



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

January 19, 2018

Mr. Richard D. Bologna  
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Beaver Valley Power Station  
Mail Stop A-BV-SEB1  
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SUBJECT: BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2 – CORRECTION OF  
ERRORS IN SAFETY EVALUATION ASSOCIATED WITH LICENSE  
AMENDMENT NOS. 300 AND 189 (CAC NOS. MF8448 AND MF8449;  
EPID L-2016-LLA-0011 AND EPID L-2017-LRO-0069)

Dear Mr. Bologna:

By letter dated October 12, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17216A570), the U.S. Nuclear Regulatory Commission (NRC) issued Amendment No. 300 to Renewed Facility Operating License No. DPR-66 for Beaver Valley Power Station, Unit No. 1, and Amendment No. 189 to Renewed Facility Operating License No. NPF-73 for Beaver Valley Power Station, Unit No. 2. The amendments revised the Emergency Plan emergency action level scheme to one based on the Nuclear Energy Institute (NEI) document NEI 99-01, Revision 6, "Development of Emergency Action Levels for Non-Passive Reactors," November 2012.

Subsequent to the issuance of these amendments, the NRC was notified by e-mails dated November 3, 2017 and November 13, 2017 (ADAMS Accession Nos. ML17317A005 and ML17345A878, respectively), by FirstEnergy Nuclear Operating Company (the licensee) that administrative errors in the safety evaluation involving incorrect references to site-specific emergency action levels, as opposed to those provided in NEI 99-01, Revision 6, had been made. Specifically, Sections 3.6.2 through 3.6.8 of the safety evaluation had incorrect references.

The NRC staff has determined that these errors were made inadvertently and are entirely editorial in nature. The corrections do not change any of the conclusions in the safety evaluation associated with the issuance of Amendment Nos. 300 and 189 and do not affect the associated notice to the public. The replacement safety evaluation associated with these amendments is enclosed. The revised pages contain a marginal line indicating the areas of change.

By conference call on January 18, 2018, the NRC staff provided clarification for the information in the safety evaluation regarding the licensee's comments in its incoming e-mails dated November 3, 2017, and November 13, 2017, on the "bounding criteria" versus "escalation criteria," and changes to the Definitions section. As such, no changes were made to the safety evaluation for these comments.

R. Bologna

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If you have any questions, please contact me at 301-415-2934 or [Booma.Venkataraman@nrc.gov](mailto:Booma.Venkataraman@nrc.gov).

Sincerely,

A handwritten signature in black ink that reads "V. Boome". The signature is written in a cursive style and is underlined with a single horizontal stroke.

Booma Venkataraman, Project Manager  
Plant Licensing Branch I  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-334 and 50-412

Enclosure:  
Corrected Safety Evaluation

cc w/Enclosure: Distribution via Listserv



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
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CORRECTED

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 300 AND 189 TO RENEWED

FACILITY OPERATING LICENSES NOS. DPR-66 AND NPF-73

FIRSTENERGY NUCLEAR OPERATING COMPANY

FIRSTENERGY NUCLEAR GENERATION, LLC

BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2

DOCKET NOS. 50-334 AND 50-412

## 1.0 INTRODUCTION

By application dated September 28, 2016 (Reference 1), as supplemented by letters dated May 20, September 7, and September 20, 2017 (References 2, 3, and 4, respectively), FirstEnergy Nuclear Operating Company (the licensee), requested changes to the Emergency Plan for the Beaver Valley Power Station, Unit Nos. 1 and 2 (Beaver Valley).

The proposed changes would revise the Beaver Valley emergency action level (EAL) scheme to one based on Nuclear Energy Institute (NEI) document NEI 99-01, Revision 6, "Development of Emergency Action Levels for Non-Passive Reactors," November 2012 (Reference 5). NEI 99-01, Revision 6, was endorsed by the U.S. Nuclear Regulatory Commission (NRC or the Commission) by letter dated March 28, 2013 (Reference 6).

