

SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

RELATED TO AMENDMENT NO. 68

TO THE COMBINED LICENSE NOS. NPF-93 AND NPF-94

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

VIRGIL C. SUMMER NUCLEAR STATION UNITS 2 AND 3

DOCKET NOS. 52-027 AND 52-028

1.0 INTRODUCTION

By application dated October 9, 2015 (Reference 1), as supplemented by letters dated December 1, 2015, August 11, 2016, and December 21, 2016 (References 2, 3 and 4 respectively), South Carolina Electric & Gas Company (SCE&G, the licensee), acting on behalf of South Carolina Public Service Authority, requested a change to the emergency action level (EAL) scheme for the Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3 Emergency Plan. SCE&G requested to revise the EAL scheme in its entirety due to VCSNS wanting to implement non-design specific enhancements from the Nuclear Energy Institute (NEI) document NEI 99-01, Revision 6, "Development of Emergency Action Levels for Non-Passive Reactors," dated November 21, 2012 (Reference 5). NEI 99-01, Revision 6, was endorsed by the U.S. Nuclear Regulatory Commission (NRC) by letter dated March 28, 2013 (Reference 6). In addition, some clarifying changes to the EAL scheme were requested from that of the initially approved EAL scheme, which was based upon NEI-07-01, Revision 0, "Methodology for Development of Emergency Action Levels for Advanced Passive Light Water Reactors," dated July 2009 (Reference 7). NEI 07-01, Revision 0, was endorsed by the NRC by letter dated August 12, 2009 (Reference 8).

The licensee also proposed a revision to License Condition (LC) 2.D(12)(c)1. for VCSNS Unit 2 and VCSNS Unit 3 (Reference 3), respectively. The proposed change will require the licensee to submit a fully-developed set of EALs in accordance with the criteria defined in this license amendment. Previously, the licensee would have been required to use the criteria in NEI 07-01, Revision 0. After receipt of this amendment, the licensee intends to propose an EAL scheme unique to VCSNS that combines NEI 99-01, Revision 6, and NEI 07-01, Revision 0, with additional clarification of several EALs based upon more detailed design-related information.

The supplemental letters provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on January 19, 2016 (81 FR 2919).

## 2.0 REGULATORY EVALUATION

The applicable regulations and guidance for the emergency plans are as follows:

### 2.1 Regulations

Title 10 of the *Code of Federal Regulations* (10 CFR), Section 52.79(a)(21) requires that the Final Safety Analysis Report includes an emergency plan that complies with the requirements of 10 CFR 50.47, "Emergency plans," and Appendix E, "Emergency Planning and Preparedness for Production and Utilization Facilities," to 10 CFR Part 50.

The regulations in 10 CFR 50.47(a)(1)(i) state, in part, that:

...no initial operating license for a nuclear power reactor will be issued unless a finding is made by the NRC that there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency.

Section 50.47(b) establishes the planning standards that the onsite and offsite emergency response plans must meet for NRC staff to make a finding that there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. Planning Standard (4) of this section requires that onsite and offsite emergency response plans meet the following standard:

A standard emergency classification and action level scheme, the bases of which include facility system and effluent parameters, is in use by the nuclear facility licensee, and State and local response plans call for reliance on information provided by facility licensees for determinations of minimum initial offsite response measures.

Section 50.47(b)(4) emphasizes the use of a standard emergency classification and action level scheme, assuring that implementation methods are relatively consistent throughout the industry for a given reactor and containment design while simultaneously providing an opportunity for a licensee to modify its EAL scheme as necessary to address plant-specific design considerations or preferences.

Section IV.B.1 of Appendix E to 10 CFR Part 50, states, in part:

The means to be used for determining the magnitude of, and for continually assessing the impact of, the release of radioactive materials shall be described, including emergency action levels that are to be used as criteria for determining the need for notification and participation of local and State agencies, the Commission, and other Federal agencies, and the emergency action levels that are to be used for determining when and what type of protective measures should be considered within and outside the site boundary to protect health and safety. The emergency action levels shall be based on in-plant conditions and instrumentation in addition to onsite and offsite monitoring. By June 20, 2012, for nuclear power reactor licensees, these action levels must include hostile action that may adversely affect the nuclear power plant.

Section IV.B.2 of Appendix E to 10 CFR Part 50 states, in part, that:

A licensee desiring to change its entire emergency action level scheme shall submit an application for an amendment to its license and receive NRC approval before implementing the change.

## 2.2 Guidance

The EAL development guidance was initially established in Generic Letter (GL) 79-50, "Emergency Planning Review Guide Number One – Revision One – Emergency Planning Acceptance Criteria for Licensed Nuclear Power Plants," dated October 10, 1979 (Reference 9), and was subsequently revised in NUREG-0654/FEMA-REP-1, Revision 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," November 1980 (Reference 10), which was endorsed as an approach acceptable to the NRC for the development of an EAL scheme by NRC Regulatory Guide (RG) 1.101, Revision 2, "Emergency Planning and Preparedness for Nuclear Power Reactors," October 1981 (Reference 11).

EAL scheme development methodology for the AP1000 Pressurized Water Reactor (PWR) and Economic Simplified Boiling Water Reactor (ESBWR) advanced passive, light water reactor designs was provided to the NRC in NEI 07-01, Revision 0, and endorsed via letter dated August 12, 2009 (References 7 and 8 respectively).

