ArevaEPRDCPEm Resource

From: BRYAN Martin (EXT) [Martin.Bryan.ext@areva.com]
Sent: Friday, March 26, 2010 5:39 PM
To: Tesfaye, Getachew
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); PANNELL George L (AREVA NP INC); WILLIFORD Dennis C (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 300, FSAR Ch. 16 OPEN ITEM
Attachments: RAI 300 Response US EPR DC.pdf

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information RAI 300. The attached file, "RAI 300 Response US EPR DC.pdf" provides technically correct and complete responses to 2 of the 6 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 16-310.

The following table indicates the respective pages in the response document, "RAI 300 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 16 — 310	2	3
RAI 16 — 311	4	9
RAI 16 — 312	10	11
RAI 16 — 313	12	16
RAI 16 — 314	17	17
RAI 16 — 315	18	23

A complete answer is not provided for 4 of the 6 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 16 — 311	May 3, 2010
RAI 16 — 312	May 3, 2010
RAI 16 — 313	May 3, 2010
RAI 16 — 314	May 3, 2010

Sincerely,

Martin (Marty) C. Bryan
Licensing Advisory Engineer
AREVA NP Inc.
Tel: (434) 832-3016
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, November 19, 2009 5:49 PM
To: ZZ-DL-A-USEPR-DL
Cc: Le, Hien; DeMarshall, Joseph; Kowal, Mark; Hearn, Peter; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 300 (3730,3742),FSAR Ch. 16 OPEN ITEM

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on September 23, 2009, and discussed with your staff on November 18, 2009. Draft RAI Question 16-311 was revised as a result of that discussion to request a revised response to RAI 16-199. The questions in this RAI are OPEN ITEMs in the safety evaluation report for Chapter 16 for Phases 2 and 3 reviews. As such, the schedule we have established for your application assumes technically correct and complete responses prior to the start of Phase 4 review. For any RAI that cannot be answered prior to the start of Phase 4 review, it is expected that a date for receipt of this information will be provided so that the staff can assess how this information will impact the published schedule.

Thanks,

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 1267

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB7105AD7EE7)

Subject: Response to U.S. EPR Design Certification Application RAI No. 300, FSAR Ch. 16 OPEN ITEM
Sent Date: 3/26/2010 5:38:45 PM
Received Date: 3/26/2010 5:38:56 PM
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Files	**Size**	**Date & Time**
MESSAGE	2607	3/26/2010 5:38:56 PM
RAI 300 Response US EPR DC.pdf	151711	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Response to

Request for Additional Information No. 300, (3730, 3742), Revision 0

11/19/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 16 - Technical Specifications
Application Section: FSAR Chapter 16

QUESTIONS for Technical Specification Branch (CTSB)

Question 16-310:

OPEN ITEM

Follow-up to RAI Question 16-126

The EPR GTS, Section 4.3, contains bracketed information and a Reviewer's Note regarding the new and spent fuel storage rack final design that is to be provided by potential EPR applicants for construction permits or COLs. Also during its review, the staff noted that the assembly pitch provided in the EPR GTS, Paragraph 4.3.1.1.c does not match the values provided in the spent fuel pool criticality topical report, UN-TR-08-001P. In RAI 16-126 the applicant was asked to provide clarification on the difference. In its response letter dated November, 2008, the applicant stated the storage rack parameters cited in UN-TR-08-001P are site specific and therefore are not appropriate for inclusion in the EPR GTS. However, in recent developments associated with reviews of combined operating license (COL) applications that reference the EPR certified design, COL applicants has indicated that the final design details of the fuel storage racks as provided in UN-TR-08-001P will be incorporated as part of the EPR certified design and will no longer be considered as a COL item. If Areva agrees with the proposed plan by COL applicants, relevant information in UN-TR-08-001P should be incorporated in the EPR FSAR Section 9.1 and the EPR GTS and Bases. This is identified as Open Item 16-126.