The supplemental letters dated May 20, September 7, and September 20, 2017, provided additional information that clarified the application, but did not expand the scope of the application as originally noticed, nor change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on December 20, 2016 (81 FR 92868).

## 2.0 REGULATORY EVALUATION

The applicable regulations and guidance for emergency plans are provided in Sections 2.1 and 2.2.

### 2.1 Regulations

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.47, "Emergency plans," sets forth emergency plan requirements for nuclear power plant facilities. The regulations in 10 CFR 50.47(a)(1)(i) state, in part, that:

Enclosure

. . . 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) of 10 CFR 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) of 10 CFR specifies 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, "Emergency Planning and Preparedness for Production and Utilization Facilities," 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:

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 79-50, "Emergency Plans Submittal Dates," dated October 10, 1979 (Reference 7). This guidance 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 8), which was endorsed by NRC Regulatory

Guide 1.101, Revision 2, "Emergency Planning and Preparedness for Nuclear Power Reactors," October 1981 (Reference 9), as an approach acceptable to the NRC for the development of an EAL scheme.

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, which the NRC endorsed by letter dated March 28, 2013, as acceptable generic (i.e., not plant-specific) EAL scheme development guidance.

Although the EAL development guidance contained in NEI 99-01, Revision 6, is generic and may not be entirely applicable for some non-passive, large light-water 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. Licensees may choose to develop plant-specific EAL schemes using NEI 99-01, Revision 6, with appropriate plant-specific alterations as applicable.

NRC Regulatory Issue Summary (RIS) 2003-18, including Supplements 1 and 2, "Use of NEI 99-01, 'Methodology for Development of Emergency Action Levels,' Revision 4, Dated January 2003" (Reference 10), 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 10 CFR Part 50, in determining whether to seek prior NRC approval of deviations from the guidance.

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

### 2.3 NRC Staff Review

In its application, the licensee proposes to revise the current Beaver Valley EAL scheme to one based on NEI 99-01, Revision 6. 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. 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. 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.

The NRC staff verified that the proposed EAL scheme is consistent with the guidance provided in NEI 99-01, Revision 6, to assure that the proposed EAL scheme meets planning standard 10 CFR 50.47(b)(4) and the requirements of Section IV of Appendix E to 10 CFR Part 50. 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 NEI 99-01, Revision 6, guidance due to specific plant designs and licensee preference.

The NRC staff verified that the instrumentation and setpoints derived for this proposed EAL scheme are consistent with the overall EAL scheme development guidance, address the plant-specific implementation strategies provided, and are consistent with a standard EAL scheme.

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 based upon the potential risk to the public health and safety;
- 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, accurate and consistent with EAL schemes implemented at similarly designed plants;
- Logical progression in classification for multiple events; and
- The use of objective and observable values.

In addition, the NRC staff verified that risk assessments were appropriately used to set the boundaries of the emergency classification levels and ensure that all EALs that trigger the declaration of an emergency classification are in the same range of relative risk.

A summary of the NRC staff's review of specific EALs is provided in Section 3.0 of this safety evaluation.

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

- The scheme's generic information is organized by Recognition Category in the following order:
  - A or R – Abnormal Radiation Levels / Radiological Effluent,
  - C – Cold Shutdown / Refueling System Malfunction,
  - E – Independent Spent Fuel Storage Installation,
  - F – Fission Product Barrier,
  - H – Hazards and Other Conditions Affecting Plant Safety, and
  - S or M – 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 that include an escalation path for one or more classification levels. Not all EAL Recognition Categories require an EAL set.

This safety evaluation uses the numbering system from the proposed plant-specific EAL scheme; however, the numbering system from the generic EAL scheme development guidance contained in NEI 99-01, Revision 6, is annotated in [brackets] to aid in cross-referencing the site-specific EAL numbering convention with that of the guidance.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Recognition Category 'R' – Abnormal Radiation Levels/Radiological Effluent

##### 3.1.1 Beaver Valley EAL Set RU1/RA1/RS1/RG1 [AU1/AA1/AS1/AG1]

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 and Alert emergency classification levels. The set provides for accident assessments using pre-calculated values based on assumed conditions, real-time parameters, and field monitoring results.

