Emergency Preparedness Program Frequently Asked Questions

EPFAQ Number: 2019-04

Originator: David Young

Organization: NEI

Relevant Guidance: Nuclear Energy Institute (NEI) document NEI 99-01, *Development of Emergency Action Levels for Non-Passive Reactors*, Revision 6, dated November 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12326A805).

Applicable Section(s): Definitions (appear generically in NEI 99-01, Revision 6, Appendix B) and the following Initiating Conditions (ICs):

- CU1, "UNPLANNED loss of (reactor vessel/RCS [PWR] or RPV [BWR]) inventory for 15 minutes or longer."
- CA1, "Loss of (reactor vessel/RCS [PWR] or RPV[BWR]) inventory."
- CS1, "Loss of (reactor vessel/RCS [PWR] or RPV [BWR]) inventory affecting core decay heat removal capability."
- CG1, "Loss of (reactor vessel/RCS [PWR] or RPV [BWR]) inventory affecting fuel clad integrity with containment challenged."
- Containment Potential Loss threshold 1.B, "(site-specific explosive mixture) exists inside containment."
- Containment Potential Loss threshold 1.C, "HCTL exceeded."
- Containment Potential Loss threshold 2.A, "Primary containment flooding required."
- SU2, "UNPLANNED loss of Control Room indications for 15 minutes or longer."
- SA2, "UNPLANNED loss of Control Room indications for 15 minutes or longer with a significant transient in progress."
- SS5, "Inability to shut down the reactor causing a challenge to (core cooling [PWR] / RPV water level [BWR]) or RCS heat removal."

Date Accepted for Review: December 4, 2019

Status: Complete

QUESTION OR COMMENT:

Background

In June 2018, the Boiling Water Reactor Owners' Group (BWROG) issued Revision 4 of the Emergency Procedure and Severe Accident Guidelines (EPG/SAG). EPG/SAG Revision 4 contains procedural enhancements that address shutdown and refueling modes, insights from the March 2011 accident at Fukushima, better integration with other event mitigation procedures (FLEX and B.5.b), post-Fukushima regulatory requirements, and lessons learned from previous

changes (e.g., training and implementation feedback). The EPG/SAG revision was developed by subject matter experts with backgrounds in BWR operations, engineering, training, risk assessment, severe accident analysis, human factors, emergency operating procedures (EOPs) and licensing.

Certain changes incorporated into EPG/SAG, Revision 4, impact the Emergency Action Level (EAL) development guidance found in NEI 99-01, Revision 6. This EPFAQ identifies those impacts and provides recommended changes to maintain alignment between a plant's EOPs, SAGs, and approved EAL scheme.

When this document is issued as a final/approved EPFAQ, a licensee may choose to use the justification for the following changes, which it deems appropriate, for implementation under 10 CFR 50.54(q)(3). Implementation of all changes is encouraged, but not required.

EPFAQ 2019-04 consists of 9 separate questions, followed by "Proposed Solutions" and proposed "Difference/Deviation Determinations," provided by NEI. Although all nine questions are related to changes incorporated into EPG/SAG Revision 4, each question is distinct. As such, these questions will be evaluated and responded to by the NRC staff as individual questions.

On May 21, 2020, representatives from the NRC, NEI, BWROG, and nuclear power plant industry held a Category 2 public teleconference to discuss the EPFAQs currently being considered by NRC staff, which included EPFAQ 2019-04. A summary of this public meeting is available in the NRC Agencywide Documents Access and Management System (ADAMS) under Accession No. ML20161A037.

Emergency Preparedness Program Frequently Asked Questions

Question 2019-04-01

EPG/SAG Revision 4, Vol. III (EPG-CSD), Step RC/L-3, and EPG/SAG Vol. IV (EPG-RF), Step DH/L-1.1, add spray cooling as a method to maintain adequate core cooling when Reactor Pressure Vessel (RPV) water level is at or above the jet pump suction. This method would be available during Modes 4 and 5 but is not currently credited in the EALs for ICs CS1 or CG1. Absent this credit, a Site Area Emergency or General Emergency declaration may occur due to the RPV level being below the top of active fuel even though adequate core cooling can be maintained through spray cooling.

Can the EALs for ICs CS1 and CG1 be revised to incorporate credit for spray cooling?

PROPOSED SOLUTION FOR QUESTION 2019-04-01:

Yes, the EALs for ICs CS1 and CG1 can be revised to incorporate credit for spray cooling, if available, provided the following applies:

- If site-specific EOPs incorporate spray cooling in Modes 4 and 5, then
- The EAL statements based on inadequate core cooling (IC CS1, EAL #2.b and IC CG1, EAL #1.a) may be revised to reflect the conditions of both an RPV level below the top of active fuel and the unavailability of spray cooling.

Difference/Deviation Determination

Considering EPFAQ 2019-04-01 is only applicable to NEI 99-01, Revision 6, this EPFAQ may be considered only by sites that have implemented NEI 99-01, Revision 6. The response above promotes alignment between BWR EOPs and EAL schemes; therefore, implementation of the guidance in this EPFAQ will improve the accuracy and timeliness of emergency classifications. Moreover, the responses will result in EAL interpretations that are consistent with the meaning and intent of NRC-approved EAL bases, such that the classification of the addressed events/conditions would not be different from that approved by the NRC in a site-specific application. For this reason, it is reasonable to conclude that incorporation of the guidance from this EPFAQ into an NRC-approved, site-specific EAL scheme would be considered a "difference" in accordance with Regulatory Issue Summary (RIS) 2003-18, Supplement 2, "Use of Nuclear Energy Institute (NEI) 99-01, 'Methodology for Development of Emergency Action Levels,' Revision 4, dated January 2003 (ADAMS Accession No. ML051450482).