As industry and regulatory experience was gained with the implementation and use of EAL schemes, the industry issued revised EAL scheme development guidance to reflect lessons learned, numerous of which have been provided to the NRC for review and endorsement as generic (i.e., non-plant-specific) EAL development guidance. Most recently, the industry provided NEI 99-01, Revision 6, to the NRC. By letter dated March 28, 2013, the NRC endorsed NEI 99-01, Revision 6, as acceptable generic (i.e., non-plant-specific) EAL scheme development guidance (Reference 6).

Although the EAL development guidance contained in NEI 99-01, Revision 6, is generic and may not be entirely applicable for passive reactor designs, it bounds the most typical accident/event scenarios for which emergency response is necessary, in a format that allows for industry standardization and consistent regulatory oversight. Development of an EAL scheme that captures the relevant non-design aspects of NEI 99-01, Revision 6, as well as maintains the applicable EALs for an AP1000 passive reactor design, may be considered. Pursuant to Section IV.B.2 of Appendix E to 10 CFR Part 50, a revision to an entire EAL scheme must receive NRC approval prior to implementation of the revised EAL scheme.

NRC Regulatory Issue Summary (RIS) 2003-18, including Supplements 1 and 2, "Use of NEI 99-01, 'Methodology for Development of Emergency Action Levels'" (Reference 12), also provides guidance for developing or changing a standard EAL scheme. In addition, this RIS and its supplements provide recommendations to assist licensees, consistent with Section IV.B of Appendix E to Part 50, in determining whether to seek prior NRC approval of deviations from the guidance.

In summary, the NRC staff considers that NEI 99-01, Revision 6, and NEI 07-01, Revision 0, are an acceptable method to develop plant-specific EALs that meet the requirements of Section IV, "Content of Emergency Plans," of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), with the understanding that licensees may want to develop EALs that differ from the guidance documents as allowed in Regulatory Guide 1.101 (Reference 11).

### 2.3 NRC Staff Review

The NRC staff verified that the proposed EAL scheme is consistent with the guidance provided in NEI 07-01, Revision 0, to assure that the proposed EAL scheme meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4). In its application, the licensee proposes to revise the current EAL scheme for VCSNS Units 2 and 3 to one based on the non-design related EALs from NEI 99-01, Revision 6, as well as enhancements to NEI 07-01, Revision 0. In its application and supplemental letters, the licensee submitted the proposed EAL scheme, the technical basis containing an evaluation and rationale for each proposed EAL change, and a comparison matrix providing a line-by-line comparison of the proposed Initiating Conditions, mode applicability, and EAL wording to that found in NEI 99-01, Revision 6, and NEI 07-01, Revision 0. The comparison matrix also included a description of global changes applicable to the EAL scheme and a justification for any differences or deviations from NEI 99-01, Revision 6, and NEI-07-01, Revision 0. The application states that the licensee used the terms “difference” and “deviation” as defined in RIS 2003-18, as supplemented, when comparing its proposed plant-specific EALs to the generic EALs in NEI 99-01, Revision 6, and NEI 07-01, Revision 0.

The NRC staff reviewed the proposed site-specific EAL scheme, technical basis, comparison matrix, and all additional information provided in the licensee’s application and supplemental letters. The NRC staff found that both the current and proposed EALs have modifications from the guidance in NEI 99-01, Revision 6, and NEI 07-01, Revision 0, due to specific plant design and licensee preference. As a result, the licensee submitted a change to LC 2.D(12)(c) to use this license amendment rather than NEI 07-01, Revision 0, as the basis for the fully developed set of EALs to be submitted to the NRC.

Although the EALs must be plant-specific, the NRC staff reviewed the proposed EALs for the following key characteristics of an effective EAL scheme to ensure consistency and regulatory stability:

- Consistency, including standardization of intent, if not in actual wording (i.e., the EALs would lead to similar decisions under similar circumstances at different plants);
- Human factors engineering and user friendliness;
- Potential for emergency classification level upgrade only when there is an increasing threat to public health and safety;
- Ease of upgrading and downgrading the emergency classification level;
- Thoroughness in addressing and disposing of the issues of completeness and accuracy raised in Appendix 1 to NUREG-0654 (i.e., the EALs are unambiguous and are based on site-specific indicators);
- Technical completeness for each classification level;
- Logical progression in classification for multiple events; and
- The use of objective and observable values.

The NRC staff verified that the proposed EAL scheme uses objective and observable values; is worded in a manner that addresses human factors engineering and user friendliness concerns; follows logical progressions for escalating events, and allows for event downgrading and upgrading based upon the potential risk to the public health and safety. Risk assessments were appropriately used to set the boundaries of the emergency classification levels and ensure that all EALs that trigger an emergency classification are in the same range of relative risk. In addition, the NRC staff verified that the proposed EAL scheme is technically complete.

A summary of the NRC staff's review of specific EALs is provided below.