Response to Question 16-310:

As noted in the responses to RAI 84, Supplement 5 Question 09.01.02-3, RAI 204, Supplement 3 Question 09.01.01-19, and RAI 230, Supplement 4, Question 14.03.02-21, AREVA NP has selected a fuel rack designed by AREVA Transnuclear (TN) for the design certification of the U.S. EPR. These fuel racks are described in Report TN-Rack.0101 which was submitted via letter NRC:09:117 from Sandra Sloan to the U.S. NRC Document Control Desk on December 8, 2009.

U.S. EPR Tier 2, Chapter 16 Technical Specifications 3.7.15, 3.7.16, 4.3 and corresponding Bases will be revised to delete COL items related to the fuel racks and to incorporate the applicable details of the TN fuel racks.

U.S. EPR Tier 2, Chapter 16 Technical Specification 3.7.16 will be revised to limit storage of new and irradiated fuel in the Region 2 fuel racks that do not meet the enrichment and burnup criteria of Figure 3.7.16-1 to a checkerboard pattern. This is potentially more restrictive than noted in U.S. EPR FSAR Tier 2, Section 9.1.2.2.2 and in the response to RAI 84, Supplement 5, Question 09.01.02-3. Section 9.1.2.2.2 will be revised to reflect this restriction.

In addition, other corrections are being made to U.S. EPR FSAR Tier 2, Section 9.1:

1. The design bases for criticality safety in Section 9.1.1.1 are being revised to clarify that several of the k-effective values must not exceed the defined limit, rather than being less than the defined limit. These changes are being made to be consistent with the requirements as stated in 10 CFR 50.68(b) and with the Report TN-Rack.0101.
2. In Section 9.1.1.3, the administrative safety margin of the upper subcritical limit is being corrected due to a typographical error from "0.05" to "0.005".
3. In Section 9.1.2.2.2, the boron concentration required for subcriticality for spent fuel will be revised from a natural boron concentration of 1100 ppm (used for analyses purposes) to an equivalent enriched boric acid value of 582 ppm (boron isotopically enriched to ≥ 37 percent B-10) for consistency with other reported boron concentrations in the FSAR.

U.S. EPR FSAR Tier 2, Section 15.10 discusses a boron dilution event in the spent fuel pool. Section 15.10 will be revised to indicate that the discussion of a boron dilution event in the spent fuel pool is relocated to Section 9.1.1.

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 9.1.1.1, 9.1.1.3, 9.1.2.2.2, 15.10, and Chapter 16 (Technical Specifications and Technical Specification Bases) will be revised as discussed in the response and indicated on the enclosed markup

Question 16-311:

OPEN ITEM

Provide the additional information and update the following RAI responses for each of the Instrumentation System Tech Spec items identified, based on the results of Audit Meetings between AREVA NP and NRC Staff on 7/30/09, 7/31/09, 8/13/09 and 8/14/09.

Request for Additional Information No. 103 (1270)

16-129

a) Condition C, Required Action C.2 guidance and associated Bases changes.

b) Bases clarification associated with signal processor discussion.

c) Use of “division” rather than “subsystem” in ALU Bases discussion.

16-130

Editorial corrections for misspelling of the word “actuation” in Protection System (PS) Bases B 3.3.1.

16-131

a) Condition V Required Action guidance.

b) Condition V Bases clarification.

c) Condition U applicability.

d) Corrections associated with RCCA Position Indication and RCCA Bottom Position Indication.

16-138

a) Numerous discrepancies associated with Bases discussions describing Permissive signal capabilities.

b) Inconsistency between footnote (i) in Table 3.3.1-2 which states “Below 10% RTP,” and Permissive P6 description in FSAR Section 7.2.1.3.4 which states “P6 permissive is representative of core thermal power above a low-power setpoint value (10 percent power) corresponding to the boundary between the operating ranges of the IRDs and the PRDs.”

c) Table 3.3.1-2 discrepancy associated with the CONDITION specified for ESFAS Function B.1.

16-141

a) Bases enhancements to ensure information accuracy and consistency.

b) Revision to FSAR Section 7.2.1.2.14 to address inconsistencies between the FSAR and Bases regarding postulated accidents/AOOs.

16-144

Table 3.3.1-1 discrepancy associated with the CONDITION specified for Hot Leg Temperature (WR).