NRC STAFF RESPONSE:

The NEI 99-01, Revision 6, Technical Basis for CS1 and CG1 provides that fuel damage is probable based on a reduction in RPV level to approximately the top of active fuel. EPG/SAG, Revision 4, provides a method to provide adequate core cooling for a condition when RPV water levels are below the top of active fuel and at or above the jet pump suction. As such, the NRC staff finds, provided that spray cooling is available in site-specific EOPs, that the addition of the condition "and the unavailability of spray cooling" to the threshold values for EALs CS1 2.b, and CG1 1.a is reasonable.

Based on a review of the proposed solution for EPFAQ 2019-04-01 and the existing guidance supporting NEI 99-01, Revision 6, the NRC staff finds that the proposed changes differ in

wording but agree in meaning and intent of EALs CS1 2.b, and CG1 1.a, such that classification of the event would be the same. As such, the proposed changes would reasonably be considered a “difference” rather than a “deviation” as provided by the guidance in RIS-2003-18, Supplement 2. As defined therein (at pages 3 and 5 of 7):

> A difference is an EAL change where the basis scheme guidance differs in wording but agrees in meaning and intent, such that classification of an event would be the same, whether using the basis scheme guidance or the site-specific proposed EAL. Examples of differences include the use of site-specific terminology or administrative re-formatting of site-specific EALs.
>
> A deviation is an EAL change where the basis scheme guidance differs in wording and is altered in meaning or intent, such that classification of the event could be different between the basis scheme guidance and the site-specific proposed EAL. Examples of deviations include the use of altered mode applicability, altering key words or time limits, or changing words of physical reference (protected area, safety-related equipment, etc.).

Based on the above, the NRC staff finds that the proposed solution to EPFAQ 2019-04-01 is acceptable.

RECOMMENDED FUTURE ACTION(S):

☐ INFORMATION ONLY, MAINTAIN EPFAQ

☒ UPDATE GUIDANCE DURING NEXT REVISION

Emergency Preparedness Program Frequently Asked Questions

Question 2019-04-02

Note: The original Question 2 submitted by industry has been revised to address NRC staff comments from the public meeting conducted on May 21, 2020.

In Table 9-F-2, "BWR EAL Fission Product Barrier Table," the Containment Barrier Potential Loss threshold 2.A, states, "Primary containment flooding required." This threshold, appearing in NEI 99-01, Revision 6, was based on guidance in EPG/SAG, Revision 2. The threshold was subsequently updated by EPFAQ 2015-004 to reflect changes incorporated into EPG/SAG, Revision 3; the revised threshold is, "SAG entry is required."

In EPG/SAG, Revision 2, primary containment flooding was required when core cooling was determined to be inadequate. The flooding action raises the water level in the primary containment, thereby reducing the available volume for non-condensible gases and leading to a rise in containment pressure. This rise in pressure will require venting of the primary containment, which is a threshold for a Loss of Containment (see Containment Loss threshold 3.B). Thus, "Primary Containment Flooding is Required" was included as a Containment Potential Loss threshold because the action is a precursor to containment venting and the release of radioactive material (i.e., a Loss of Containment Barrier). These conditions also served as transition criteria for exiting the EOPs and entering the SAGs.

In EPG/SAG, Revision 3, the condition "primary containment flooding is required" was reached only after SAG entry and the decision to flood the primary containment had been thoroughly evaluated against a set of technical criteria. To address the variability in the timing of containment flooding, as permitted by the EPG/SAG, Revision 3 strategy change, the containment barrier potential loss threshold was changed by EPFAQ 2015-004 such that it remained functionally equivalent to the threshold wording reflecting the EPG/SAG, Revision 2, strategy. The Containment Barrier was considered potentially lost when adequate core cooling could no longer be assured, and core damage was imminent. Within the context of EOPs, this point is best defined when operators are directed to enter a SAG (i.e., the threshold of "SAG entry is required").

In EPG/SAG, Revision 4, the containment flooding strategy was re-evaluated and modified to consider new insights related to quenching and cooling of fuel debris in the primary containment. The flooding strategy was modified to permit the use of FLEX equipment to supply an initial flow of water with a preferred injection point into the vessel and then reduce it to just enough to stabilize the debris and remove decay heat. This strategy preserves the availability of the hardened wetwell vent, provides for longer-term use of the suppression pool to scrub radionuclides (which reduces the offsite consequences from a release), and extends the time available to put an alternative method of containment heat removal in place (which alleviates the need for venting). Thus, flooding of the containment is a less preferred option early in a severe accident progression and, in some sequences, may not be directed.

