



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
ON REVISED EMERGENCY ACTION LEVELS FOR
CENTERIOR ENERGY'S PERRY NUCLEAR POWER PLANT
DOCKET NO. 50-440

1.0 INTRODUCTION

By letter dated February 16, 1996, as supplemented by letters dated September 27, 1996, and December 23, 1996, Cleveland Electric Illuminating Company (the licensee) submitted proposed changes to the Perry Nuclear Power Plant emergency action levels (EALs) developed in accordance with NUMARC/NESP-007 guidance. Specifically, the licensee provided a proposed revision to the Perry Nuclear Plant "Emergency Action Level Basis Document," and documentation justifying site-specific EAL thresholds and deviations from the NUMARC/NESP-007 guidance. The Emergency Action Level Basis Document included the site-specific initiating conditions (ICs), EALs, and basis for the ICs and EALs. The licensee intends to revise its emergency plan and emergency plan implementing procedures to incorporate the ICs and EALs following NRC's approval of these ICs and EALs.

2.0 BACKGROUND

The proposed revision to the Perry EALs was reviewed against the requirements in 10 CFR 50.47(b)(4) and Appendix E to 10 CFR Part 50.

10 CFR 50.47(b)(4) specifies that onsite emergency plans must meet the following standard: "A standard classification and action level scheme, the bases of which include facility system and effluent parameters, is in use by the nuclear facility licensee..."

Appendix E (IV)(C) specifies that "emergency action levels (based not only on onsite and offsite radiation monitoring information but also on readings from a number of sensors that indicate a potential emergency, such as pressure in containment and response of the Emergency Core Cooling System) for notification of offsite agencies shall be described....The emergency classes defined shall include (1) notification of unusual events, (2) alert, (3) site area emergency, and (4) general emergency."

In Revision 3 to Regulatory Guide 1.101, "Emergency Planning and Preparedness for Nuclear Power Reactors," the NRC endorsed NUMARC/NESP-007, Revision 2, "Methodology for Development of Emergency Action Levels," as an acceptable method for licensees to meet the requirements of 10 CFR 50.47 (b)(4) and Appendix E to 10 CFR Part 50. The staff relied upon the guidance in

NUMARC/NESP-007 as the basis for its review of the Perry EAL changes.

3.0 EVALUATION

Most of the proposed EALs conformed closely to the guidance. However, some of the licensee's proposed EALs deviate from the example EALs in NUMARC/NESP-007. In addition, the licensee included a number of EALs not specified in NUMARC/NESP-007. The staff's evaluation of these variations is discussed below.

Deviation #1

Modified Basis for Setpoint for Release Monitor EAL

The Perry Unusual Event EAL for the release of gaseous radioactive material is set at 140% technical specification values instead of the 200% specified in the NUMARC/NESP-007 guidance. The use of the 140% allows for the use of a multiple of the alarm setpoint for the monitor and therefore is readily observable. Release of gaseous radioactive material at a level of 140% of the technical specification limit is a valid indication of the loss of control of the release of radioactive material which is the basis for this EAL. Similarly, the Perry Alert EAL for the release of gaseous radioactive material is set at 140 times technical specification values instead of the 200 times specified in the NUMARC/NESP-007 guidance. These deviations are acceptable.

Deviation #2

Fission Product Barrier -- Loss of Fuel Clad as Indicated by Water Level

The NUMARC/NESP-007 EAL for the loss of the fuel clad barrier based on reactor vessel water level indications is:

Level LESS THAN (site-specific) value

The corresponding Perry EAL is:

Entry into PEI-T23, Containment Flooding

PEI-T23 is entered if any of the criteria below CANNOT be met:

- Under non-anticipated transient without scram (non-ATWS) conditions, Reactor Pressure Vessel (RPV) water level cannot be restored and maintained above top of active fuel with the RPV depressurized.
- Under non-ATWS conditions, RPV water level cannot be maintained above minimum steam cooling RPV water level (-42.5 inches) with the RPV pressurized.
- RPV water level cannot be determined and RPV flooding conditions cannot be established and maintained.
- Under ATWS conditions, RPV water level cannot be maintained above minimum zero injection RPV water level (-25 inches)