To aid in understanding the nomenclature used in this safety evaluation (SE), the following conventions are used:

- The scheme's generic information is organized by Recognition Category in the following order.
  - R - Abnormal Radiation Levels/Radiological Effluent,
  - C - Cold Shutdown/Refueling System Malfunction,
  - F - Fission Product Barrier,
  - H - Hazards and Other Conditions Affecting Plant Safety, and
  - S - System Malfunction.
- The Recognition Category letter is the first letter for EALs.
- The second letter signifies the emergency classification level:
  - U - Notification of Unusual Event (UE),
  - A - Alert,
  - S - Site Area Emergency (SAE), and
  - G - General Emergency (GE).
- The number denotes the sequential subcategory designation from the plant-specific EAL scheme.

An EAL set refers to EALs within an EAL Recognition Category and subcategory that includes an escalation path for one or more classification levels. Not all EAL Recognition Categories require an EAL set. EAL Recognition Categories are comprised of one or more EAL subcategories. EAL sets and EALs are referred to, generically, as EAL subcategories.

This SE uses the numbering system from the proposed plant-specific EAL scheme. The proposed plant-specific EAL scheme, while using NEI 07-01, Revision 0, and NEI 99-01, Revision 6, to help develop it, is specific to VCSNS; however, the numbering system is consistent with both.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Recognition Category 'R' – Abnormal Radiological Release/Radiological Effluent

##### 3.1.1 VCSNS EAL Set RU1/RA1/RS1/RG1

The intent of this EAL set is to ensure that an EAL is declared upon plant-specific indications of a release of radioactivity (gaseous and/or liquid). In recognition of the lower possible radioactivity concentrations, the assessment of liquid releases is limited to the UE emergency classification level. The set provides for accident assessments using pre-calculated values based on assumed conditions, real-time parameters, and field monitoring results.

The staff evaluated the Developer Notes described in Attachment 5 of the licensee's letter dated December 21, 2016 (Reference 4), and finds them acceptable to complete the development of the applicable EALs in this EAL set.

The NRC staff verified that the progression from UE to GE is appropriate and consistent with EAL scheme development guidance.

- RU1 - This EAL addresses a potential decrease in the level of safety of the plant as indicated by a low-level radiological release that exceeds regulatory commitments for an extended period of time (e.g., an uncontrolled release).
- RA1 - This EAL addresses a release of gaseous radioactivity that results in projected or actual offsite doses greater than or equal to 1 percent of the U.S. Environmental Protection Agency (EPA) Protective Action Guides (PAGs).
- RS1 - This initiating condition addresses a release of gaseous radioactivity that results in projected or actual offsite doses greater than or equal to 10 percent of the EPA PAGs.
- RG1 - This initiating condition addresses a release of gaseous radioactivity that results in projected or actual offsite doses greater than or equal to the EPA PAGs.

The numbering, sequencing, formatting, instrumentation, and (eventual) setpoints for this EAL set were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL set is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL set is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.1.2 VCSNS EAL Set RU2/RA2/RS2/RG2

The intent of this EAL set is to ensure that an EAL is declared upon plant-specific indications of potential or actual damage to an irradiated fuel assembly or multiple assemblies. It addresses a lowering of water level over irradiated fuel or fuel uncover (i.e., level below the top of the fuel), a spectrum of fuel handling accidents that result in mechanical damage to irradiated fuel (e.g., a dropped fuel assembly), and NRC Order EA-12-051, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," dated March 12, 2012 (Reference 13).

The NRC staff has verified that the progression from UE to GE is appropriate and consistent with EAL scheme development guidance.

- RU2 - This EAL addresses a decrease in water level above irradiated fuel sufficient to cause elevated radiation levels.
- RA2 - This EAL addresses events that have caused imminent or actual damage to an irradiated fuel assembly, or a significant lowering of water level within the spent fuel pool, and addresses NRC Order EA-12-051.
- RS2 - This EAL addresses a significant loss of spent fuel pool inventory control and makeup capability leading to imminent fuel damage and addresses NRC Order EA-12-051.
- RG2 - This EAL addresses a significant loss of spent fuel pool inventory control and makeup capability leading to a prolonged uncover of spent fuel and addresses NRC Order EA-12-051.

The SAE and GE emergency classification levels for this specific accident progression are also bounded by Recognition Category 'F', as well as EALs RS1 and RG1. With the availability of new spent fuel pool level instrumentation, the enhanced EALs will provide a redundant escalation path by including specific SAE and GE initiating conditions.

The numbering, sequencing, formatting, instrumentation, and setpoints for this EAL set were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL set is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL set is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.1.3 VCSNS EAL RA3

The intent of this EAL is to ensure that an EAL is declared upon radiation levels in the plant that limit normal access. The EAL addresses elevated radiation levels in certain plant rooms and areas sufficient to preclude or impede personnel from performing actions necessary to maintain normal plant operation, or to perform a normal plant cooldown and shutdown. This includes equipment in the control room and the central alarm station. The Alert EAL is primarily intended to ensure that the plant emergency response organization (ERO) is activated to support the control room in removing the impediment to normal access, as well as assisting in quantifying potential damage to the fuel. Indications of increasing radiation levels in the plant are bounded by Recognition Category 'F', as well as EALs RS1 and RG1.