With the incorporation of the "SAG entry is required" threshold described in EPFAQ 2015-004, the entry into a SAG results in meeting the thresholds for a Fuel Clad Barrier Loss and a Containment Barrier Potential Loss. Given that the Reactor Coolant System (RCS) Barrier would also be assessed as lost by other thresholds, a General Emergency declaration would be required at the time a SAG is entered. This declaration would be premature since primary containment flooding (and subsequent containment venting) may not be directed after entry into

the SAG (per EPG/SAG, Revision 4). In other words, the SAG entry by itself is not indicative of a potential loss of containment (e.g., events could lead to a recovery of RPV injection sources to resubmerge the core before the onset of significant fuel damage). For this reason, the Containment Potential Loss threshold 2.A approved in EPFAQ 2015-004, "SAG entry is required," is no longer optimum.

To address the SAG strategy change discussed above, a new threshold was developed that is both tied to an operationally significant decision within the SAGs and a precursor to a potential loss of containment. The goal was to maintain consistency between a site's SAGs and EAL scheme, which facilitates more timely and accurate classification assessments. The new threshold is, "It cannot be determined that core debris will be retained in the RPV." This determination is made from the evaluation of criteria identified in the SAGs and the supporting Technical Support Guidelines. If it cannot be determined that core debris will be retained in the RPV, then subsequent events could lead to a potential challenge to primary containment integrity. This decision would occur prior to RPV failure and the release of core debris into the primary containment. As such, the new threshold will promote an accurate and timely General Emergency declaration and preclude an unwarranted evacuation of the public.

Based on the discussion above, can the Containment Barrier Potential Loss threshold 2.A be revised to read, "It cannot be determined that core debris will be retained in the RPV?"

PROPOSED SOLUTION FOR QUESTION 2019-04-02:

Yes. Containment Barrier Potential Loss threshold 2.A may be revised to read, "It cannot be determined that core debris will be retained in the RPV."

NOTE: The related change discussed in EPFAQ 2015-004 regarding the recommended use "SAG entry is required" for Fuel Clad Loss threshold 2.A is not affected by this EPFAQ.

During development of this EPFAQ, a conforming and non-intentional (inadvertent) change was identified. Since containment venting could be directed as part of a SAG strategy, as described above, and in the interest of clarity, EAL scheme developers should also make the following changes (shown in underlined text). These changes make explicit reference to SAGs in decision-making related to containment venting.

1. Revise Containment Barrier Loss Threshold 3.B to read, "Intentional primary containment venting per EOPs/<u>SAGs</u>."

2. Revise the associated Basis section to read:

   "EOPs <u>or SAGs</u> may direct primary containment isolation valve logic(s) to be intentionally bypassed, even if offsite radioactivity release rate limits will be exceeded. Under these conditions with a valid primary containment isolation signal, the containment should also be considered lost if primary containment venting is actually performed. Intentional venting of primary containment for primary containment pressure or combustible gas control <u>in the EOPs, or for any reason in the SAGs</u>, to the secondary containment and/or the environment is a Loss of the Containment. Venting for primary containment pressure control when not in an accident situation (e.g., to control pressure

below the drywell high pressure scram setpoint while in the EOPs) does not meet the threshold condition."

Difference/Deviation Determination

Considering EPFAQ 2019-04-02 is only applicable to NEI 99-01, Revision 6, this EPFAQ may be considered only by sites that have implemented NEI 99-01, Revision 6. The response above promotes alignment between BWR EOPs and EAL schemes; therefore, implementation of the guidance in this EPFAQ will improve the accuracy and timeliness of emergency classifications. Moreover, the responses will result in EAL interpretations that are consistent with the meaning and intent of NRC-approved EAL bases, such that the classification of the addressed events/conditions would not be different from that approved by the NRC in a site-specific application. For this reason, it is reasonable to conclude that incorporation of the guidance from this EPFAQ into an NRC-approved, site-specific EAL scheme would be considered a "difference" in accordance with Regulatory Issue Summary (RIS) 2003-18, Supplement 2.

NRC STAFF RESPONSE

The NEI 99-01, Revision 6, Technical Basis for Containment Barrier Potential Loss 2.A provides that threshold values should be modified to agree with the site-specific terminology used to direct SAG entry as a result of inadequate core cooling. EPG/SAG Revision 4 provides a method to remove decay heat using FLEX equipment that could delay or eliminate the need for containment flooding and/or the need for containment venting. As such, using a threshold value based on either SAG entry or containment flooding is no longer appropriate. The BWROG proposed a Containment Barrier Potential Loss 2.A threshold value of "It cannot be determined that core debris will be retained in the RPV." Considering that this threshold value reflects a SAG decision point which indicates that decay heat removal is no longer effective and that the primary containment barrier could be challenged, the NRC staff agrees with the proposed threshold value for Containment Barrier Potential Loss 2.A.

NOTE: Although EPFAQ 2019-04-02 specifically addresses the threshold for Containment Barrier Potential Loss 2.A, licensees that currently use containment flooding or SAG entry as threshold values for Fuel Clad Barrier Loss 2.A should also use "It cannot be determined that core debris will be retained in the RPV" as a threshold value for FCB Loss 2.A.

The proposed revision of Containment Barrier Loss Threshold 3.B to read, "Intentional primary containment venting per EOPs/SAGs" provides clarification that intentional containment venting per SAGs should be included as a threshold value. The NRC staff agrees that this clarification is appropriate.