16-145

a) Extraneous information regarding Operability included in Permissive P6 Bases discussion.

b) Bases clarification regarding Permissive P16 Reactor Coolant Pump (RCP) operational requirements.

c) Apparent omission of RCP Current sensors in Permissive P16 Bases.

d) Explanation regarding Intermediate Range sensor mode applicability. Applicable modes specified for the Intermediate Range sensors in Table 3.3.1-1 and the Bases are 1, 2, and 3 with the Reactor Control, Surveillance and Limitation (RCSL) System capable of withdrawing an RCCA or one or more RCCA's not fully inserted. Mode 1 applicability for Intermediate Range sensors is typically ≤ 10% RTP.

16-147

a) Discrepancy regarding use of "and" versus "or" in Pressurizer Pressure (NR) Bases discussion associated with Mode Applicability.

b) Discrepancy regarding use of "and" versus "or" in Permissive P12 Bases discussion associated with Mode Applicability.

c) Permissive P12 Bases does not specify all of the affected functions that are automatically activated when Pressurizer Pressure rises above the P12 Permissive value.

d) Bases clarification regarding use of the word "ensures" in Permissive P12 Bases discussion associated with the transition from Hot Shutdown to Cold Shutdown.

e) Bases clarification regarding reference to "Increase in reactor coolant inventory" in Low DNBR Bases discussion associated with Anticipated Operational Occurrences.

f) Pressurizer Pressure (NR) instrumentation mode applicability. Apparent inability of Pressurizer Pressure (NR) instrumentation (1615 – 2515 psia) to support Permissive P12 Operability in Mode 4 with P15 inhibited.

16-149

a) Table 3.3.1-2 mode applicability footnotes for Functions B.3.c, B.11.b and B.11.c.

b) Table 3.3.1-1 mode applicability footnotes for Sensor A.23.

16-150

a) Bases discrepancies regarding references to Cold Shutdown.

b) Discrepancy regarding use of "and" versus "or" in Function B.3.b Bases discussion associated with Mode Applicability.

c) Bases discrepancy regarding use of the word “automatically” to describe the capability of Permissive P15 to disable Function B.3.b.

d) Revision to FSAR Section 7.3.1.2.1 to address inconsistencies between the FSAR and Bases regarding postulated accidents/AOOs.

16-151

Discrepancy in the RAI response regarding use of the word “automatically” to describe the capability of Permissive P15 to disable Function B.3.b.

16-153

Revision to FSAR Section 7.3.1.2.9 to address inconsistencies between the FSAR and Bases regarding Safeguards Building HVAC reconfiguration.

16-154

Table 3.3.1-1 mode applicability requirements necessary for Sensors A.7 and A.8 to support Table 3.3.1-2 ESF Function B.9.a.

16-162

a) Bases discrepancy regarding the reference to Function B.3.c.

b) Bases discrepancy regarding use of the word “automatically” to describe the capability of Permissive P14 to enable Function B.5.

c) Discrepancy regarding use of “and” versus “or” in Bases discussion describing the capability of Permissive P14 to enable Function B.5.

16-166

Bases enhancements to ensure information accuracy and consistency.

16-167

Bases enhancements to ensure information accuracy and consistency.

16-169

a) Discrepancy regarding the apparent omission of Bases text associated with the isolation of “low load lines.”

b) Relocation of information to enhance Bases presentation.

16-174

a) Inconsistent use of “SSS Feedwater Isolation” in the Bases.

b) Discrepancy regarding the reference to “16-171” in the markup associated with Question 16-174.

16-180

a) Inconsistent use of footnote (f) in Table 3.3.1-1 for Sensor A.6.

b) Discrepancy regarding the applicable modes specified for Sensor A.6 in Table 3.3.1-1, and those necessary for Sensor A.6 to support Permissive P17 in the modes specified in Table 3.3.1-2.

16-182

a) Description inaccuracies associated with Functions B.11.b, B.11.c and B.11.d.

b) Table 3.3.1-2 footnote presentation associated with footnotes (b) and (c) for Functions B.11.c, B.11.d, A.1.a, A.1.b, A.1.c, A.1.d, A.1.e, and A.2.

c) Bases clarification regarding Permissive P7 Reactor Coolant Pump (RCP) operational requirements.