The numbering, sequencing, and formatting for this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

## 3.2 Recognition Category 'C' – Cold Shutdown/Refueling System Malfunction

### 3.2.1 VCSNS EAL Set CU1/CA1/CS1/CG1

The intent of this EAL set is to ensure that an EAL is declared upon a loss of reactor pressure vessel inventory and/or reactor coolant system (RCS) leakage.

The NRC staff verified that the progression from UE to GE is appropriate and consistent with EAL scheme development guidance.

- CU1 - This EAL addresses the inability to restore and maintain water level to a required minimum level (or the lower limit of a level band), or a loss of the ability to monitor reactor vessel/RCS level concurrent with indications of coolant leakage.
- CA1 - This EAL addresses conditions that are precursors to a loss of the ability to adequately cool irradiated fuel (i.e., a precursor to a challenge to the fuel clad barrier).

- CS1 - This EAL addresses a significant and prolonged loss of reactor vessel/RCS inventory control and makeup capability leading to imminent fuel damage.
- CG1 - This EAL addresses the inability to restore and maintain reactor vessel level above the top of active fuel with containment challenged.

The numbering, sequencing, formatting, instrumentation, and setpoints for this EAL set were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL set is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL set is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.2.2 VCSNS EAL CA2

The intent of this EAL is to ensure that an EAL is declared upon a total loss of alternating current (AC) power that compromises the performance of all systems requiring electric power for emergency core cooling, containment heat removal/pressure control, spent fuel heat removal, and the ultimate heat sink.

The SAE and GE classification levels for this specific accident progression are bounded by EALs RS1 and RG1.

The numbering, sequencing, and formatting for this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.2.3 VCSNS EAL Set CU3/CA3

The intent of this EAL set is to ensure that an EAL is declared upon an inability to maintain control of decay heat removal.

The NRC staff verified that the progression from UE to Alert is appropriate and consistent with EAL scheme development guidance. The SAE and GE classification levels for this specific accident progression are bounded by EALs RS1 and RG1.

- CU3 - This EAL addresses an unplanned increase in RCS temperature above the technical specification cold shutdown temperature limit, or the inability to determine RCS temperature and level.

- CA3 - This EAL addresses conditions involving a loss of decay heat removal capability or an addition of heat to the RCS in excess of that which can currently be removed.

The numbering, sequencing, formatting, instrumentation, and setpoints for this EAL set were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL set is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL set is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

#### 3.2.4 VCSNS EAL Set CU4/CA4

The intent of this EAL set is to ensure that an EAL is declared when there is a loss of vital direct current (DC) power, or a loss of the capability to charge the applicable DC power sources. The SAE and GE emergency classification levels for a protracted loss of vital DC power are bounded by EALs RS1 and RG1.

- CU4 – This EAL addresses a total loss of capability to charge at least one Class 1E 24-hour DC battery for an extended period of time.
- CA4 – This EAL addresses a total loss of all required Class 1E 24-hour DC buses for an extended period of time.

The numbering, sequencing, formatting, instrumentation, and setpoints for this EAL set were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL set is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL set is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

#### 3.2.5 VCSNS EAL CU5

The intent of this EAL is to highlight the importance of emergency communications by ensuring that an EAL is declared if normal communication methods for onsite and offsite personnel, or with offsite response organizations (OROs), including the NRC, are lost. It is primarily intended to ensure that key ERO members and OROs are aware of the loss of communications capabilities, the resources necessary to restore communications are mobilized, and compensatory measures are promptly implemented. The NRC staff verified that no escalation path is necessary for this EAL.

The staff evaluated the Developer Notes described in Attachment 5 of the licensee's letter dated December 21, 2016 (Reference 4), and finds it acceptable to complete the development of this EAL.

The numbering, sequencing, and formatting for this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.2.6 VCSNS EAL CU6

The intent of this EAL is to ensure that an EAL is declared when a complete loss of indicating, monitoring, and control functions from the following instrumentation and control systems occur:

- Protection and Monitoring System (PMS),
- Plant Control System (PLS), and
- Diverse Actuation System (DAS).

A complete loss of these systems makes it difficult to monitor and control plant functions, but the relevant design elements and the applicable operating modes make the risk to the public commensurate with the UE emergency classification level. The Alert, SAE and GE classification levels for this accident progression are bounded by EALs RA1, RS1 and RG1.

The numbering, sequencing, and formatting of this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.2.7 VCSNS EAL CA7

The intent of this EAL is to ensure that an EAL is declared when hazardous events lead to potential damage to systems needed for safe shutdown or safe cooldown. The hazardous events of interest include, but are not limited to, an earthquake, flooding, high winds, tornado strike, explosion, fire, or any other hazard applicable for the site. It is primarily intended to ensure that the plant ERO is activated to support the control room in understanding the event

impacts and restoring affected safety system equipment to service. The SAE and GE classification levels for this accident progression are bounded by EALs RS1 and RG1.

The numbering, sequencing, and formatting of this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.3 Recognition Category 'F' – Fission Product Barrier Matrix

#### 3.3.1 VCSNS EAL Set FA1/FS1/FG1

The intent of this EAL set is to ensure that an EAL is declared upon a loss or potential loss of one or more fission product barriers.