Based on a review of the proposed solution for EPFAQ 2019-04-02 and NEI 99-01, Revision 6, the NRC staff finds that the proposed changes differ in wording but agree in meaning and intent of Containment Barrier Potential Loss 2.A, and Containment Barrier Loss 3.B, such that classification of the event would be the same. As such, the proposed changes would reasonably be considered a difference as provided by the guidance in RIS-2003-18, Supplement 2.

Based on the above, the NRC staff finds that the proposed solution to EPFAQ 2019-04-02 is acceptable.

RECOMMENDED FUTURE ACTION(S):

☐ INFORMATION ONLY, MAINTAIN EPFAQ

☒ UPDATE GUIDANCE DURING NEXT REVISION

Emergency Preparedness Program Frequently Asked Questions

Question 2019-04-03

Concerning Table 9-F-2, "BWR EAL Fission Product Barrier Table," Fuel Clad Potential Loss threshold 2.A and RCS Loss threshold 2.A state, "RPV water level cannot be restored and maintained above (site-specific RPV water level corresponding to the top of active fuel) or cannot be determined."

The bases section states, in part:

> This threshold is considered to be exceeded when, as specified in the site-specific EOPs, RPV water level cannot be restored and maintained above the specified level following depressurization of the RPV (either manually, automatically or by failure of the RCS barrier) or when procedural guidance or a lack of low pressure RPV injection sources preclude Emergency RPV depressurization.

The EPG/SAG definition of the phrase "cannot be restored and maintained above" includes the requirement that the parameter be held above the limit as well as restored above the limit. Refer to EPG/SAG, Revision 4, Appendix B, Volume I, page B.I-4-5, for the definitions of "cannot be maintained above/below" and "cannot be restored above/below."

To promote understanding and use of this term consistent with the BWR EOPs, can a licensee operating a BWR add the definitions of "cannot be maintained above/below" and "cannot be restored above/below" from EPG/SAG, Revision 4, to their EAL scheme?

PROPOSED SOLUTION FOR QUESTION 2019-04-03:

Yes. A BWR licensee may add the definitions of "cannot be maintained above/below" and "cannot be restored above/below," from EPG/SAG, Revision 4, to their EAL scheme, if those definitions appear in the site-specific EOPs and/or controlling development procedures.

Difference/Deviation Determination

Considering EPFAQ 2019-04-03 is only applicable to NEI 99-01, Revision 6, this EPFAQ may be considered only by sites that have implemented NEI 99-01, Revision 6. The response above promotes alignment between BWR EOPs and EAL schemes; therefore, implementation of the guidance in this EPFAQ will improve the accuracy and timeliness of emergency classifications. Moreover, the responses will result in EAL interpretations that are consistent with the meaning and intent of NRC-approved EAL bases, such that the classification of the addressed events/conditions would not be different from that approved by the NRC in a site-specific application. For this reason, it is reasonable to conclude that incorporation of the guidance from this EPFAQ into an NRC-approved, site-specific EAL scheme would be considered a "difference" in accordance with Regulatory Issue Summary (RIS) 2003-18, Supplement 2.

NRC STAFF RESPONSE:

Defining terms used in the EAL Technical Basis document consistent with BWROG EOPs will provide consistency and facilitate timelier and more accurate EAL assessments. Additionally,

defining terms provides clarification that does not alter or change the EAL threshold values or technical basis for Fuel Clad Potential Loss threshold 2.A and RCS Loss threshold 2.A.

Based on a review of the proposed solution for EPFAQ 2019-04-03 and NEI 99-01, Revision 6, the NRC staff finds that the proposed changes differ in wording but agrees in meaning and intent of Fuel Clad Potential Loss threshold 2.A and RCS Loss threshold 2.A, such that classification of the event would be the same. As such, the proposed changes would reasonably be considered a difference as provided by the guidance in RIS-2003-18, Supplement 2.

Based on the above, the NRC staff finds that the proposed solution to EPFAQ 2019-04-03 is acceptable.

RECOMMENDED FUTURE ACTION(S):

☐ INFORMATION ONLY, MAINTAIN EPFAQ

☒ UPDATE GUIDANCE DURING NEXT REVISION

Emergency Preparedness Program Frequently Asked Questions

Question 2019-04-04

Concerning Table 9-F-2, "BWR EAL Fission Product Barrier Table," the bases for Containment Potential Loss threshold 1.C, Heat Capacity Temperature Limit (HCTL) exceeded, states:

> The HCTL is the highest suppression pool temperature from which Emergency RPV Depressurization will not raise:
>
> - Suppression chamber temperature above the maximum temperature capability of the suppression chamber and equipment within the suppression chamber which may be required to operate when the RPV is pressurized,
>
> OR
>
> - Suppression chamber pressure above Primary Containment Pressure Limit A, while the rate of energy transfer from the RPV to the containment is greater than the capacity of the containment vent.
>
> The HCTL is a function of RPV pressure, suppression pool temperature, and suppression pool water level. It is utilized to preclude failure of the containment and equipment in the containment necessary for the safe shutdown of the plant, and therefore, the inability to maintain plant parameters below the limit constitutes a potential loss of containment.

