3, Revision to UFSAR Table 15A-7. The staff used the source-receptor directions found in a response to RAI Letter No. 001 (ADAMS Accession No. ML082590051), submitted to the agency on September 11, 2008, as part of the VEGP COLA review. After adjusting the directions used in the ARCON96 model to account for the updated location of the Auxiliary Building Fuel Handing Area Blowout Panel, the results of SNC's CR χ/Q values, included in SER Tables 1 and 2, were found acceptable.

During the review of the initial submission of the LAR, the staff noted that most of the ARCON96 χ/Q values in LAR Enclosure 3, Revision to UFSAR Tier 2, Table 2.3-201 appeared to be incorrect. The values crossed out in this table are the values intended to be used for the control room dose analysis. By letter dated March 8, 2018 (ADAMS Accession No. ML18067A648), SNC provided updated ARCON96 χ/Q values in Enclosure 13. The staff has reviewed the updated Control Room dispersion factors and finds the values acceptable.

	Control Room HVAC Intake							
	Plant Vent	PCS Air Diffuser	Aux Building FHA	Radwaste Building Truck Staging Area Door	Steam Vent	PORV & Safety Valve Releases	Condenser Air Removal Stack	Containment Shell
0 - 2 Hr	2.27E-03	1.71E-03	1.57E-03	1.30E-03	1.87E-02	1.77E-02	6.60E-04	2.93E-03
2 - 8 Hr	1.86E-03	1.32E-03	1.15E-03	9.36E-04	1.51E-02	1.41E-02	4.83E-04	1.75E-03
8 - 24 Hr	7.36E-04	5.56E-04	4.62E-04	3.78E-04	6.79E-03	6.25E-03	2.17E-04	7.78E-04

1 - 4 Days	5.99E-04	4.63E-04	3.72E-04	2.98E-04	4.94E-03	4.61E-03	1.57E-04	6.81E-04
4 - 30 Days	4.31E-04	3.43E-04	2.68E-04	2.09E-04	4.14E-03	3.87E-03	1.17E-04	5.30E-04

Table 1: ARCON96 χ/Q Values at the Control Room HVAC Intake

	Annex Building Access (Control Room Door)							
	Plant Vent	PCS Air Diffuser	Aux Building FHA	Radwaste Building Truck Staging Area Door	Steam Vent	PORV & Safety Valve Releases	Condenser Air Removal Stack	Containment Shell
0 - 2 Hr	5.02E-04	4.62E-04	3.99E-04	3.83E-04	1.00E-03	1.13E-03	1.72E-03	3.97E-04
2 - 8 Hr	3.94E-04	3.55E-04	3.00E-04	2.88E-04	7.97E-04	8.98E-04	1.12E-03	3.26E-04
8 - 24 Hr	1.61E-04	1.49E-04	1.22E-04	1.21E-04	3.25E-04	3.69E-04	4.50E-04	1.34E-04
1 - 4 Days	1.29E-04	1.23E-04	1.00E-04	9.58E-05	2.58E-04	2.92E-04	3.17E-04	1.10E-04
4 - 30 Days	9.63E-05	9.12E-05	7.23E-05	6.78E-05	1.91E-04	2.19E-04	2.60E-04	8.32E-05

Table 2: ARCON96 χ/Q Values at the Annex Building Access Door

Conclusion:

The staff reviewed the methodology used by SNC to derive the χ/Q values associated with postulated releases from potential release points. The staff performed an extensive screening of meteorological data and found SNC used appropriate atmospheric dispersion models to derive the resulting χ/Q values in accordance with staff regulatory guidance. On the basis of this review and the staff's confirmatory atmospheric dispersion analyses, the staff concluded that the meteorological data and the resulting control room χ/Q values followed the guidance provided in RG 1.194 and SRP 2.3.4, and are therefore acceptable for use in the radiological consequence assessments supporting this LAR.

3.5 Evaluation of Instrumentation and Control (I&C) Changes:

The technical evaluation of I&C related changes in this LAR is provided below in this section.