16-185

Contradiction between the FSAR and RCOLA/SCOLAs regarding the LTSP/Setting Basis value for Function B.11.b in Table 3.3.1-2. RAI response states that the LTSP for Function B.11.b is a fixed value. Departure Item 4 in “Part 4 - Technical Specifications and Bases,” of the BBNPP SCOL Application states that the Setting Basis for B.11.b is a cycle-specific parameter value specified in the COLR. CCNPP Reference COL also specifies Function B.11.b Setting Basis as a cycle-specific value residing in the COLR.

16-190

a) Ambiguities associated with RCS Loop Flow sensor Operability requirements in Bases Table B 3.3.1-1 (3 of 4 per division and per loop) and Tech Spec Table 3.3.1-1 (3 per division and per loop) for Functions A.1, A.4 and A.5.

b) Ambiguities associated with RCS Loop Flow sensor Operability requirements in Tech Spec Table 3.3.1-1 (3 per division and per loop).

c) Ambiguities associated with RCP Current sensor Operability requirements in Bases Table 3.3.1-1 for Functions B.4 and Permissive P15.

d) Clarification regarding the number of required RCCA Position Indicators specified in Bases Table B 3.3.1-1 for Function A.1.

e) Clarification regarding the number of required RCCA Bottom Position Indicators in Bases Table B 3.3.1-1 for Permissive P8.

f) Clarification regarding the number of RCCA Units in Bases Table B 3.3.1-1 for Permissive P8.

g) Bases clarification regarding the Low Saturation Margin trip Bases text that states “[t]herefore, the Low Saturation Margin reactor trip function assures that the High Core Power Level trip Function remains valid.”

h) Clarification regarding the Table B 3.3.1-1 Bases discussion and the response to Question 16-190 which state “[i]n general, when a sensor becomes inoperable, the Acquisition and Processing Unit

(APU) that receives the signal from the sensor declares the functions supported by that sensor to be valid."

16-191

a) Table 3.3.1-1 footnote discrepancy associated with Modes 3, 4 and 5 for Actuation Device D.3.

b) Ambiguities associated with the first sentences of the Bases discussions for ACTIONS Q.1 and R.1.

16-193

a) Removal of all technical references associated with the Standard Technical Specifications (STS) regarding the basis and methodology for obtaining allocated sensor, signal processing/conditioning, and actuation logic response times for Protection System (PS) Instrumentation without providing comparable replacement references in the Bases for SR 3.3.1.10.

b) Discrepancy between the revised definition for SENSOR OPERATIONAL TEST (SOT) provided in the response to Question 16-243 of RAI 122, and the definition in Bases Section SR 3.3.1.5.

c) Discrepancy between the revised definition for CALIBRATION provided in the response to Question 16-243 of RAI 122, and the definition in Bases Section SR 3.3.1.6.

d) Potential discrepancies regarding the applicability of SR 3.3.1.8 to Sensors A.24 and A.25, and Manual Actuation Switch B.1 in Table 3.3.1-1.

16-194

Inconsistencies regarding use of the terms "channel" and "division" throughout the Protection System Bases B 3.3.1.

16-195

Discrepancy regarding the RAI Block reference associated with the FSAR Markup for Question 16-195 in Table 3.3.1-1.

16-198

RAI reference errors in the response to Question 16-198.

16-199

Revise RAI response.

16-200

Discrepancies regarding the reference to "ACTUATION" in SR 3.3.1.3 and SR 3.3.1.8.

16-203

Inaccuracies associated with the response to Question 16-203 regarding the statement "Boron dilution events are protected by the chemical and volume control system (CVCS) charging line isolation function of the anti-dilution mitigation (ADM) system."

16-204

Question 16-204 requested a technical justification regarding omission of the Overtemperature Delta T Reactor Trip function from the U.S.EPR GTS, LCO 3.3.1. The response to 16-204 was reviewed by the Reactor Systems Branch for concurrence. The Reactor Systems Branch was unable to confirm the RAI response on the basis of their review of ANP-10286P, Revision 0, US EPR Rod Ejection Accident Methodology Topical Report. The applicant is requested to provide a qualified determination to substantiate that the fuel is protected against the risk of departure from nucleate boiling during events that lead to a decrease in the DNBR value, in Mode 1 less than 10% power, and in Mode 2.