The Containment Potential Loss 1.C developer note states:

> Since the HCTL is defined assuming a range of suppression pool water levels as low as the elevation of the downcomer openings in Mk I/II containments, or 2 feet above the elevation of the horizontal vents in a Mk III containment, it is unnecessary to consider separate Containment barrier Loss or Potential Loss thresholds for abnormal suppression pool water level conditions. If desired, developers may include a separate Containment Potential Loss threshold based on the inability to maintain suppression pool water level above the downcomer openings in Mk I/II containments, or 2 feet above the elevation of the horizontal vents in a Mk III containment with RPV pressure above the minimum decay heat removal pressure, if it will simplify the assessment of the suppression pool level component of the HCTL.

The material in EPG/SAG, Revision 4, may necessitate a change the HCTL value in two ways:

1. Appendix C contains an updated HCTL calculation methodology, and

2. The Primary Containment Control guideline now places increased emphasis on ensuring suppression pool water level never rises higher than the most limiting of the Maximum Pressure Suppression Primary Containment Water Level (MPSPCWL), elevation of the suppression chamber-to-drywell vacuum breakers, or the elevation of the suppression chamber vent. This change supports implementation of the Severe Accident Water Addition and Water Management (SAWA/SAWM) strategies used if conditions degrade and SAGs are entered. The high suppression pool water level forms one of the bounding values for the HCTL.

Can a licensee update the HCTL threshold in their EAL scheme to reflect the calculation methodology in EPG/SAG, Revision 4, and add an additional threshold statement to address high suppression pool water level?

PROPOSED SOLUTION FOR QUESTION 2019-04-04:

Yes. A licensee may update the Containment Potential Loss threshold 1.C threshold in their EAL scheme to reflect the HCTL developed in accordance with EPG/SAG, Revision 4, and implemented in the site-specific EOPs. This includes the addition of a threshold to address high suppression pool water level.

Difference/Deviation Determination

Considering EPFAQ 2019-04-04 is only applicable to NEI 99-01, Revision 6, this EPFAQ may be considered only by sites that have implemented NEI 99-01, Revision 6. The response above promotes alignment between BWR EOPs and EAL schemes; therefore, implementation of the guidance in this EPFAQ will improve the accuracy and timeliness of emergency classifications. Moreover, the responses will result in EAL interpretations that are consistent with the meaning and intent of NRC-approved EAL bases, such that the classification of the addressed events/conditions would not be different from that approved by the NRC in a site-specific application. For this reason, it is reasonable to conclude that incorporation of the guidance from this EPFAQ into an NRC-approved, site-specific EAL scheme would be considered a "difference" in accordance with Regulatory Issue Summary (RIS) 2003-18, Supplement 2.

NRC STAFF RESPONSE:

The NEI 99-01, Revision 6, Technical Basis for Containment Barrier Potential Loss 1.C provides that the HCTL is a function of RPV pressure, suppression pool level, and suppression pool temperature that is utilized to preclude failure of the containment. Therefore, the inability to maintain plant parameters below the limit constitutes a potential loss of the containment barrier. EPG/SAG, Revision 4, provides an updated HTCL calculation methodology that now includes high suppression pool level as a bounding value for the HTCL. The BWROG proposed that the Containment Barrier Potential Loss 1.C threshold value be updated to reflect the EPG/SAG, Revision 4, calculated values of HTCL which, depending on the site-specific calculation methodology, could include high suppression pool level. The proposed HTCL methodology continues to provide a threshold value that is a function of RPV pressure, suppression pool level, and suppression pool temperature that indicates decay heat removal is no longer effective and that the primary containment barrier could be challenged. As such, the NRC staff agrees with the proposed threshold value for Containment Barrier Potential Loss 1.C.

Based on a review of the proposed solution for EPFAQ 2019-04-02 and NEI 99-01, Revision 6, the NRC staff finds that the proposed changes differ in wording but agrees in meaning and intent of Containment Barrier Potential Loss 2.A, and Containment Barrier Loss 3.B, such that classification of the event would be the same. As such, the proposed changes would reasonably be considered a difference as provided by the guidance in RIS-2003-18, Supplement 2.

Based on the above, the NRC staff finds that the proposed solution to EPFAQ 2019-04-04 is acceptable.

RECOMMENDED FUTURE ACTION(S):

☐ INFORMATION ONLY, MAINTAIN EPFAQ

☒ UPDATE GUIDANCE DURING NEXT REVISION

Emergency Preparedness Program Frequently Asked Questions

Question 2019-04-05

Concerning Table 9-F-2, "BWR EAL Fission Product Barrier Table," Containment Potential Loss threshold 1.B states, "(site-specific explosive mixture) exists inside containment."

The threshold bases states:

> If hydrogen concentration reaches or exceeds the lower flammability limit, as defined in plant EOPs, in an oxygen rich environment, a potentially explosive mixture exists. If the combustible mixture ignites inside the primary containment, loss of the Containment barrier could occur.

The associated developer notes state:

> BWR EPGs/SAGs specifically define the limits associated with explosive mixtures in terms of deflagration concentrations of hydrogen and oxygen. For Mk I/II containments the deflagration limits are "6% hydrogen and 5% oxygen in the drywell or suppression chamber". For Mk III containments, the limit is the "Hydrogen Deflagration Overpressure Limit". The threshold term "explosive mixture" is synonymous with the EPG/SAG "deflagration limits."