In this LAR, SNC found that the failure of nonsafety-related VBS supply side components leading to a loss of flow (for radiation events when ac power is available) could lead to an isolation of the VBS radiation monitors, which are used in the safety logic function for the MCR isolation and actuation of the VES. These circumstances would require SNC to manually actuate the VES to meet the regulatory requirement in GDC 19. Clause 5.1 of IEEE Std. 603-1991 as incorporated in 10 CFR 50.55a(h)(3) requires the safety systems to meet the single-failure criterion. Clause 6.1 of IEEE Std. 603-1991 requires, in part, that means shall be provided to automatically initiate and control all protection actions. In order to meet the regulatory requirement on automatic actuation for all protective actions as required in IEEE Std. 603-1991 , SNC proposes to add two MCR DPTs which are used to provide the safety action to isolate the MCR and initiate the VES air supply automatically when the measurement from one of the two MCR DPTs is below the low setpoint for more than ten minutes. Hence, the required safety action will be actuated automatically. The staff finds that the proposed changes to add

two safety-related, MCR DPTs meet the regulatory criterion on automatic action for protective safety actions as required in Clause 6.1 of IEEE Std. 603-1991. In addition, the staff finds that the two new MCR DPTs are proposed to be used in the one-out-of-two logic function to initiate the MCR isolation and start the VES air supply if one of the two MCR DPTs shows the differential pressure below the low setpoint for more than ten minutes. The one-out-of-two logic function design is implemented to provide redundancy and avoid the adverse impact of the single failure. So, the staff finds that the proposed changes to add two new MCR DPTs and modify the associated logic meet the single failure criterion as required in Clause 5.1 of IEEE Std. 603-1991 and finds it acceptable.

SNC found that the VBS radiation monitoring setpoints used in the MCR dose calculations supporting UFSAR Chapter 15 safety analyses were not selected in a manner to ensure compliance with GDC 19 in 10 CFR Part 50 Appendix A and to support the AP1000 design objective. So, SNC proposed to adjust numerical values of SAL setpoints used to actuate VBS SFM and VES from reconsideration of the HVAC filter contributions. The staff finds that only numerical values of the setpoints are proposed to be changed and there is no change to the setpoint calculation methodology previously reviewed and approved by the staff for the certified AP1000 design. Therefore, the staff finds that the proposed change to use the adjusted setpoints to actuate VBS SFM and VES still meets the regulatory requirements on setpoints in IEEE Std. 603-1991, and therefore, this proposed change to the SAL setpoints is acceptable from the I&C perspective.

Two new instruments are proposed in this LAR to be added to monitor the differential pressure between the MCR and outside corridor over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions. The staff finds that, if the differential pressure is detected to be lower than the low setpoint for more than ten minutes, the isolation of the MCR and initiation of the VES air supply will automatically be actuated to assure personnel habitability requirements in the MCR. Hence, the staff finds that the above I&C related changes meet the regulatory requirements as specified in GDC 13 for I&C and finds it acceptable.

In this LAR, SNC proposed to revise the name of actuation signals to iodine or particulate control room air supply radioactivity used to actuate VBS SFM and the MCR VBS. SNC also proposed a few additional editorial and clarification changes as listed in Table 3-2 of this LAR. The staff finds that the proposed editorial and clarification changes are made to Figure 7.2-1, Sections 7.2 and 7.3 in the UFSAR to reflect the above proposed technical changes accordingly. The staff finds that those changes are made to for the purpose of clarity and consistency and are not technical. Therefore, the staff finds those editorial and clarification changes are acceptable.

Conclusion:

Based on the above evaluation of the I&C related changes, the staff concludes that the proposed changes in this LAR meet the relevant regulatory requirements in GDC 13, 19, 10 CFR 50.55a(h)(3) and its endorsed IEEE Std. 603-1991. Therefore, the staff finds that the proposed changes are acceptable from an I&C perspective.

3.6 Evaluation of Ventilation Changes

There are two groups of proposed changes discussed in LAR 17-023, i.e., “departure previously reviewed on the WLS docket” and “additional changes”.

Departures previously reviewed on the WLS docket:

- Increase main control room emergency habitability system (VES) filter adsorber efficiency from 30 to 90 percent.

  RG 1.52, Section C.7 defines laboratory testing criteria for activated carbon. Carbon adsorber material should be performed in accordance with ASTM D3803-1991 and Table 1 of RG 1.52. RG 1.52, Table 1, allows a maximum of 95 percent activated carbon decontamination efficiencies for a two-inch bed. Therefore, with the two-inch bed design for the VES filter, the filter efficiency is increased from 30 to 90 percent. The staff considers it is conservative to use 90 percent efficiency for MCR dose analysis and consistent with the guidance in RG 1.52.

- Revise names of actuation signals (High-1 and High-2) and adjust numerical values of SAL setpoints used to actuate nuclear island nonradioactive ventilation system (VBS) SFM and VES.