16-205

Question 16-205 requested a technical justification regarding omission of the Overpower Delta T Reactor Trip function from the U.S.EPR GTS, LCO 3.3.1. The response to 16-205 was reviewed by the Reactor Systems Branch for concurrence. The Reactor Systems Branch was unable to confirm the RAI response on the basis of their review of ANP-10286P, Revision 0, US EPR Rod Ejection Accident Methodology Topical Report. The applicant is requested to provide a qualified determination to substantiate that the fuel is protected against melting at the center of the fuel pellet during events which lead to an increase in the linear power density within the core, in Mode 1 less than 10% power, and in Mode 2.

16-207

Reviewer's Notes provided in the U.S. EPR GTS allowing the optional approach of specifying a yet to be defined Setpoint Control Program (SCP) Administrative Controls Tech Spec (TS), instead of placing brackets around a fully developed SCP Administrative Controls TS and Surveillance Requirement (SR) or table references to the SCP TS, do not satisfy 10 CFR 52.47(a)(11).

16-208

LCO reference omission from Reporting Requirements Section 5.6.3, CORE OPERATING LIMITS REPORT (COLR).

16-209

LCO reference omission from Reporting Requirements Section 5.6.4, Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR).

Response to Question 16-311:

A response to this question will be provided by May 3, 2010.

Question 16-312:

OPEN ITEM

Provide the additional information and update the following RAI responses for each of the Instrumentation System Tech Spec items identified, based on the results of Audit Meetings between AREVA NP and NRC Staff on 7/30/09, 7/31/09, 8/13/09 and 8/14/09.

Request for Additional Information No. 110 (1295)

16-212

a) Omission of Regulatory Guide 1.97 (Revision 4) and IEEE Standard 492-2002 from the Post Accident Monitoring (PAM) Instrumentation Bases B 3.3.2 REFERENCES Section.

b) NUREG-0737, Supplement1, "TMI Action Items," is listed in the PAM Instrumentation Bases B 3.3.2 REFERENCES Section, but is not included anywhere in the associated Bases. NUREG-0737 is referenced in the PAM Instrumentation Bases B 3.3.3 BACKGROUND Section of the WOG STS.

16-213

Response to Question 16-213 states that "the subject text is now bracketed as described in the response to Question 16-212." The response to Question 16-212 removes the current list of PAM Instrumentation and associated discussions from U.S. EPR FSAR Tier 2, Chapter 16 Technical Specifications Section 3.3.2, and U.S. EPR FSAR Tier 2, Chapter 16 Technical Specification Bases B 3.3.2. There does not appear to be any bracketed text associated with the response to Question 16-212.

16-217

a) Inconsistencies between Chapter 15 FSAR Tables 15.0-7 and 15.0-8 regarding the use of "Normal/Degraded" in the "Uncertainty" column header.

b) Clarification regarding Note 6 of Table 15.0-7 for the Low Saturation Margin trip which states "however, it is required to maintain the validity of the high core power level trip."

c) Clarification regarding use of the term "RT check-back" in Table 15.0-8 under the Main Feedwater Isolation Function.

d) Note information associated with the Steam Generator (SG) Pressure Drop setpoint, similar to Note 1 in FSAR Figure 7.2-18, is missing from FSAR Figure 7.3-17 for Startup and Shutdown System (SSS) Feedwater Isolation on SG Pressure Drop Function B.2.c.

e) Potential ambiguity associated with the bolding of initiating condition "SIS Actuation signal (Stage 1)" under the Containment Isolation Function in Table 15.0-8.

f) First paragraph of B 3.3.1 Bases text on page B 3.3.1-14 of Interim Revision 2 states that "credited functions are tabulated in FSAR Tables 15.0-7, 15.0-8, and 15.0-9." It does not appear that all functions specified in the referenced tables are actually credited.

16-219

Bases enhancement to ensure the accuracy and completeness of information.