The threshold wording and bases, which currently focus on "explosive mixture," is inconsistent with the diagnostic approach in EPG/SAGs which directs actions relative to "deflagration limits" (Mark I/II/ABWR) or the "Hydrogen Deflagration Overpressure Limit" (Mark III) as reflected in the developer note above. Deflagration (i.e., subsonic flame propagation) is different from detonation (i.e., an explosion), and hydrogen concentrations necessary for deflagration are lower than those needed for detonation. To address this inconsistency, can a licensee revise the bases to identify the flammability concern as deflagration since this is the parameter considered within EPG/SAG diagnostic and control guidance?

PROPOSED SOLUTION FOR QUESTION 2019-04-05:

Yes. A licensee may revise the threshold and bases paragraph to read:

> "(site-specific deflagration mixture) exists inside containment," and
>
> An elevated hydrogen concentration in the presence of oxygen may lead to a deflagration of the mixture inside the primary containment. The rapid burning of this mixture will lead to a pressure increase that could result in a loss of the primary containment barrier.

Difference/Deviation Determination

Considering EPFAQ 2019-04-05 is only applicable to NEI 99-01, Revision 6, this EPFAQ may be considered only by sites that have implemented NEI 99-01, Revision 6. The response above promotes alignment between BWR EOPs and EAL schemes; therefore, implementation of the guidance in this EPFAQ will improve the accuracy and timeliness of emergency classifications. Moreover, the responses will result in EAL interpretations that are consistent with the meaning and intent of NRC-approved EAL bases, such that the classification of the addressed events/conditions would not be different from that approved by the NRC in a site-specific

application. For this reason, it is reasonable to conclude that incorporation of the guidance from this EPFAQ into an NRC-approved, site-specific EAL scheme would be considered a "difference" in accordance with Regulatory Issue Summary (RIS) 2003-18, Supplement 2.

NRC STAFF RESPONSE:

The NEI 99-01, Revision 6, Technical Basis for Containment Barrier Potential Loss 1.C threshold value uses "site-specific explosive mixture" while the associated basis discussion provides for the lower flammability limit and the developer notes provide for deflagration limits and further provide that the threshold term of "explosive mixture" is synonymous with the EPG/SAG "deflagration limits." As such, the proposed response to EPFAQ 2019-04-05 is consistent with the intent of NEI 99-01, Revision 6.

Based on a review of the proposed solution for EPFAQ 2019-04-05 and NEI 99-01, Revision 6, the NRC staff finds that the proposed changes differ in wording but agrees in meaning and intent of Fuel Clad Potential Loss threshold 1.C, such that classification of the event would be the same. As such, the proposed changes would reasonably be considered a difference as provided by the guidance in RIS-2003-18, Supplement 2.

Based on the above, the NRC staff finds that the proposed solution to EPFAQ 2019-04-05 is acceptable.

RECOMMENDED FUTURE ACTION(S):

☐ INFORMATION ONLY, MAINTAIN EPFAQ

☒ UPDATE GUIDANCE DURING NEXT REVISION

Emergency Preparedness Program Frequently Asked Questions

Question 2019-04-06

Concerning Table 9-F-2, "BWR EAL Fission Product Barrier Table," the bases for Containment Potential Loss threshold 1.C, "HCTL exceeded," states, in part:

> Suppression chamber pressure above Primary Containment Pressure Limit A, while the rate of energy transfer from the RPV to the containment is greater than the capacity of the containment vent.

The guidance in EPG/SAG, Revision 4, no longer differentiates Primary Containment Pressure Limits (PCPL) as PCPL-A, PCPL-B, and PCPL-C, but now recognizes only one PCPL.

Can a licensee revise the Containment Potential Loss threshold 1.C bases to align with the EPG/SAG, Revision 4, guidance by reflecting only one PCPL?

PROPOSED SOLUTION FOR QUESTION 2019-04-06:

Yes. Provided that site-specific EOPs and/or controlling development procedures reference only one PCPL, a licensee may revise the cited sentence above to read, "Suppression chamber pressure above Primary Containment Pressure Limit, while the rate of energy transfer from the RPV to the containment is greater than the capacity of the containment vent."

Difference/Deviation Determination

Considering EPFAQ 2019-04-06 is only applicable to NEI 99-01, Revision 6, this EPFAQ may be considered only by sites that have implemented NEI 99-01, Revision 6. The response above promotes alignment between BWR EOPs and EAL schemes; therefore, implementation of the guidance in this EPFAQ will improve the accuracy and timeliness of emergency classifications. Moreover, the responses will result in EAL interpretations that are consistent with the meaning and intent of NRC-approved EAL bases, such that the classification of the addressed events/conditions would not be different from that approved by the NRC in a site-specific application. For this reason, it is reasonable to conclude that incorporation of the guidance from this EPFAQ into an NRC-approved, site-specific EAL scheme would be considered a "difference" in accordance with Regulatory Issue Summary (RIS) 2003-18, Supplement 2.

NRC STAFF RESPONSE:

The NEI 99-01, Revision 6, Technical Basis provides that the HCTL is the highest suppression pool temperature that would not raise suppression chamber pressure above PCPL 'A' while the rate of energy transfer from the RPV to the containment is greater than the capacity of the containment vent. Considering that EPG/SAG, Revision 4, will only calculate one PCPL and will no longer calculate PCPL 'A', the proposed change to replace PCPL 'A' and simply state PCPL is appropriate. Additionally, the proposed changes provide clarification and do not alter or change the EAL threshold values for Fuel Clad Potential Loss threshold 1.C.