Each of these conditions is indicative of the loss of adequate core cooling which would lead to fuel clad damage. The use of the emergency operating procedure (EOP) threshold is beneficial because it accurately defines the condition of concern and is familiar to plant operators. One drawback with the use of this threshold is that it may cause a slight delay in classification because operators will have to progress through the EOPs to the point where entry into containment flooding is required. However, other EALs are available for identifying the potential loss or loss of fuel clad (including an EAL for the potential loss of fuel clad based upon water level at the top of active fuel) in the interim, while the EOPs are being stepped through. Therefore, this deviation is acceptable.

Deviation #3

Fission Product Barrier -- Loss of reactor coolant system (RCS) barrier as indicated by main steam line break

A NUMARC/NESP-007 EAL for the loss of the reactor coolant system barrier based on reactor coolant leak rate is:

(site-specific) Indication of Main Steamline [MSL] Break

The corresponding Perry EAL is:

MSL break outside Containment exceeding one or more MSIV [Main Steamline Isolation Valve] Tech. Spec. isolation setpoints

and

Containment penetration does NOT isolate on a valid closure signal

and

Immediate operator actions in the Control Room are NOT successful in isolating affected penetration.

The Perry EAL deviates from the NUMARC/NESP-007 EAL by including the additional conditions that: (1) the MSL break is of a magnitude which exceeds the technical specification isolation setpoint, and (2) the MSIV fails to isolate. This prevents inappropriate classification for small MSL leaks and prevents unwarranted classification if the MSIVs are immediately isolated. Therefore, this deviation is acceptable.

Deviation #4

Fission Product Barrier -- Loss of RCS as indicated by RCS leakage

One of the NUMARC/NESP-007 EALs for the loss of the reactor coolant system barrier based on reactor coolant system leakage indications is:

RCS leakage greater than 50 gpm inside the drywell

The licensee stated that they did not include this EAL because control room instrumentation cannot be used to adequately assess a 50 gpm instantaneous threshold. The licensee included an EAL based upon drywell pressure (greater than 1.68 psig) which the licensee has determined would be exceeded for about a 50 gpm RCS leak into the drywell. This deviation is acceptable.

Deviation #5

Fission Product Barrier -- Loss of RCS as indicated by Drywell Pressure

The NUMARC/NESP-007 EAL for the loss of RCS as indicated by drywell pressure is the drywell pressure alarm setpoint. The licensee deviated from this guidance by utilizing the drywell pressure scram setpoint. The licensee states that the alarm setpoint is set low enough to allow operator action to reduce containment pressure with containment cooling systems and is not intended to be the threshold of a loss-of-coolant-accident (LOCA). The scram setpoint is indicative of a LOCA and therefore is used as the threshold for this EAL. This deviation is acceptable.

Deviation #6

Fission Product Barrier -- Loss of Containment based upon Drywell Pressure

NUMARC/NESP-007 EALs for the loss of the containment barrier based on drywell pressure include:

Rapid unexplained decrease following initial increase

Drywell pressure response not consistent with LOCA conditions

The Perry EAL scheme did not include the first of these EALs as a stand alone EAL but rather included it under the envelope of emergency coordinator judgement. This deviation is acceptable.

The Perry EAL did not include the second of these EALs because, in the opinion of the licensee, the indication is too vague for the Emergency Coordinator to analyze and implies that the LOCA response for Containment will follow a pre-analyzed response time. The licensee states that Emergency Coordinator judgment is still available if technical support center engineers do not believe that Containment is performing as designed. This deviation is acceptable.