  GDC 19 is one of the VES and VBS regulatory bases requiring that a control room shall be provided from which actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain it in a safe condition under accident conditions.

  SNC found that the VBS radiation monitoring setpoints used in the MCR dose calculations supporting UFSAR Chapter 15 safety analyses were not selected in a manner to ensure compliance with GDC 19 in 10 CFR Part 50 Appendix A and to support the AP1000 design objective. So, SNC proposed to adjust numerical values of SAL setpoints used to actuate VBS SFM and VES from reconsideration of the HVAC filter contributions. The staff finds that only numerical values of the setpoints are proposed to be changed and there is no change to the setpoint calculation methodology previously reviewed and approved by the staff for the certified AP1000 design. Therefore, the staff finds that the proposed change to use the adjusted setpoints to actuate VBS SFM and VES still meets the regulatory requirements on setpoints in IEEE Std. 603 1991, as incorporated in 10 CFR 50.55a(h)(3) and therefore, this proposed change to the SAL setpoints is acceptable.

- Recalculate MCR volume and MCR HVAC volume.

  The evaluation of the changes to the MCR and MCR HVAC volumes and associated dose consequence analysis are provided in Section 3.2.1.7 of this SER.

- Increase time to switch from VBS normal operation to SFM and increase response time to actuate VES.

  The evaluation of the change to increase the time to switch from VBS normal operation to SFM and increase response time to actuate VES is provided in section 3.2.1.7 of this SER.

- Decrease VBS outside air intake flow rate.

  The VBS outside air intake flow rate has been recalculated and indicates a nominal 1320 cfm. For dose analysis, 1650 cfm is used. Since 1650 cfm was used and found acceptable in the dose analysis, the staff finds that using 1320 cfm is conservative.

- Increase VBS ancillary fan air intake flow rate.

  The previous assumption of 1700 cfm is increased to 1900 cfm for conservatism. This change will provide the control room envelope more fresh air to implement its Regulatory Treatment of Nonsafety Systems (RTNSS) program during an accident. The staff finds this change acceptable because it increases conservatism of the analysis.

Additional Changes:

- Changes to address VBS loss of flow event.

  The existing abnormal operating procedures direct operators to manually initiate VES for an event in which normal control room ventilation is lost and cannot be restored. SNC proposes a change in which MCR isolation and air supply initiation will be initiated automatically on Low MCR Differential Pressure existing for 10 minutes. Without the proposed changes, both MCR isolation and air supply require operator manual action. This automatic actuation is designed to prevent the MCR environment from being outside the analysis assumptions (i.e, no longer positively pressurized). The staff agrees that this new design is acceptable since it will relieve operator burden during an abnormal event to automatically initiate VES.

- Changes to update fan location in post-accident access figures (UFSAR Tier 2 Chapter 12 radiation protection, figures for radiation zones).

  The changes clarify fresh air movement paths from the fan storage locations and air access points to the MCR and the location of portable auxiliary fans during a loss of power of offsite power or post-72-hour time frame. The staff evaluated SNC's proposed changes and found them to be acceptable for clarification of the design.

- Removal of VBS radiation monitoring sample return line.

  A VBS radiation monitoring sample return line will be removed. According to SNC, this radiation monitoring equipment does not require a return line to the VBS return line. The staff evaluated the applicant's statement above and agrees that the proposed change does not impact the results of the dose consequences analysis.

- Adjust VBS out leakage values and table notation for MCR.

  The VBS outleakage rates are adjusted to support the licensing basis requirements for MCR/CSA pressurization in accordance with the updated detailed design documentation. The out-leakage values currently detailed in UFSAR are greater than the credited outside air makeup. Consequently, VBS would not be able to pressurize MCR/CSA - a licensing basis requirement. By adjusting the out-leakage rates the MCR is maintained at a positive pressure. The staff finds this change acceptable.

- Changes to increase VBS allowable inleakage.

  For the ease of future operation, the maximum unfiltered VBS assumed air inleakage is increased from 25 cfm to 60 cfm. Since the existing dose analyses will be updated to reflect the new inleakage rate, the staff finds this change acceptable.

- Revising the MCR HVAC systems normal air flowrates.

The VBS outside air intake during SFM is reduced from 860 cfm to 800 cfm. The existing analysis lowers the VBS flowrate by 10 percent as a conservative action. This meets system design for pressurization and ventilation and reduces the amount outside air that bypasses the VBS filters. The staff agrees with the change.