The NRC staff verified that the progression from a UE to a GE classification level 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 or liquid radioactivity that results in projected or actual offsite doses greater than or equal to 1 percent of the U.S. Environmental Protection Agency (EPA), EPA-400/R-17/001, PAG [Protective Action Guide] Manual: Protective Action Guides and Planning Guidance for Radiological Incidents," January 2017 (Reference 11).
- 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 licensee chose to modify this EAL set by using a site-specific implementation method that uses a modified numbering format and EAL sequence other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, ease of upgrading/downgrading, and instrumentation and setpoints for this EAL set are 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 an unambiguous manner that addresses human factors engineering and user friendliness concerns, is technically complete for each

classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL set acceptable.

### 3.1.2 Beaver Valley EAL Set RU2/RA2/RS2/RG2 [AU2/AA2/AS2/AG2]

The intent of this EAL set is to ensure that an emergency classification 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 (Effective Immediately)," dated March 12, 2012 (Reference 12).

The NRC staff has verified that the progression from a UE to a GE classification level 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.
- RS2 – This EAL addresses a significant loss of spent fuel pool water 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 licensee chose to modify this EAL set by using a site-specific implementation method that uses a modified numbering format and EAL sequence other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, ease of upgrading/downgrading, and instrumentation and setpoints for this EAL set are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for each classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL set acceptable.



### 3.1.3 Beaver Valley EAL RA3 [AA3]

The intent of this EAL is to ensure that an emergency classification is declared when elevated radiation levels in certain plant rooms and areas 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 classification level 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 RS1 and RG1.

The licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, and instrumentation and setpoints for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

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

#### 3.2.1 Beaver Valley EAL Set CU1/CA1/CS1/CG1 [CU1/CA1/CS1/CG1]

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

The NRC staff verified that the progression from a UE to a GE classification level 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 RPV/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 in the RPV (i.e., a precursor to a challenge to the fuel clad barrier).
- CS1 – This EAL addresses a significant and prolonged loss of RPV/RCS inventory control and makeup capability leading to imminent fuel damage.
- CG1 – This EAL addresses the inability to restore and maintain RPV/RCS level above the top of active fuel with containment challenged.

The licensee chose to modify this EAL set by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, ease of upgrading/downgrading, and instrumentation and setpoints for this EAL set are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for each classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL set acceptable.

### 3.2.2 Beaver Valley EAL Set CU2/CA2 [CU2/CA2]

The intent of this EAL set is to ensure that an emergency classification is declared upon a loss of available alternating current (AC) power to emergency power electrical busses.

The NRC staff verified that the progression from a UE to an Alert classification level 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.

- CU2 – This EAL describes a significant degradation of offsite and onsite AC power sources such that any additional single failure would result in a loss of all AC power to safety systems.
- CA2 – This EAL addresses a loss of all AC power that compromises the performance of all safety systems requiring electric power, including those necessary for emergency core cooling, containment heat removal/pressure control, irradiated fuel heat removal, and the ultimate heat sink.

The licensee chose to modify this EAL set by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, and ease of upgrading/downgrading for this EAL set are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for each classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL set acceptable.

### 3.2.3 Beaver Valley EAL Set CU3/CA3 [CU3/CA3]

The intent of this EAL set is to ensure that an emergency classification is declared based on the inability to maintain control of decay heat removal.

The NRC staff verified that the progression from a UE to an Alert classification level 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 licensee chose to modify this EAL set by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, and ease of upgrading/downgrading for this EAL set are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for each classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL set acceptable.