This EAL set uses plant condition based thresholds as triggers within a particular logic configuration needed to reflect a loss or potential loss of a fission product barrier. Light-water reactors in the United States have three fission product barriers: fuel cladding, RCS, and primary containment. Licensees are to develop thresholds that provide EAL decision-makers input into making an event declaration based upon degradation of one or more of these fission product barriers.

There are numerous triggers used as logic inputs to decide on the appropriate classification based upon the number of loss and/or potential loss indicators that are triggered for each barrier. By design, these indicators are redundant with other similar indicators in Recognition Categories 'R' and 'S.'

The NRC staff verified that the logic used to determine the appropriate emergency classification is consistent with the generic EAL scheme development guidance. The progression from Alert to GE is appropriate and consistent with EAL scheme development guidance.

- FA1 - Any loss or any potential loss of either the fuel clad or RCS barrier.
- FS1 - Loss or potential loss of any two barriers.
- FG1 - Loss of any two barriers and loss or potential loss of the third barrier.

The staff evaluated the Developer Notes described in Attachment 5 of the licensee's letter dated December 21, 2016 (Reference 4), and finds it acceptable to complete the development of the applicable thresholds.

The numbering, sequencing, formatting, instrumentation, and setpoints for this EAL set were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL set is worded in a manner that addresses human factors engineering and user friendliness

concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL set is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.4 Recognition Category 'H' – Hazards

#### 3.4.1 VCSNS EAL Set HU1/HA1/HS1

The intent of this EAL set is to ensure that an EAL is declared based upon a security-related event.

This EAL set was developed in accordance with the guidance from NRC Bulletin 2005-02, "Emergency Preparedness and Response Actions for Security-Based Events," July 18, 2005 (Reference 14), and RIS 2006-12, "Endorsement of Nuclear Energy Institute Guidance 'Enhancements to Emergency Preparedness Programs for Hostile Action,'" July 19, 2006 (Reference 15), for licensees to implement, regardless of the specific version of the generic EAL scheme development guidance used, or if the particular licensee developed its EAL scheme using an alternative approach. Based upon lessons learned from the implementation and use of this EAL set, particularly the insights gained from combined security and emergency preparedness drills, the NRC staff and the industry worked to enhance the language of these EALs in NEI 99-01, Revision 6.

Subsequent experience with this EAL set led to the development of Emergency Preparedness Frequently Asked Question (EPFAQ) 2015-013 for EAL HG1 (Reference 16). Licensees may choose not to develop EAL HG1 as long as EALs RA2, RS2, RG2, RS1, RG1, HS1, HS6, HS7, and HG7 are developed as endorsed. VCSNS chose not to develop EAL HG1. The NRC staff verified that VCSNS EALs RA2, RS2, RG2, RS1, RG1, HS1, HS6, HS7, and HG7 are as endorsed and, therefore, bounds the events of concern for EAL HG1.

The NRC staff verified that the progression from UE to SAE is appropriate and consistent with EAL scheme development guidance.

- HU1 - This EAL addresses events that pose a threat to plant personnel or safety system equipment.
- HA1 - This EAL addresses the occurrence of a hostile action within the owner controlled area or notification of an aircraft attack threat.
- HS1 - This EAL addresses the occurrence of a hostile action within the protected area.

The numbering, sequencing, and formatting for this EAL set was verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL set is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL set is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3),

meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.4.2 VCSNS EAL HU2

The intent of this EAL is to ensure that an EAL is declared based upon a seismic event that results in accelerations at the plant site greater than specified for an operating basis earthquake. This EAL is primarily intended to ensure that key ERO members and OROs are aware of the earthquake magnitude at the plant site and that post-event damage assessments are promptly implemented. This EAL is considered part of an EAL set containing EALs CA7 and SA8, depending on the Operating Mode applicable at the time of the event. Indications of earthquake-induced damage to components containing radioactive materials are bounded by Recognition Category 'F', as well as EALs RA1, RS1, or RG1.

The numbering, sequencing, and formatting of this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.4.3 VCSNS EAL HU3

The intent of this EAL is to ensure that an EAL is declared based upon the effects that natural or technological hazard events may have on the facility that are considered to be precursors to a more significant event or condition or have potential impacts that warrant emergency notification to local, State, and Federal authorities. Specific hazards addressed include:

- Tornado strike within the protected area;
- Internal room or area flooding requiring electrical isolation of a system component needed for safe shutdown or safe cooldown;
- Movement in the protected area impeded by an offsite event (gaseous); and
- An external event that prohibits the plant staff from accessing the site.

This EAL is primarily intended to ensure that key ERO members and OROs are aware of the hazardous event affecting the plant site, and post-event damage assessments are promptly implemented. In addition, other events that may impact the effective implementation of the site emergency plan are considered in this EAL. This EAL is considered part of an EAL set containing EALs CA7 and SA8, depending on the operating mode applicable at the time of the event. Indications of hazard induced damage to components containing radioactive materials are bounded by Recognition Category 'F', as well as EALs RA1, RS1, or RG1.