Based on a review of the proposed solution for EPFAQ 2019-04-06 and NEI 99-01, Revision 6, the NRC staff finds that the proposed changes differ in wording but agrees in meaning and intent of Fuel Clad Potential Loss threshold 1.C, such that classification of the event would be

the same. As such, the proposed changes would reasonably be considered a difference as provided by the guidance in RIS-2003-18, Supplement 2.

Based on the above, the NRC staff finds that the proposed solution to EPFAQ 2019-04-06 is acceptable.

RECOMMENDED FUTURE ACTION(S):

☐ INFORMATION ONLY, MAINTAIN EPFAQ

☒ UPDATE GUIDANCE DURING NEXT REVISION

Emergency Preparedness Program Frequently Asked Questions

Question 2019-04-07

In an email, dated August 12, 2020, the Nuclear Energy Institute and the Boiling Reactor Owners Group requested to withdraw EPFAQ 2019-04-07 (Agencywide Documents Access and Management System Accession No. ML20233A699).

Emergency Preparedness Program Frequently Asked Questions

Question 2019-04-08

IC SS5 is based on a failure of the reactor to shut down following automatic and manual scram signals, in combination with either:

- (Site-specific indication of an inability to adequately remove heat from the core).
- (Site-specific indication of an inability to adequately remove heat from the RCS).

The developer notes state:

Site-specific indication of an inability to adequately remove heat from the core:

[BWR] – Reactor vessel water level cannot be restored and maintained above Minimum Steam Cooling RPV Water Level (as described in the EOP bases).

Site-specific indication of an inability to adequately remove heat from the RCS:

[BWR] - Use the Heat Capacity Temperature Limit. This addresses the inability to remove heat via the main condenser and the suppression pool due to high pool water temperature.

For BWRs, the second EAL generic statement "Site-specific indication of an inability to adequately remove heat from the RCS" should be updated to better align with the diagnostic approach and terminology used in EPGs and SAGs to assess heat removal capability. During an Anticipated Transient Without Scam (ATWS) condition, when the main condenser is unavailable, heat/energy from the RCS is transferred to the suppression pool as steam flow through the safety relief valves (SRVs). Reaching the Heat Capacity Temperature Limit (HCTL), which is specified in the Developer Notes, indicates a challenge to the capability to remove heat from the suppression pool (i.e., primary containment). Therefore, rather than referencing RCS heat removal, a term more appropriate for PWRs, the BWR-portion of the statement should focus on heat removal capability from the suppression pool (i.e., a challenge to the HCTL).

To align the BWR-related threshold wording with the diagnostic approach and terminology used in EPGs and SAGs, can IC SS5, EAL 1.c, second bullet, be revised to read, "Site-specific indication of an inability to adequately remove heat from the RCS [*PWR*] or a challenge to the Heat Capacity Temperature Limit [*BWR*]."

PROPOSED SOLUTION FOR QUESTION 2019-04-08:

Yes. IC SS5, EAL 1.c, second bullet, can be revised to read, "Site-specific indication of an inability to adequately remove heat from the RCS [PWR] or a challenge to the Heat Capacity Temperature Limit [BWR]."

Difference/Deviation Determination

Considering EPFAQ 2019-04-08 is only applicable to NEI 99-01, Revision 6, this EPFAQ may be considered only by sites that have implemented NEI 99-01, Revision 6. The response above promotes alignment between BWR EOPs and EAL schemes; therefore, implementation of the

guidance in this EPFAQ will improve the accuracy and timeliness of emergency classifications. Moreover, the responses will result in EAL interpretations that are consistent with the meaning and intent of NRC-approved EAL bases, such that the classification of the addressed events/conditions would not be different from that approved by the NRC in a site-specific application. For this reason, it is reasonable to conclude that incorporation of the guidance from this EPFAQ into an NRC-approved, site-specific EAL scheme would be considered a "difference" in accordance with Regulatory Issue Summary (RIS) 2003-18, Supplement 2.

NRC STAFF RESPONSE:

EPFAQ 2019-04-08 seeks to align the BWR-related threshold wording with the diagnostic approach and terminology used in EPGs and SAGs for IC SS5, EAL 1.c. Specifically, this EPFAQ requests revising the second bullet for IC SS5, EAL 1.c to read:

> Site-specific indication of an inability to adequately remove heat from the RCS [*PWR*] or a challenge to the Heat Capacity Temperature Limit [*BWR*].

Considering that the above statement provides BWR specific indications that reflect an inability to remove heat from the RCS, the NRC staff finds that the above revision would provide a BWR specific clarification that is consistent with BWROG EOPs which will provide consistency and facilitate timelier and more accurate EAL assessments.

Based on a review of the proposed solution for EPFAQ 2019-04-08 and NEI 99-01, Revision 6, the NRC staff finds that the proposed changes differ in wording but agrees in meaning and intent of Fuel Clad Potential Loss threshold 2.A and RCS Loss threshold 2.A, such that classification of the event would be the same. As such, the proposed changes would reasonably be considered a difference as provided by the guidance in RIS-2003-18, Supplement 2.