### 3.2.4 Beaver Valley EAL CU4 [CU4]

The intent of this EAL is to ensure that an emergency classification is declared upon a loss of vital direct current (DC) power, which compromises the ability to monitor and control operable safety systems when the plant is in the cold shutdown or refueling mode. This EAL is primarily intended to ensure that key ERO members and offsite response organizations (OROs) are aware of the event, resources necessary to respond to the event are mobilized, and any necessary compensatory measures are promptly implemented. The Alert, SAE, and GE classification levels for a protracted loss of vital DC power are bounded by EALs CA1, CA3, CS1, CG1, RA1, RS1 and RG1.

The licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, formatting, logical progression, and instrumentation and setpoints for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this

classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

### 3.2.5 Beaver Valley EAL CU5 [CU5]

The intent of this EAL is to highlight the importance of emergency communications by ensuring that an emergency classification is declared if normal communication methods for onsite and offsite personnel or with OROs, including the NRC, are lost. This EAL 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 communication methods derived for this EAL are consistent with the overall EAL scheme development guidance. The licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, and logical progression for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

### 3.2.6 Beaver Valley EAL CA6 [CA6]

The intent of this EAL is to ensure that an emergency classification is declared when hazardous events lead to potential damage to safety systems. 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. Indications of hazard-induced damage to components containing radioactive materials are bounded by EALs CS1, CG1, RS1, and RG1.

The licensee is proposing that an Alert classification will be made when a hazardous event results in indications of degraded performance to one train of a safety system with either indications of degraded performance on a second safety system train or visible damage to a second safety system train, such that the operability or reliability of the second safety system train is a concern. Although different from the endorsed guidance in NEI 99-01, Revision 6,

which would result in an Alert declaration when one train of a safety system has sustained visible damage or indications of degraded performance due to the hazardous event, this change is acceptable, considering that the endorsed guidance in NEI 99-01, Revision 6, is intended to ensure that an Alert is declared only when an actual or potential substantial degradation of the level of safety of the plant has occurred as a result of a hazardous event.

The licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, and logical progression for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

### 3.3 Recognition Category 'E' – Independent Spent Fuel Storage Installation (ISFSI)

#### 3.3.1 Beaver Valley EAL EU1 [E-HU1]

The intent of this EAL is limited to an event that results in damage to the confinement boundary of a storage cask containing irradiated fuel, regardless of the cause. This EAL is primarily intended to ensure that key ERO members and OROs are aware of the cask damage, resources necessary to respond to the event are mobilized, and protective measures, if warranted, are promptly implemented.

The licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, and logical progression for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

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

#### 3.4.1 Beaver Valley EAL Set FA1/FS1/FG1 [FA1/FS1/FG1]

The intent of this EAL set is to ensure that an emergency classification 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. Non-passive, large light-water reactors in the United States have three fission product barriers: fuel cladding, the RCS, and primary containment. Licensees are to develop thresholds that provide EAL decisionmakers' 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 in NEI 99-01, Revision 6. The progression from an Alert to a GE classification level is appropriate and consistent with EAL scheme development guidance.

- FA1 – This EAL addresses any loss or any potential loss of either the fuel clad or RCS barrier.
- FS1 – This EAL addresses any loss or potential loss of any two barriers.
- FG1 – This EAL addresses loss of any two barriers and loss or potential loss of the third barrier.

The licensee chose to modify this EAL set by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, ease of upgrading/downgrading, and instrumentation and setpoints for this EAL set are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for each classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL set acceptable.

### 3.5 Recognition Category 'H' – Hazards and Other Conditions Affecting Plant Safety

#### 3.5.1 Beaver Valley EAL Set HU1/HA1/HS1/HG1 [HU1/HA1/HS1/HG1]

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

This EAL set was developed in accordance with the guidance from NRC Bulletin 2005-02 (Reference 13), and RIS 2006-12 (Reference 14), 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.