The numbering, sequencing, and formatting of this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL is worded in a manner that

addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

#### 3.4.4 VCSNS EAL HU4

The intent of this EAL is to ensure that an EAL is declared based upon the effect that fires may have on the facility that may be indicative of a potential degradation of the level of safety of the plant. It is primarily intended to ensure that key ERO members and OROs are aware of the fire, and post-event damage assessments are promptly implemented. This EAL is considered part of an EAL set containing EALs CA7 and SA8, depending on the operating mode applicable at the time of the event. Indications of a protracted fire involving radioactive materials are bounded by Recognition Category 'F', as well as EALs RA1, RS1, or RG1.

The numbering, sequencing, and formatting of this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

#### 3.4.5 VCSNS EAL HA5

The intent of this EAL is to ensure that an EAL is declared based upon the effect that toxic, corrosive, asphyxiate, or flammable gases may have on the facility that precludes or impedes access to equipment necessary to maintain normal plant operation or required for a normal plant cooldown and shutdown. This EAL is primarily intended to ensure that the plant ERO is activated to support the control room in removing the impediment to normal access to the affected area or room.

The numbering, sequencing, and formatting of this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.4.6 VCSNS EAL Set HA6/HS6

The intent of this EAL set is to ensure that an EAL is declared based upon a control room evacuation with the inability to control critical plant systems remotely.

The NRC staff verified that the progression from Alert to SAE is appropriate and consistent with EAL scheme development guidance.

- HA6 – This EAL addresses an evacuation of the control room that results in transfer of plant control to alternate locations outside the control room.
- HS6 - This EAL addresses an evacuation of the control room that results in transfer of plant control to alternate locations, and the control of a key safety function cannot be reestablished in a timely manner.

The GE classification level for this specific accident progression is bounded by Recognition Category 'F', as well as EAL RG1.

The numbering, sequencing, and formatting of this EAL set were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL set is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL set is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.4.7 VCSNS EAL Set HU7/HA7/HS7/HG7

The intent of this EAL set is to provide decision-makers with EALs to consider when, in their judgment, an emergency classification is warranted.

The NRC staff verified that the progression from UE to GE is appropriate and consistent with EAL scheme development guidance.

- HU7 – This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist that are believed by the Emergency Coordinator to fall under the emergency classification level description for a UE.
- HA7 – This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist that are believed by the Emergency Coordinator to fall under the emergency classification level description for an Alert.
- HS7 – This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist that are believed by the Emergency Coordinator to fall under the emergency classification level description for a SAE.

- HG7 - This EAL addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist that are believed by the Emergency Coordinator to fall under the emergency classification level description for a GE.

The numbering, sequencing, and formatting of this EAL set were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL set is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL set is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.5 Recognition Category 'S' – System Malfunction

#### 3.5.1 VCSNS EAL Set SU1/SA1/SS1

The intent of this EAL set is to ensure that an EAL is declared based upon a loss of available DC power sources to the emergency buses or loss of the capability to effectively charge the Class 1E 24-hour DC batteries.

The NRC staff reviewed the licensee's evaluation and justification for plant-specific changes associated with this EAL set and verified that the progression from UE to GE is appropriate and consistent with EAL scheme development guidance.

- SU1 – This EAL addresses a loss of all capability to charge at least one Class 1E 24-hour DC battery for at least 30-minutes;
- SA1 – This EAL addresses a loss of all capability to charge at least one Class 1E 24-hour DC battery for at least 60-minutes;
- SS1 – This EAL addresses a total loss of DC power to all required DC buses (IDSA/B/C/D).

The numbering, sequencing, formatting, instrumentation, and setpoints for this EAL set were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL set is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL set is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.5.2 VCSNS EAL Set SU2/SA2

The intent of this EAL set is to ensure an EAL is declared when a partial, or complete, loss of indicating, monitoring, and control functions from the following instrumentation and control systems occur:

- Protection and Monitoring System (PMS),
- Plant Control System (PLS), and
- Diverse Actuation System (DAS).

A complete loss of these systems makes it difficult to monitor and control plant functions, but the relevant design elements and the applicable operating modes, make the risk to the public commensurate with the UE and Alert emergency classification level. The SAE and GE classification levels for this accident progression are bounded by EALs RA1, RS1 and RG1.

- SU2 – This EAL addresses an unplanned partial loss of any of the listed systems for an extended period of time;
- SA2 – This EAL addresses an unplanned full loss of all the listed systems for an extended period of time.

The numbering, sequencing, formatting, instrumentation, and setpoints for this EAL set were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL set is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL set is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.5.3 VCSNS EAL SU3

The intent of this EAL is to ensure that an EAL is declared when RCS activity is greater than technical specification allowable limits. This EAL is primarily intended to ensure that key ERO members are aware of the elevated reactor coolant activity and support the control room in implementation of appropriate response measures. Escalation of the emergency classification is bounded by Recognition Category 'F', as well as EALs RA1, RS1, and RG1.

The numbering, sequencing, formatting, instrumentation, and setpoints for this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

#### 3.5.4 VCSNS EAL SU4

The intent of this EAL is to ensure that an EAL is declared when the plant has indications of RCS leakage. By design, this EAL is redundant with corresponding indicators from a loss or potential loss of fission product barriers, as well as radiation monitoring, to ensure reactor and/or fission product barrier events are recognized. This EAL is primarily intended to ensure that key ERO members are aware of the RCS leakage and support the control room in implementation of appropriate response measures. Escalation of the emergency classification is bounded by Recognition Category 'F', as well as EALs RA1, RS1, and RG1.