Deviation #7

Fission Product Barrier -- Loss of Containment based upon Isolation Failure

The NUMARC/NESP-007 EAL for the potential loss of the containment barrier based on containment isolation is:

*Failure of both valves in any one line to close
AND*

Downstream pathway to the environment exists

The corresponding Perry EAL is:

*Containment penetration does NOT isolate on a valid closure signal
AND*

*Immediate Operator action in the Control Room are NOT successful in isolating affective penetration
AND*

Pathway to then environment exists via penetration²

² Pathway exists through a break or system penetration which would in effect bypass Containment creating a pathway to the environment outside the normal process stream or with normal filtration NOT intact

This EAL deviates from the NUMARC/NESP-007 guidance by defining what constitutes a "Pathway to the environment" as the conditions described in footnote 2. It is inappropriate to define the loss of the containment barrier in this manner because, even if the normal process stream or normal filtration is intact, a release of radioactive material which may affect the environment could occur. This EAL would be acceptable if the footnote for this EAL and the corresponding definition in the basis for this EAL are eliminated. Alternatively, the licensee may provide additional justification for this deviation or submit a revised EAL for NRC approval.

Deviation #8

Fission Product Barrier -- Potential Loss of Containment based upon RPV level

The NUMARC/NESP-007 EAL for the potential loss of the containment barrier based on RPV level is:

Reactor vessel water level LESS THAN (site-specific) value and the maximum core uncover time limit is in the UNSAFE region

The corresponding Perry EAL is:

Entry into PEI-T23 Containment Flooding

and is used as an indication of the loss of containment (rather than potential loss as in NUMARC/NESP-007).

The licensee stated that it did not include the NUMARC/NESP-007 EAL because the NUMARC/NESP-007 EAL is not an appropriate indication of core damage. The NUMARC/NESP-007 EAL is based upon a curve which is applicable under conditions where RPV water cannot be determined. Furthermore the licensee stated that the assumptions used in deriving the curve are not consistent with various plant conditions which may exist when the EAL is being applied.

The licensee chose instead to use the indication of entry into the containment flooding procedure for this EAL. As described previously under Deviation #2, this entry condition is based upon the loss of adequate core cooling and therefore is indicative of the potential for a large degree of core damage. In addition, the entry into this EOP is accompanied by the opening of the Containment vent which would cause the bypass (i.e. loss) of the containment barrier. Therefore this EAL is acceptable.

Deviation #9

Fission Product Barrier -- Potential loss of Containment on explosive mixture

The NUMARC/NESP-007 EAL for the potential loss of the containment barrier based on explosive concentration is:

Explosive mixture exists

The corresponding Perry EAL is:

Intentional venting of Containment required per PEI-M51/M56

and is indicative of the loss, rather than potential loss, of containment.

The licensee states that intentional venting per PEI-M51/M56 is required at the combustible gas limits and therefore this EAL threshold is equivalent to the NUMARC/NESP-007 EAL (but is indicative of the loss of containment due to the intentional venting which occurs). This deviation is acceptable.

Deviation #10

Toxic or Flammable Gas EAL

The NUMARC/NESP-007 guidance specifies the following EAL under IC HU3:

Report or detection of toxic or flammable gases that could enter within the site area boundary in amounts that can affect normal operation of the plant.

The corresponding Perry EAL (MUI) deviates from NUMARC/NESP-007 EAL HU3 by restricting the applicability of the EAL to the protected area boundary instead of the site area boundary. The justification for this deviation is that releases that do not affect the protected area would not impact normal operation of the plant. This deviation is acceptable.

Deviation #11

NUMARC/NESP-007 EAL SU5

RCS Leakage

The NUMARC/NESP-007 guidance specifies the following EAL under IC SU5:

The following conditions exist:

- a. Unidentified or pressure boundary leakage greater than 10 gpm.*
- OR*
- b. Identified leakage greater than 25 gpm.*

The corresponding Perry EAL is:

Greater than 10 gpm unidentified leakage in Drywell

or

Greater than 30 gpm total leakage in Drywell averaged over the previous 24 hour period

or

Greater than 30 gpm total leakage in Drywell and greater than 2 gpm increase in unidentified leakage within the previous 24 hour period

The Perry EAL deviates from the NUMARC/NESP-007 guidance by specifying different limits for identified leakage and not including an EAL for pressure boundary leakage. The licensee states that pressure boundary leakage is equivalent to unidentified leakage in accordance with the Perry technical specification. Furthermore, the licensee states that the use of the 30 gpm limit averaged over 24 hours in conjunction with a 2 gpm increase is consistent with the Perry technical specifications and is an appropriate

threshold for indication of the potential degradation in the level of safety of the plant. This deviation is acceptable.