The NRC staff also verified that the progression from a UE to a GE classification level 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.
- HG1 – This EAL addresses an event in which a hostile force has taken physical control of the facility to the extent that the plant staff can no longer operate equipment necessary to maintain key safety functions. It also addresses a hostile action leading to a loss of physical control that results in actual or imminent damage to spent fuel.

The NRC staff verified that this EAL set is consistent with the guidance provided in NRC Bulletin 2005-02 and RIS 2006-12, as further enhanced by the lessons learned from implementation and drills, and revised in NEI 99-01, Revision 6.

In its September 20, 2017, submittal, the licensee provided further clarification of the EAL threshold of "Damage to spent fuel has occurred or is IMMINENT." This clarification provides a specific spent fuel pool level that would indicate that damage to spent fuel is imminent. The spent fuel pool level identified for HG1 is the same level used for RS2 which, as identified in Section 3.1.2 of this safety evaluation, addresses a significant loss of SFP water inventory control and makeup capability leading to imminent fuel damage.

The licensee chose to modify this EAL set by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, ease of upgrading/downgrading for this EAL set are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for each classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL set acceptable.

### 3.5.2 Beaver Valley EAL HU2 [HU2]

The intent of this EAL is to ensure that an emergency classification 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 CA6 and SA9, 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 licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, and instrumentation and setpoints for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

### 3.5.3 Beaver Valley EAL HU3 [HU3]

The intent of this EAL is to ensure that an emergency classification is declared based upon the effects that natural or technological hazard events may have on the facility, which 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 safety system component,
- Movement in the protected area impeded by an offsite event (gaseous),
- An external event that prohibits the plant staff from accessing the site, and
- Other site-specific events.

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 site-specific events that may impact the effective implementation of the site emergency plan are considered.

This EAL is considered part of an EAL set containing EALs CA6 and SA9, 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 licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, and logical progression for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

#### 3.5.4 Beaver Valley EAL HU4 [HU4]

The intent of this EAL is to ensure that an emergency classification is declared based upon the effect that a fire may have on the facility, which would be indicative of a potential degradation of the level of safety of the plant. This EAL 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 CA6 and SA9, 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 RS1 and RG1.

The licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, and logical progression for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

### 3.5.5 Beaver Valley EAL HA5 [HA5]

The intent of this EAL is to ensure that an emergency classification is declared based upon the effect that toxic, corrosive, asphyxiating, or flammable gases may have on the facility, which 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. Indications of a protracted loss of access to equipment necessary for normal plant operations, cooldown, or shutdown are bounded by Recognition Category 'F,' as well as EALs RS1 and RG1.

The licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, and formatting for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

### 3.5.6 Beaver Valley EAL Set HA6/HS6 [HA6/HS6]

The intent of this EAL set is to ensure that an emergency classification 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 an Alert to an SAE classification level 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 NRC staff verified that the progression from an Alert to an SAE classification level is appropriate and consistent with EAL scheme development guidance. The GE classification level for this specific accident progression is bounded by Recognition Category 'F,' as well as EAL RG1.

The licensee chose to modify this EAL set by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, and ease of upgrading/downgrading for this EAL set are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for each classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL set acceptable.

### 3.5.7 Beaver Valley EAL Set HU7/HA7/HS7/HG7 [HU7/HA7/HS7/HG7]

The intent of this EAL set is to provide decisionmakers with an escalating emergency classification to consider when, in their judgment, entry into the site's emergency plan and mobilization of the licensee's ERO and ORO is warranted.

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

- HU7 – This EAL addresses unanticipated conditions not addressed explicitly elsewhere but, in the judgment of EAL decisionmakers, warrants declaration of an emergency due to conditions existing that are believed to fall under the emergency classification level description for a UE.
- HA7 – This EAL addresses unanticipated conditions not addressed explicitly elsewhere but, in the judgement of EAL decisionmakers, warrants declaration of an emergency due to conditions existing that are believed to fall under the emergency classification level description for an Alert.
- HS7 – This EAL addresses unanticipated conditions not addressed explicitly elsewhere but, in the judgement of EAL decisionmakers, warrants declaration of an emergency due to conditions existing that are believed to fall under the emergency classification level description for an SAE.
- HG7 – This EAL addresses unanticipated conditions not addressed explicitly elsewhere but, in the judgement of EAL decisionmakers, warrants declaration of an emergency due to conditions existing that are believed to fall under the emergency classification level description for a GE.