16-223

Potential discrepancy regarding the response to Question 16-223 which states “the hardwired logic will be periodically tested as part of U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Surveillance Requirements (SR) 3.3.1.3 (for reactor trip functions) and 3.3.1.8 (for ESF functions).” SR 3.3.1.8 is currently specified for Sensors A.24, A.25, Manual Actuation Switches B.1, B.2, B.3, and Actuation Device D.1 in Table 3.3.1-1. Components A.25 and B.1 do not appear to be associated with ESF functions.

16-226

Potential discrepancy regarding the deletion of “manual actuation switches” from the second paragraph of Bases page B 3.3.1-15, Interim Revision 2.

16-227

The ≤ sign associated with the LTSP/Design Limit of 36.3 psia for Function B.9.c was not included in Table 3.3.1-2 of Interim Revision 2. The ≤ was incorporated into Revision 1 of the DCD and is specified in the FSAR Markup for RAI 110, Question 16-227.

16-234

a) Discrepancies regarding omission of the Note in SR 3.3.3.2 (NUREG-1431) from EPR GTS surveillance requirement SR 3.3.2.1, and deletion of the associated Bases discussion in EPR Bases Section SR 3.3.2.1.

b) Discrepancy regarding the omission of Bases text associated with Core Exit thermocouples in Bases Section SR 3.3.3.2 (NUREG-1431), from EPR Bases Section SR 3.3.2.1.

Response to Question 16-312:

A response to this question will be provided by May 3, 2010.

Question 16-313:

OPEN ITEM

Provide the additional information and update the following RAI responses for each of the Electrical Power System Tech Spec items identified, based on the results of Audit Meeting between AREVA NP and NRC Staff on 6/24/09.

Request for Additional Information No. 74 (953)

16-11

The applicant is requested to include mode restriction information in EPR Surveillance Requirement (SR) 3.8.1.10 and associated Bases section. EPR SR 3.8.1.10 omits bracketed NOTE 1 in WOG SR 3.8.1.10 which addresses mode restrictions associated with performance of the surveillance. EPR Bases omits discussion of the Note presented in the corresponding WOG Bases as well.

16-18

The applicant is requested to enhance the AC Sources - Operating Bases (B 3.8.1) discussion associated with Required Actions C.1 and C.2 in order to provide a clearer understanding of the ability of these actions to ensure the availability of sufficient standby AC sources to 1) power the minimum required ESF Functions, and 2) achieve completion of required safety functions following an AOO or postulated accident, regardless of which two diesels are inoperable.

16-22

The applicant is requested to include mode restriction information in EPR Surveillance Requirement (SR) 3.8.1.12 and associated Bases section. EPR SR 3.8.1.12 omits bracketed NOTE 2 in WOG SR 3.8.1.12 which addresses mode restrictions associated with performance of the surveillance. EPR Bases omits discussion of the Note presented in the corresponding WOG Bases as well.

16-23

a) The applicant is requested to include mode restriction information in EPR Surveillance Requirement (SR) 3.8.1.13 and associated Bases section. EPR SR 3.8.1.13 omits the bracketed NOTE in WOG SR 3.8.1.13 which addresses mode restrictions associated with performance of the surveillance. EPR Bases omits discussion of the Note presented in the corresponding WOG Bases as well.

b) Question 16-23 response states “this test is a logic function test that is performed without the EDG operating.” It appears that the test could actually be conducted with the EDG in service (i.e. during performance of LOP/LOCA testing IAW SR 3.8.1.18 for example), which is a common practice in the operating fleet. Designation of SR 3.8.1.13 as strictly a logic function test may be overly restrictive. In addition, there is no mention in the Bases of the test being a logic function test that is performed without the EDG operating. The applicant is requested to evaluate the testing strategy for SR 3.8.1.13 and make any necessary changes.

16-26

The applicant is requested to include mode restriction information in EPR Surveillance Requirement (SR) 3.8.1.9 and associated Bases section. EPR SR 3.8.1.9 omits bracketed NOTE 1 in WOG SR

3.8.1.9 which addresses mode restrictions associated with performance of the surveillance. EPR Bases omits discussion of the Note presented in the corresponding WOG Bases as well.