Based on the above, the NRC staff finds that the proposed solution to EPFAQ 2019-04-08 is acceptable.

RECOMMENDED FUTURE ACTION(S):

☐ INFORMATION ONLY, MAINTAIN EPFAQ

☒ UPDATE GUIDANCE DURING NEXT REVISION

Emergency Preparedness Program Frequently Asked Questions

Question 2019-04-09

With respect to the inability to determine RPV water level, the EALs for ICs CU1, CA1, CS1 and CG1 contain the phrase, "cannot be monitored …." The associated bases state:

> If water level cannot be monitored, operators may determine that an inventory loss is occurring by observing changes in sump and/or tank levels.

The EALs for ICs SU2 and SA2 contain the phrase, "inability to monitor one or more of the following parameters from with the Control Room …." The associated bases state:

> As used in this EAL, an "inability to monitor" means that values for one or more of the listed parameters cannot be determined from within the Control Room.

EPG/SAG, Revision 4, uses the phrase "cannot be determined ..." to address instances when operators cannot monitor a parameter by any means (e.g., "RPV water level cannot be determined," "reactor power cannot be determined"). The NEI 99-01 terms "cannot be monitored" and "inability to monitor" are synonymous (i.e., functionally equivalent) with the EPG/SAG term "cannot be determined."

Can a BWR licensee replace the term "cannot be monitored" in ICs CU1, CA1, CS1 and CG1, and "inability to monitor" in ICs SU2 and SA2, with "cannot be determined" to align the EAL wording with the terminology used in EPG/SAG, Revision 4, and site-specific EOPs?

PROPOSED SOLUTION FOR QUESTION 2019-04-09:

Yes. Provided site-specific EOPs use the term "cannot be determined" in a manner consistent with EPG/SAG, Revision 4, a BWR licensee may revise:

- IC CU1, EAL 2.a, to read, "RPV level cannot be determined."
- IC CA1, EAL 2.a, to read, "RPV level cannot be determined for 15 minutes or longer."
- IC CS1, EAL 3.a, to read, "RPV level cannot be determined for 30 minutes or longer."
- IC CG1, EAL 2.a, to read, "RPV level cannot be determined for 30 minutes or longer."
- The Basis sentence in IC CA1, CS1 and CG1, to read, "If water level cannot be determined, operators may conclude that an inventory loss is occurring by observing changes in sump and/or tank levels."
- IC SU2 and SA2, EAL #1.a to read, "One or more of the following parameters cannot be determined from within the Control Room for 15 minutes or longer due to an UNPLANNED event."
- The Basis sentence in IC SU2 and SA2, "As used in this EAL, an "inability to monitor" means that values for one or more of the listed parameters cannot be determined from within the Control Room," may be deleted as it is no longer needed; the phase "inability to monitor" has been replaced with "cannot be determined" in the EALs.

For clarity, this change is not intended to generically permit credit for indications (parameter values) obtained at locations outside the Control Room (AKA [also known as] local indications). The use of such indications may be acceptable; however, the proposed reliance on locally obtained data to support an EAL assessment requires an evaluation in accordance with the requirements of 10 CFR 50.54(q).

Difference/Deviation Determination

Considering EPFAQ 2019-04-09 is only applicable to NEI 99-01, Revision 6, this EPFAQ may be considered only by sites that have implemented NEI 99-01, Revision 6. The response above promotes alignment between BWR EOPs and EAL schemes; therefore, implementation of the guidance in this EPFAQ will improve the accuracy and timeliness of emergency classifications. Moreover, the responses will result in EAL interpretations that are consistent with the meaning and intent of NRC-approved EAL bases, such that the classification of the addressed events/conditions would not be different from that approved by the NRC in a site-specific application. For this reason, it is reasonable to conclude that incorporation of the guidance from this EPFAQ into an NRC-approved, site-specific EAL scheme would be considered a "difference" in accordance with Regulatory Issue Summary (RIS) 2003-18, Supplement 2.

NRC STAFF RESPONSE:

The NEI 99-01, Revision 6, Technical Basis for EALs CU1, CA1, CS1 and CG1 uses "cannot be monitored" as a threshold condition while the associated basis discussion provides the condition "loss of the ability to monitor." The threshold values for EALs SU2 and SA2 include the condition "inability to monitor," while the basis document discussion includes "an "inability to monitor," which means that values for one or more of the listed parameters cannot be determined." As such, the NRC staff finds proposed solution for EPFAQ 2019-04-09 acceptable. Additionally, the proposed solution will be consistent with terminology used in EPG/SAG, Revision 4, will improve consistency and facilitate accurate and timely EAL assessments.

Based on a review of the proposed solution for EPFAQ 2019-04-03 and NEI 99-01, Revision 6, the NRC staff finds that the proposed changes differ in wording but agrees in meaning and intent of EALs CU1, CA1, CS1, CG1, SU2, and SA2. As such, the proposed changes would reasonably be considered a difference as provided by the guidance in RIS-2003-18, Supplement 2.

Based on the above, the NRC staff finds that the proposed solution to EPFAQ 2019-04-09 is acceptable.

RECOMMENDED FUTURE ACTION(S):

☐ INFORMATION ONLY, MAINTAIN EPFAQ

☒ UPDATE GUIDANCE DURING NEXT REVISION

Emergency Preparedness Program Frequently Asked Questions

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