- Increasing VBS credited filter efficiency.

  The VBS filter efficiency is increased from 90 to 99 percent for elemental and organic iodine. This change aligns the analysis with the RG 1.140 methodology for 4 inches bed depth activated carbon. According to RG 1.140, C. Regulatory Position, 7.1, carbon adsorber should be assigned the decontamination efficiencies given in Table 1. RG 1.140, Table 1 allows carbon filter efficiency up to 99% for 4 inches bed depth. UFSAR C of Chapter 9.4.1 states that VBS carbon bed depth is 4 inches. Based on consistency with the guidance in RG 1.140, the staff finds this change acceptable.

- Isolation of outside air intakes.

  A design change is proposed to isolate (i.e., close) the outside air intakes for these seven VBS and VXS subsystems on a High-2 radiation signal. The annex building door is more distant from the source locations than the VBS air intake. Therefore, the resulting atmospheric dispersion factors reflect additional atmosphere dilution before contaminated air enters the building. The proposed change will provide assurance that the selection of the annex building entrance X/Q remains valid if ac power is available. The staff considers the proposed design change acceptable and necessary to maintain design compliance with existing licensing basis.

Conclusion:

The scope of this conclusion is to review whether LAR 17-023 is in compliance with GDC 19 related to HVAC systems. The staff concludes that the relevant information presented in the LAR regarding improvements to HVAC systems is acceptable and meets the regulatory requirements and guidance of GDC 19. The staff based its conclusion on the following:

- Compliance with GDC 19 is achieved by maintaining MCR personnel dose below 5 rem TEDE for the duration of a design basis accident (DBA).

- Safety-related design functions of VBS and VES are not adversely affected.

3.7 Evaluation of Technical Specification Changes:

The proposed changes (Reference 1), discussed in Technical Evaluation Section 2.0 of the amendment would revise the licensing basis information regarding the nuclear island VBS, the MCR VES, and post-accident operator dose analyses. According to the application, these changes are proposed to maintain compliance with GDC 19, which requires that MCR personnel dose does not exceed 5 rem TEDE for the duration of a DBA.

The application proposes changes to TS 3.3.13, TS LCO 3.7.4, and TS SR 3.7.4.1 in order to make VBS and VCE specifications consistent with GDC 19 requirements.

The proposed TS changes are made to align the TS with the UFSAR changes to the MCR VES in order to meet GDC 19. Per SNC analysis and as confirmed by the staff in Section 3.6, the

post-accident MCR doses does not exceed the GDC 19 limit of 5 rem TEDE. SNC further states that the switchover times from normal HVAC in the control room (VBS) to either the VBS SFM or to the VES are analyzed to determine conservative setpoints to establish bounding system-level requirements for each system participating in the switchover. As a result, the proposed changes do not adversely affect the ability of the VBS and VES to provide control room habitability during normal and accident conditions. The proposed changes do not adversely affect any safety-related equipment or functions, design functions, radioactive material barriers, or safety analyses.

Conclusion:

The proposed TS changes reflect the revised licensing basis information reviewed by the staff and meet the requirements of 10 CFR 50.36. Based on the above evaluation, the staff finds the proposed TS revisions acceptable. The staff concludes that the TS Bases changes are consistent with the TS changes.

3.8 SUMMARY

In LAR 17-023, SNC proposes to make changes that would affect the COL Appendix C, the corresponding plant-specific Tier 1 information, as well as the UFSAR, ITAAC, and Tier 2 TS. The proposed changes do not adversely affect any safety-related equipment or function, design function, radioactive material barrier, or safety analysis. The staff documented its review of the above changes in Sections 3.2 through 3.8 of this safety evaluation and finds the changes acceptable in accordance with 10 CFR 50, Appendix A, GDCs 13 and 19, 10 CFR 50.55a(h)(3), 10 CFR 52.79(a)(1), 10 CFR 50.36, and 10 CFR 50.34(f)(2).

4.0 STATE CONSULTATION

In accordance with the Commission's regulations in 10 CFR 50.91(b)(2), the Georgia State official was notified of the proposed issuance of the amendment on March 5, 2018. 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, "*Standards for Protection Against Radiation*." 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. 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 (82 FR 49234, published on October 24, 2017). 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 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) does not present special circumstances, and (5) does not reduce the level of safety at the licensee's facility. Therefore, the staff grants the licensee an exemption from the Tier 1 information requested by SNC.