16-27

Inconsistencies exist throughout Technical Specifications and the FSAR regarding appropriate use of the words “Engineered Safety Features (ESF) Systems.” The response to Question 16-27 states “the systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no “Engineered Safety Features System” in the U.S EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable.” “Engineered Safety Features Systems” is cited throughout the FSAR. Section 7.3 of the FSAR for example, is titled “Engineered Safety Features Systems” and Chapter 15 includes references to ESF Systems. The applicant is requested to resolve the inconsistencies, clarify the response, and make any necessary changes.

16-29

a) The applicant is requested to correct an inaccuracy associated with the response to Question 16-29 regarding the reference to "Chapter 16, Technical Specifications Section 3.8.3, “Diesel Fuel Oil, Lube Oil, and Starting Air.” The indicated reference is not being revised as stated in the response and should be removed.

b) The applicant is requested to resolve inconsistencies identified in Bases B 3.8.3 regarding the Diesel Lube Oil System. The revision 1 Bases discussions associated with the fourth paragraph on page B 3.8.3-1 and SR 3.8.3.2 on page B 3.8.3-5 appear to contain conflicting information.

16-33

The applicant is requested to correct an inaccuracy associated with the response to Question 16-33 regarding the statement "The chemical and volume control system (CVCS) charging line isolation on anti-dilution mitigation (ADM) at shutdown conditions (reactor coolant pump (RCP) not operating) engineered safety feature (ESF) function is shown on U.S. EPR FSAR Tier 2, Figure 7.3-22." The CVCS charging line does not isolate on ADM.

16-36

Inconsistencies exist throughout Technical Specifications and the FSAR regarding appropriate use of the words “Engineered Safety Features (ESF) Systems.” The response to Question 16-36 references the response to 16-27 which states “the systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no “Engineered Safety Features System” in the U.S EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable.” “Engineered Safety Features Systems” is cited throughout the FSAR. Section 7.3 of the FSAR for example, is titled “Engineered Safety Features Systems” and Chapter 15 includes references to ESF Systems. The applicant is requested to resolve the inconsistencies, clarify the response, and make any necessary changes.

16-39

Inconsistencies exist throughout Technical Specifications and the FSAR regarding appropriate use of the words “Engineered Safety Features (ESF) Systems.” The response to Question 16-39 references the response to 16-27 which states “the systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no “Engineered Safety Features System” in the U.S EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable.” “Engineered Safety Features Systems” is cited throughout the FSAR. Section 7.3 of the FSAR for example, is titled “Engineered Safety Features Systems” and Chapter 15 includes references to ESF Systems. The applicant is requested to resolve the inconsistencies, clarify the response, and make any necessary changes.

16-40

a) CONDITION A of LCO 3.8.8, Inverters - Shutdown, states “one or more required inverters inoperable.” The applicant is requested to clarify what is meant by the word “required” in terms of operable inverters for the U.S. EPR Electrical System design and to evaluate the technical accuracy of CONDITION A and the REQUIRED ACTIONS specified, considering that 1) the wording associated with CONDITION A of comparable LCO 3.8.8 in the WOG STS is similar, and 2) the WOG design has two inverters per train (total of four inverters), whereas the EPR design has one inverter per division (total of four inverters). The response to Question 16-40 states that “two divisions of Class 1E power are required to mitigate the consequences of an accident or an anticipated operational occurrence (AOO) in cold shutdown or refueling modes.”

b) The applicant is requested to correct an inaccuracy associated with the response to Question 16-40 regarding the statement "The chemical and volume control system (CVCS) charging line isolation on anti-dilution mitigation (ADM) at shutdown conditions (reactor coolant pump (RCP) not operating) engineered safety feature (ESF) function is shown on U.S. EPR FSAR Tier 2, Figure 7.3-22." The CVCS charging line does not isolate on ADM.

16-42

Inconsistencies exist throughout Technical Specifications and the FSAR regarding appropriate use of the words “Engineered Safety Features (ESF) Systems.” The response to Question 16-42 references the response to 16-27 which states “the systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no “Engineered Safety Features System” in the U.S EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable.” “Engineered Safety Features Systems” is cited throughout the FSAR. Section 7.3 of the FSAER for example, is titled “Engineered Safety Features Systems” and Chapter 15 includes references to ESF Systems. The applicant is requested to resolve the inconsistencies, clarify the response, and make any necessary changes.