The licensee chose to modify this EAL set by using a site-specific implementation method that uses a modified numbering format other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, and ease of upgrading/downgrading for this EAL set are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for each classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in

Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL set acceptable.

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

#### 3.6.1 Beaver Valley EAL Set SU1/SA1/SS1/SG1 [SU1/SA1/SS1/SG1]

The intent of this EAL set is to ensure that an emergency classification is declared based upon a loss of available AC power sources to the emergency busses.

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 a UE to a GE classification level is appropriate and consistent with EAL scheme development guidance.

- SU1 – This EAL addresses a prolonged loss of offsite AC power.
- SA1 – This EAL describes a significant degradation of offsite and onsite AC power sources such that any additional single failure would result in a loss of all AC power to safety systems.
- SS1 – This EAL addresses a loss of all AC power that compromises the performance of all safety systems requiring electric power, including those necessary for emergency core cooling, containment heat removal/pressure control, irradiated fuel heat removal, and the ultimate heat sink.
- SG1 – This EAL addresses a prolonged loss of all power sources to AC emergency buses.

The licensee chose to modify this EAL set by using a site-specific implementation method that uses a modified numbering format and EAL sequence other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, ease of upgrading/downgrading, and instrumentation and setpoints for this EAL set are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for each classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL set acceptable.

#### 3.6.2 Beaver Valley EAL Set SU3/SA3 [SU2/SA2]

The intent of this EAL set is to ensure that an emergency classification is declared based upon the effect that a loss of available indicators in the control room has on the facility.

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

Category 'F,' as well as EALs RS1 and RG1.

- SU3 – This EAL addresses the difficulty associated with monitoring normal plant conditions without the ability to obtain safety system parameters from within the control room.
- SA3 – This EAL addresses the difficulty associated with monitoring rapidly changing plant conditions during a transient without the ability to obtain safety system parameters from within the control room.

The licensee chose to modify this EAL set by using a site-specific implementation method that uses a modified numbering format and EAL sequence other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, ease of upgrading/downgrading, and instrumentation and setpoints for this EAL set are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for each classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL set acceptable.

### 3.6.3 Beaver Valley EAL SU4 [SU3]

The intent of this EAL is to ensure that an emergency classification 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 licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format and EAL sequence other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, and instrumentation and setpoints for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

#### 3.6.4 Beaver Valley EAL SU5 [SU4]

The intent of this EAL is to ensure that an emergency classification is declared when the plant has indications of RCS leakage. By design, this EAL is redundant with corresponding indicators for 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 licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format and EAL sequence other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, and instrumentation and setpoints for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

#### 3.6.5 Beaver Valley EAL Set SU6/SA6/SS6 [SU5/SA5/SS5]

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

The NRC staff verified that the progression from a UE to an SAE classification level 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.

- SU6 – This EAL addresses an event where the RPS 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.
- SA6 – This EAL addresses an event where the RPS 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.
- SS6 – This EAL addresses an event where the RPS 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 licensee chose to modify this EAL set by using a site-specific implementation method that uses a modified numbering format and EAL sequence other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, ease of upgrading/downgrading, and instrumentation and

setpoints for this EAL set are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for each classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL set acceptable.

### 3.6.6 Beaver Valley EAL SU7 [SU6]

The intent of this EAL is to highlight the importance of emergency communications by ensuring that an emergency classification 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 communication methods derived for this EAL are consistent with the overall EAL scheme development guidance.

The licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format and EAL sequence other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, and logical progression for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

### 3.6.7 Beaver Valley EAL SU8 [SU7]

The intent of this EAL is to ensure that an emergency classification is declared based upon indications of containment barrier degradation. It also addresses an event that results in high containment pressure with a concurrent failure of containment pressure control systems. 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 and OROs are aware of significant challenges to containment integrity, and compensatory measures 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 licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format and EAL sequence other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, and instrumentation and setpoints for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

### 3.6.8 Beaver Valley EAL Set SS2/SG1.2 [SS8/SG8]

The intent of this EAL set is to ensure that an emergency classification is declared when a loss of DC power occurs, as this condition compromises the ability of the licensee to monitor and control the removal of decay heat.

The NRC staff verified that the progression from an SAE to a GE classification level is appropriate and consistent with EAL scheme development guidance.

- SS2 – This EAL addresses a loss of vital DC power, which compromises the ability to monitor and control safety systems.
- SG1.2 – This EAL addresses a concurrent and prolonged loss of both AC and vital DC power.

The licensee chose to modify this EAL set by using a site-specific implementation method that uses a modified numbering format and EAL sequence other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, ease of upgrading/downgrading, and instrumentation and setpoints for this EAL set are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for each classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in



Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL set acceptable.

### 3.6.9 Beaver Valley EAL SA9 [SA9]

The intent of this EAL is to ensure that an emergency classification is declared when a hazardous event leads to potential damage to safety systems needed 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 Beaver Valley. 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. Indications of hazard-induced damage to components containing radioactive materials are bounded by Recognition Category 'F,' as well as EALs RS1 and RG1.

The licensee is proposing that an Alert classification will be made when a hazardous event results in indications of degraded performance to one train of a safety system with either indications of degraded performance on a second safety system train or visible damage to a second safety system train, such that the operability or reliability of the second safety system train is a concern. Although different from the endorsed guidance in NEI 99-01, Revision 6, which would result in an Alert declaration when one train of a safety system has sustained visible damage or indications of degraded performance due to the hazardous event, this change is acceptable, considering that the endorsed guidance in NEI 99-01, Revision 6, is intended to ensure that an Alert is declared only when an actual or potential substantial degradation of the level of safety of the plant has occurred as a result of a hazardous event.

The licensee chose to modify this EAL by using a site-specific implementation method that uses a modified numbering format and EAL sequence other than that provided in the generic EAL scheme development guidance. The NRC staff verified that the numbering, sequencing, formatting, logical progression, and instrumentation and setpoints for this EAL are 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 an unambiguous manner that addresses human factors engineering and user-friendliness concerns, is technically complete for this classification level, addresses completeness and accuracy issues raised in Appendix 1 to NUREG-0654, and uses objective and observable values based on site-specific indications.

Based on the above, 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 (identified in Section 2.3 above), and meets the requirements of 10 CFR 50.47(b)(4) and Section IV.B of Appendix E to 10 CFR Part 50. Therefore, the NRC staff finds this EAL acceptable.

### 3.7 Review Summary

The NRC staff has reviewed the technical bases for the proposed EAL scheme; the modifications from NEI 99-01, Revision 6; 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 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 verified that these modifications do not alter the intent of any specific EAL within a set, recognition category, or within the entire EAL scheme

described in NEI 99-01, Revision 6. Thus, the proposed changes meet the requirements in Appendix E to 10 CFR Part 50 and planning standard 10 CFR 50.47(b).

The NRC staff determined 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 or multiple 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 determined that the proposed EAL scheme is technically complete, accurate, and consistent with EAL schemes implemented at similarly designed plants.

Therefore, the NRC staff concludes that the licensee's proposed EAL scheme 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 site-specific Beaver Valley EAL technical basis document provided in the letter dated May 20, 2017, as supplemented by letters dated May 20, September 7, and September 20, 2017, is acceptable for implementation.