Deviation #12

ATWS EAL

The NUMARC/NESP-007 guidance specifies the following EAL under IC SS2:

(Site-specific) indications exist that automatic and manual scram were not successful

The corresponding Perry EAL is:

Following automatic actuations of either of the following "shutdown under all conditions without boron" has not been obtained:

- RPS
- RRCS

and

1. *Manual operator actions taken at 1H13-P680 to insert control rods were NOT successful in lowering Reactor power to less than 4% or*
2. *Reactor Power CANNOT be determined or*
3. *Suppression Pool temperature is greater than 110 °F*

The licensee states that the last three conditions of this EAL provide readily apparent indication of a situation where the reactor is producing more heat than the maximum decay heat load for which the safety systems are designed. This is consistent with the basis for the corresponding NUMARC/NESP-007 EAL and, therefore this EAL is acceptable.

Deviation #13

EAL for Loss of Function to Achieve Hot Shutdown

The NUMARC/NESP-007 guidance specifies the following IC and EAL under IC SS2:

Complete loss of function needed to achieve HOT SHUTDOWN

1. *Complete loss of any (site-specific) function required for hot shutdown*

The corresponding Perry IC and EAL are:

Complete loss of function needed to achieve COLD SHUTDOWN

*RHR Loops A and B are NOT capable of lowering RPV temperature
and
Suppression Pool temperature is above the HCL*

The Perry IC deviates by referencing the inability to achieve cold shutdown rather than the inability of achieving hot shutdown. The licensee justified this deviation by noting that for a BWR, entering Hot Shutdown merely requires placing the reactor mode switch in shutdown. The

NUMARC/NESP-007 guidance addresses complete loss of functions, including heat removal and reactivity control. The licensee's EAL is indicative of the complete loss of the decay heat removal function. The licensee has a separate EAL which covers the loss of reactivity control. This EAL meets the intent of the NUMARC/NESP-007 guidance and therefore is acceptable.

Deviation #14

NUMARC/NESP-007 EAL SS5

Loss of Water
Level

The NUMARC/NESP-007 guidance includes the following EAL under IC SS5 (applicable in Cold Shutdown, and Refueling modes):

Loss of RPV water level indicated by:

*loss of all decay heat removal cooling as indicated by (site-specific)
procedure
and
(site-specific) indication that the core is or will be uncovered*

The corresponding Perry EAL (which is applicable in Power Operations, Start Up, Hot Shutdown, Cold Shutdown, and Refueling modes) is:

RPV water level CANNOT be maintained greater than 0"

AND

Reactor is "shutdown under all conditions without boron"

The licensee deviates from the NUMARC/NESP-007 guidance by: (1) not including the condition of "loss of all decay heat removal cooling as indicated by (site-specific) procedure," (2) including the condition "shutdown under all conditions without boron," and (3) being applicable in three additional modes of operation. The licensee did not include the condition "loss of all decay heat removal cooling as indicated by (site-specific) procedure" because the inability to keep the core covered is, in itself, a loss of decay heat removal cooling capability. The licensee expanded the mode applicability to ensure consistency with the Fission Product Barrier matrix for declaration of a Site Area Emergency based upon RPV level. The licensee included the condition "shutdown under all conditions without boron" because RPV level is intentionally lowered during an ATWS to reduce power level in accordance with plant procedures and the licensee's EAL scheme includes an EAL which specifically addresses ATWS conditions. These deviations are acceptable.

Site-specific Addition #1

Radioactive effluent monitor EAL

The Perry EAL scheme included the following EAL under the IC "Any Unplanned Release of Gaseous Radioactivity to the Environment that Exceeds 200 Times ODCM Control Limit for 15 Minutes or Longer:"

Portable survey instruments indicated radiation levels of greater than 10 mRem/hr at the Site Boundary for greater than or equal to 15 minutes

This EAL was not specified in the NUMARC/NESP-007 guidance but is an

appropriate indication of the initiating condition. Therefore, this EAL is acceptable.