The numbering, sequencing, and formatting for this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

#### 3.5.5 VCSNS EAL Set SU5/SA5/SS5

The intent of this EAL set is to ensure that an EAL is declared based upon the effect that a failure of the reactor trip system (RTS) may have on the plant.

The NRC staff verified that the progression from UE to SAE is appropriate and consistent with EAL scheme development guidance. The GE classification level for this event is bounded by Recognition Category 'F', as well as EAL RG1.

- SU5 - This EAL addresses an event where the RTS fails to automatically shut down the reactor when required, yet the reactor is successfully shut down by taking manual action(s) at the reactor control consoles.
- SA5 – This EAL addresses an event where the RTS fails to automatically shut down the reactor when required and operator actions taken at the reactor control consoles to manually shut down the reactor are unsuccessful.
- SS5 - This EAL addresses an event where the RTS fails to automatically shut down the reactor when required, all operator actions to manually shut down the reactor are unsuccessful, and continued power generation is challenging the capability to adequately remove heat from the core, the RCS, or both.

The numbering, sequencing, formatting, instrumentation, and setpoints for this EAL set were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL set is worded in a manner that addresses human factors engineering and user friendliness

concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL set is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.5.6 VCSNS EAL SU6

The intent of this EAL is to highlight the importance of emergency communications by ensuring that an EAL is declared if normal communication methods for onsite and offsite personnel, or with OROs, including the NRC, are lost. It is primarily intended to ensure that key ERO members and OROs are aware of the loss of communications capabilities, the resources necessary to restore communications are mobilized, and compensatory measures are promptly implemented. The NRC staff verified that no escalation path is necessary for this EAL.

The staff evaluated the Developer Notes described in Attachment 5 of the licensee's letter dated December 21, 2016 (Reference 4), and finds it acceptable to complete the development of this EAL.

The numbering, sequencing, and formatting for this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.5.7 VCSNS EAL SU7

The intent of this EAL is to ensure that an EAL is declared when containment fails to isolate when required by an actuation signal and at least one isolation valve in each penetration fails to close within an extended period of time from the actuation signal.

This EAL is primarily intended to ensure that key ERO members and OROs are aware of significant challenges to containment integrity, and corrective actions are promptly implemented. The escalation of the emergency classification level is bounded by Recognition Category 'F', as well as EALs RA1, RS1, and RG1.

The numbering, sequencing, formatting, instrumentation, and setpoints for this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EALs worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.5.8 VCSNS EAL SA8

The intent of this EAL is to ensure that an EAL is declared when a hazardous event leads to potential damage to systems needed for safe shutdown or safe cooldown, or for the current operating mode. The hazardous events of interest include, but are not limited to, an earthquake, flooding, high winds, tornado strike, explosion, fire, or any other hazard applicable for the site. This EAL is primarily intended to ensure that the plant ERO is activated to support the control room in understanding the event impacts and restoring affected safety system equipment to service. The SAE and GE classification levels for this accident progression are bounded by Recognition Category 'F', as well as EALs RS1 and RG1.

The numbering, sequencing, and formatting for this EAL were verified to be consistent with the overall EAL scheme development guidance and address the plant-specific implementation strategies provided, and are, therefore, consistent with a standard EAL scheme, as required by 10 CFR 50.47(b)(4). The NRC staff also verified that the EAL is worded in a manner that addresses human factors engineering and user friendliness concerns, addresses the completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values.

The NRC staff concludes that the plant-specific implementation method for this EAL is in alignment with the key characteristics of an effective EAL scheme (as discussed in Section 2.3), meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable for implementation.

### 3.6 License Condition 2.D(12)(c)

The intent of this LC is to ensure that the licensee develops the EAL scheme in accordance with how the scheme was approved via this license amendment. Attachment 5, of the licensee's letter dated December 21, 2016 (Reference 4), contains information necessary for the development of several EALs. Where applicable, the staff annotated a review of this attachment in the technical evaluation. A corresponding change to the LC, as stated in Enclosure 4 of the licensee's letter dated August 11, 2016 (Reference 3), is necessary to allow the licensee to develop the set of EALs in accordance with the criteria in this license amendment rather than on NEI 07-01, Revision 0, with no deviations. Further, the EALs shall have been discussed and agreed upon with State and local officials.

The NRC staff concludes that the proposed change meets the requirements of Section IV of Appendix E to 10 CFR Part 50 and 10 CFR 50.47(b)(4), and is, therefore, acceptable.

### 3.7 Review Summary

The NRC staff has reviewed the technical bases for the proposed EAL scheme, the modifications from the NEI 07-01, Revision 0 and the NEI 99-01, Revision 6, EAL schemes, and the licensee's evaluation of the proposed changes. The licensee chose to modify its proposed EAL scheme from the generic EAL scheme development guidance provided in NEI 07-01, Revision 0, and NEI 99-01, Revision 6, in order to adopt a format that is better aligned with how it currently implements its EALs, as well as with plant-specific writer's guides and preferences.

The NRC staff concludes that the proposed changes meet the requirements in Appendix E to 10 CFR Part 50 and the planning standards of 10 CFR 50.47(b).