#### 4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania State official was notified of the proposed issuance of the amendments on August 8, 2017. The State official had comments (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17222A219). The licensee supplemented its license amendment request on September 7, 2017, and September 20, 2017, to resolve the comments. On September 25, 2017, the NRC informed the State official about the licensee's resolution of the comments. The State official responded on September 27, 2017 (ADAMS Accession No. ML17270A190), that the supplements addressed his concerns.

#### 5.0 ENVIRONMENTAL CONSIDERATION

The amendments change requirements with respect to the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding published in the *Federal Register* on December 20, 2016 (81 FR 92868). Accordingly, the amendments meet 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 amendments.

#### 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 amendments will not be inimical to the common defense and security or to the health and safety of the public.

## 7.0 REFERENCES

1. Richey, M. L., FirstEnergy Nuclear Operating Company, letter to U.S. Nuclear Regulatory Commission, "Beaver Valley Power Station Unit Nos. 1 and 2, Request for Licensing Action to Revise the Emergency Plan," dated September 28, 2016 (ADAMS Package Accession No. ML16277A194).
2. Richey, M. L., FirstEnergy Nuclear Operating Company, letter to U.S. Nuclear Regulatory Commission, "Beaver Valley Power Station, Unit Nos. 1 and 2, Response to Request for Additional Information Regarding a Request to Revise the Emergency Plan," dated May 20, 2017 (ADAMS Accession No. ML17144A484).
3. Bologna, R. D., FirstEnergy Nuclear Operating Company, letter to U.S. Nuclear Regulatory Commission, "Beaver Valley Power Station, Unit Nos. 1 and 2, Supplement to Request for Licensing Action to Revise the Emergency Plan," dated September 7, 2017 (ADAMS Accession No. ML17250B169).
4. Bologna, R. D., FirstEnergy Nuclear Operating Company, letter to U.S. Nuclear Regulatory Commission, "Beaver Valley Power Station, Unit Nos. 1 and 2, Response to Request for Additional Information Regarding a Request to Revise the Emergency Plan," dated September 20, 2017 (ADAMS Accession No. ML17264A034).
5. Nuclear Energy Institute, NEI 99-01, Revision 6, "Development of Emergency Action Levels for Non-Passive Reactors," November 2012 (ADAMS Package Accession No. ML13091A209).
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," dated March 28, 2013 (ADAMS Accession No. ML12346A463).
7. U.S. Nuclear Regulatory Commission, Generic Letter 79-50, "Emergency Plans Submittal Dates," dated October 10, 1979 (ADAMS Accession No. ML031320278).
8. 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, published November 1980 (ADAMS Accession No. ML040420012).
9. 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).
10. 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," dated October 8, 2003; July 13, 2004; and December 12, 2005 (ADAMS Accession Nos. ML032580518, ML041550395, and ML051450482, respectively).

11. U.S. Environmental Protection Agency, EPA-400/R-17/001, "PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents," January 2017 (ADAMS Accession No. ML17044A073).
12. 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)," dated March 12, 2012 (ADAMS Accession No. ML12056A044).
13. U.S. Nuclear Regulatory Commission, Bulletin 2005-02, "Emergency Preparedness and Response Actions for Security-Based Events," dated July 18, 2005 (ADAMS Accession No. ML051740058).
14. U.S. Nuclear Regulatory Commission, Regulatory Issue Summary 2006-12, "Endorsement of Nuclear Energy Institute Guidance 'Enhancements to Emergency Preparedness Programs for Hostile Action,'" dated July 19, 2006 (ADAMS Accession No. ML072670421).

Principal Contributor: Michael Wasem, NSIR

Date: October 12, 2017

Corrected Date: January 19, 2018

**SUBJECT:** BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2 – CORRECTION OF ERRORS IN SAFETY EVALUATION ASSOCIATED WITH LICENSE AMENDMENT NOS. 300 AND 189 (CAC NOS. MF8448 AND MF8449; EPID L-2016-LLA-0011 AND EPID L-2017-LRO-0069) DATED JANUARY 19, 2018

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