The staff has concluded, based on the considerations discussed in Sections 3.2 through 3.8 and confirming that these changes do not change an analysis methodology, assumptions, or the design itself, 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. Southern Nuclear Operating Company, Vogtle Electric Generating Plant Units 3 and 4, "Request for License Amendment and Exemption: Improvements to Main Control Room (MCR) Post-Accident Radiological Consequences," August 31, 2017 (ADAMS Accession No. ML17243A351).

2. Southern Nuclear Operating Company, Vogtle Electric Generating Plant Units 3 and 4, "LAR 17-002S1 ─ Supplement to VEGP Units 3 and 4 Request for License Amendment and Exemption: Improvements to Main Control Room (MCR) Post-Accident Radiological Consequences," February 9, 2018 (ADAMS Accession No. ML18040A487).

3. Southern Nuclear Operating Company, Vogtle Electric Generating Plant Units 3 and 4, "LAR 17-002S2 ─ Supplement to VEGP Units 3 and 4 Request for License Amendment and Exemption: Improvements to Main Control Room (MCR) Post-Accident Radiological Consequences," March 8, 2018 (ADAMS Accession No. ML18067A648).

4. Audit Report for Vogtle Electric Generating Plant Units 3 and 4, Request for License Amendment and Exemption: Improvements to Main Control Room Post-Accident Radiological

5. Vogtle Units 3 and 4, Updated Final Safety Analysis Report, Revision 6, June 15, 2017 (ADAMS Accession No. ML17172A218).

6. AP1000 Design Control Document, Revision 19, June 13, 2011 (ADAMS Accession No. ML11171A500).

7. AP1000 Design Control Document Final Safety Evaluation Report, February 18, 2014 (ADAMS Accession No. ML112091879).

8. Vogtle Electric Generating Plant Unit 3 Combined Licenses NPF-91 and NPF-92 (ADAMS Accession Nos. ML14100A106 and ML14100A135).

9. Levy County Units 1 and 2 Combined Licenses NPF-99 and NPF-100, October 26, 2016 (ADAMS Accession Nos. ML12265A029 and ML12265A042).

10. William States Lee III Nuclear Station Units 1 and 2 Combined Licenses NPF-101 and NPF-102, December 20, 2016 (ADAMS Accession Nos. ML16333A329 and ML16333A331).

11. Levy Nuclear Plant Units 1 and 2, Final Safety Evaluation Report, Chapters 1-22 and Appendices A through F (ADAMS Accession No. ML16084A664).

12. William States Lee III Nuclear Station Units 1 and 2, Final Safety Evaluation Report, Chapters 1-22 and Appendices A through F (ADAMS Accession No. ML16160A414).

13. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.145, “Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants,” November 1982 (ADAMs Accession No. ML003740205).

14. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.194, “Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants,” June 2003 (ADAMs Accession No. ML031530505).

15. U.S. Nuclear Regulatory Commission, “Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants,” Regulatory Guide 1.52, Revision 3, June 2001.

16. U.S. Nuclear Regulatory Commission, “Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants,” Regulatory Guide 1.140, Revision 2, June 2001.

17. U.S. Nuclear Regulatory Commission, “Alternative Radiological Source Terms for Evaluating Design Basis Accidents At Nuclear Power Reactors,” Regulatory Guide 1.183, July 2000.

18. U.S. Nuclear Regulatory Commission, NUREG/CR-6331, Revision 1, “Atmospheric Relative Concentrations in Building Wakes,” May 1997.

19. U.S. Nuclear Regulatory Commission, NUREG-0737, “Clarification of TMI Action Plan Requirements,” January 1983.

20. U.S. Nuclear Regulatory Commission, NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition,” March 2007.

21. U.S. Nuclear Regulatory Commission, “Evaluation of Fission Product Release and Transport,” NRC Staff Technical Paper, October 1971 (ADAMS Accession No. ML16357A003).

22. Duke Energy Carolinas, LLC, Letter # WLG2016.02-03, “AP1000 Combined License Application for the William States Lee III Nuclear Station Units 1 and 2 Voluntary Submittal

of Exemption Request and Design Change Description for Departure from AP1000 DCD Revision 19 to Address Main Control Room Dose Analysis," February 12, 2016 (ADAMS Accession No. ML16049A411).

23. Institute of Electrical and Electronics Engineers Std. 603 1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," June 27, 1991.