Based on its review, the NRC staff verified that the proposed EAL scheme uses objective and observable values; is worded in a manner that addresses human factors engineering and user friendliness concerns; follows logical progressions for escalating events, and allows for event downgrading and upgrading based upon the potential risk to the public health and safety. Risk assessments were appropriately used to set the boundaries of the emergency classification levels and ensure that all EALs that trigger an emergency classification are in the same range of relative risk. In addition, the NRC staff verified that the proposed EAL scheme is technically complete. The proposed change to LC 2.D(12)(c) requires the licensee to submit a fully developed set of plant-specific EALs in accordance with the criteria defined in this amendment, and that those EALs be discussed and agreed upon with the State and local officials.

Therefore, the NRC staff concludes that the licensee's proposed EAL scheme, as set forth in the licensee's application dated October 9, 2015 (Reference 1), as supplemented by letters dated December 1, 2015, August 11, 2016 and December 21, 2016 (References 2, 3 and 4 respectively), is acceptable and provides reasonable assurance that the licensee can and will take adequate protective measures in the event of a radiological emergency. Specifically, the staff concludes that the licensee's updated site-specific EAL bases document provided by Enclosure 10, "Emergency Action Level Technical Basis Document for the VCSNS Units 2&3," of the letter dated December 21, 2016 (Reference 4), is acceptable for implementation.

#### 4.0 STATE CONSULTATION

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

#### 5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant change in the types, or no significant increase in the amounts of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (81 FR 2919; published on January 19, 2016). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

#### 6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that 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.

## 7.0 REFERENCES

1. Letter from South Carolina Electric & Gas Company to U.S. Nuclear Regulatory Commission, "LAR 14-13: VCSNS Units 2 & 3 Proposed Emergency Action Levels," October 9, 2015 (ADAMS Accession No. ML15282A309).
2. Letter from South Carolina Electric & Gas Company to U.S. Nuclear Regulatory Commission, "LAR 14-13R: VCSNS Units 2 & 3 Proposed Emergency Action Levels," December 1, 2015 (ADAMS Accession No. ML15335A448).
3. Letter from South Carolina Electric & Gas Company to U.S. Nuclear Regulatory Commission, "LAR 14-13R1: VCSNS Units 2 & 3 Proposed Emergency Action Levels," August 11, 2016 (ADAMS Accession No. ML16225A160).
4. Letter from South Carolina Electric & Gas Company to U.S. Nuclear Regulatory Commission, "LAR 14-13R1 S1: V.C. Summer Unit 2 and 3 Response to Request for Additional Information Regarding Emergency Action Level Scheme LAR 14-13R1," December 21, 2016 (ADAMS Accession No. ML16357A573).
5. NEI 99-01, Revision 6, "Development of Emergency Action Levels for Non-Passive Reactors," November 2012 (ADAMS Accession No. ML12326A805).
6. Thaggard, M., U.S. Nuclear Regulatory Commission, Letter to Ms. Perkins-Grew, Nuclear Energy Institute, "U.S. Nuclear Regulatory Commission Review and Endorsement of NEI-99-01, Revision 6, dated November, 2012, (TAC No. D92368)," March 28, 2013 (ADAMS Accession No. ML12346A463).
7. NEI 07-01, Revision 0, "Methodology for Development of Emergency Action Levels, Advanced Passive Light Water Reactors," dated July 2009, (ADAMS Accession No. ML092030210).
8. Miller, C., U.S. Nuclear Regulatory Commission, Letter to Mr. Alan Nelson, Nuclear Energy Institute, "U.S. Nuclear Regulatory Commission Review and Endorsement of NEI 07-01, "Methodology for the Development of Emergency Action Levels," dated August 12, 2009, (ADAMS Accession No. ML092190035).
9. U. S. Nuclear Regulatory Commission, Generic Letter (GL) 79-50, "Emergency Planning Review Guideline Number One – Revision One – Emergency Planning Acceptance Criteria for Licensed Nuclear Power Plants," dated October 10, 1979 and September 7, 1979, (ADAMS Accession No. ML031320278).
10. U.S. Nuclear Regulatory Commission and Federal Emergency Management Agency, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," NUREG-0654/FEMA-REP-1, Revision 1, November 1980 (ADAMS Accession No. ML040420012).
11. U.S. Nuclear Regulatory Commission, "Emergency Planning and Preparedness for Nuclear Power Reactors," Regulatory Guide 1.101, Revision 2, October 1981 (ADAMS Accession No. ML090440294), Revision 3, August 1992 (ADAMS Accession No. ML003740302), and Revision 4, July 2003 (ADAMS Accession No. ML032020276).

12. U.S. Nuclear Regulatory Commission, Regulatory Issue Summary 2003-18, with Supplements 1 and 2, "Use of NEI-99-01, 'Methodology for Development of Emergency Action Levels,' Revision 4, dated January 2003," October 8, 2003, July 13, 2004, and December 12, 2005 (ADAMS Accession Nos. ML032580518, ML041550395, and ML051450482, respectively).
13. Leeds, E. and Johnson, M., U.S. Nuclear Regulatory Commission, letter to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, NRC Order EA-12-051, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Effective Immediately)," March 12, 2012 (ADAMS Accession No. ML12054A679).
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