Site-specific Addition #2

Fission Product Barrier -- Potential Loss of Fuel Clad based on Water Level

The Perry EAL scheme includes the EAL "RPV level cannot be determined" as a site-specific EAL for the potential loss of the fuel clad barrier. This was not included in the NUMARC/NESP-007 scheme. The licensee states that when the RPV water level cannot be determined, the plant operators are directed to attempt to establish RPV flooding conditions with the assumption that RPV water level is below the top of active fuel, and therefore, this condition is consistent with the fuel clad challenge criteria. This site-specific EAL is acceptable.

Site-specific Addition #3

Fission Product Barrier -- site specific addition for loss of RCS

The Perry EAL scheme included the following site-specific EALs for the loss of the RCS barrier:

A. *SRV stuck open or an SRV is being cycled to control RPV pressure*
AND
Sample activity is equal to or greater than 300 μ Ci/gm dose equivalent Iodine-131

B. *Emergency Depressurization is required*

The first of these EALs is indicative of the bypassing (unintentionally in the case where the SRV is stuck open or intentionally if the SRV is being cycling) of the RCS with fuel damage. This condition is indicative of the loss of two fission product barriers. This EAL is used as indication of the loss of the RCS barrier and an EAL based upon 300 μ Ci/gm dose equivalent iodine-131 is used as an indication of the loss of the fuel clad barrier EAL. Therefore, this site-specific EAL is acceptable.

The second of these EALs "emergency depressurization is required" is indicative of the loss of the RCS because the EOP for performing the intentional depressurization specifies that the SRVs should remain open until the emergency no longer exists. Therefore, this site-specific EAL is acceptable.

Site-specific Addition #4

Fission Product Barrier -- Site-specific addition for potential loss of Containment

The licensee added the following EAL as a site-specific indication of the potential loss of the containment barrier.

In the UNSAFE region on the HCL figure

Entry into the UNSAFE region indicates that the suppression pool temperature is above the heat capacity temperature limit or below the heat capacity level

limit. Either of these conditions are indicative of an increased potential for the loss of containment during an event. Therefore the addition of this EAL as an indication of the potential loss of containment is acceptable.

Site-specific Addition #5

High Winds Unusual Event EAL

The Perry EAL scheme included the following site-specific Unusual Event EAL under the IC of Natural and Destructive Phenomena Affecting the Protected Area:

High sustained winds greater than 70 mph for equal to or greater than 15 minutes

The licensee states that high sustained winds in excess of 70 mph is a potentially destructive phenomenon that may accompany certain events such as a tornado, hurricane, or unstable weather conditions and represents a potential degradation in the level of safety of the plant. Therefore, declaration of an Unusual Event for this type of event is appropriate. This site-specific EAL is acceptable.

Site-specific Addition #6

Internal Flooding EAL

The Perry EAL scheme included the following site-specific Alert EAL under the IC "Natural and Destructive Phenomena Affecting the Protected Area:"

Greater than PEI-N11 Maximum Safe Operating Value for Area Water Level (internal flooding)

The licensee states that the Maximum Safe Operating Value for Area Water Level, as defined in PEI-N11, is used to quantify the magnitude and significance of plant internal flooding and is based on equipment qualification. Internal flooding which may effect equipment operability represents a potential substantial degradation of the level of safety of the plant. Therefore this site-specific EAL is acceptable.

4.0 CONCLUSION

With one exception the proposed EAL changes for the Perry Nuclear Power Plant are consistent with the guidance in NUMARC/NESP-007, with variations as identified and accepted in this review, and, therefore, meet the requirements of 10 CFR 50.47(b)(4) and Appendix E to 10 CFR Part 50. The exception is the EAL for the loss of the containment barrier as indicated by failure of a containment penetration to isolate with existence of a pathway to the environment. This EAL includes a footnote (number 2) which indicates that the containment is not considered lost if the pathway to the environment is through the normal process stream or with normal filtration intact. The staff considers this footnote to be an inappropriate deviation from the NUMARC/NESP-007 guidance. Removal of this footnote will make the EAL acceptable. Alternatively, the licensee may provide additional justification for this deviation or submit a revised EAL for NRC approval.

Principal Contributor: J. O'Brien, PERB/NRR

Date: January 27, 1997