16-43

Inconsistencies exist throughout Technical Specifications and the FSAR regarding appropriate use of the words “Engineered Safety Features (ESF) Systems.” The response to Question 16-43 references the response to 16-27 which states “the systems that perform the ESF functions (e.g., emergency

feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no “Engineered Safety Features System” in the U.S EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable.” “Engineered Safety Features Systems” is cited throughout the FSAR. Section 7.3 of the FSAR for example, is titled “Engineered Safety Features Systems” and Chapter 15 includes references to ESF Systems. The applicant is requested to resolve the inconsistencies, clarify the response, and make any necessary changes.

16-46

The applicant is requested to enhance the AC Sources - Shutdown Bases (B 3.8.2) LCO discussion regarding the requirement for two diesels to reside within the same divisional pair, as opposed to one Operable EDG residing in each of two separate divisional pairs. The referenced Bases section does not currently address the potential inability of two emergency diesels in separate divisional pairs to supply the necessary electrical power for the various combinations of subsystems, equipment, and components required Operable by LCO 3.8.10 with the alternate feeds not aligned. This is relevant information which needs to be captured in the Bases.

16-49

a) The applicant is requested to include applicable WOG B 3.8.2 LCO Bases information associated with automatic load sequencing, in the EPR B 3.8.2 LCO Bases Section. The proper sequencing of loads (even though achieved through the Protection System) ensures that sufficient time exists for the diesel to restore voltage and frequency before the next load is applied. As such, load sequencing has the potential to affect diesel operability.

b) The applicant is requested to evaluate the technical accuracy of the EPR B 3.8.1 LCO Bases statement on page B 3.8.1-4 that reads “proper sequencing of loads is a required function for EDG OPERABILITY.” It appears that the bracketed phrase “including tripping of nonessential loads” in the comparable WOG B 3.8.1 LCO Bases statement, may be applicable to the referenced EPR Bases statement as well, on the basis of EPR surveillance requirement SR 3.8.1.11.b which verifies load shedding from the emergency buses on either an actual or simulated loss of offsite power signal.

16-51

The applicant is requested to enhance the Distribution Systems - Operating Bases (B 3.8.9) LCO discussion regarding the ability of redundant equipment with divisional pairs to maintain safety-related functional capabilities when alternate power feed cross tie breakers are closed. The Bases does not adequately describe the capabilities of the inter-divisional alternate feed protection and coordination scheme to provide protection so that a fault on one division does not degrade the other division below an acceptable level with a tie breaker closed.

16-53

U.S. EPR safety analysis assumptions are satisfied with three operable EDGs and the alternate feed established. The divisional pair concept in application of implementing the alternate feed provides a standby source of power to safety-related components when an EDG is out of service. By maintaining divisional pairs physically and electrically separate, and selecting diverse power sources between the divisional pairs to accomplish required safety functions, the electrical distribution contains the required independence and redundancy to perform the required safety functions assuming a single failure.

Although the alternate feed alignment is not a temporary modification in that it is part of the actual design, the referenced condition is not the normal alignment and is aligned when in a Tech Spec Action Statement that is intended to be temporary. CTSB requested the Electrical Engineering Technical Branch (EEB) review the 120-day Required Action Time for concurrence.

EEB raised the following concerns based on their review:

In RAI No. 11, Question 08.03.01-13, the staff expressed that the 120-day completion time currently specified for LCO 3.8.1, REQUIRED ACTION B.5, for restoration of a single inoperable diesel is excessive. In the response to RAI No. 11, Question 08.03.01-3, the applicant stated that the alternate feed configuration will be used only during specific maintenance activities, and cited EDG maintenance as an example. Provide a detailed list of maintenance activities that would require a EDG to be out of service for a period of 120 days, the associated maintenance time needed for each activity, and state that how frequently those maintenance activities will be needed (e.g., every 10 years). In addition, provide what type of compensatory measures would be in effect during the 120 days, and what control configuration management would be in place for an additional EDG failure. The applicant is requested to provide the additional information necessary to assure the staff that use of the alternate feed configuration required to support EDG maintenance will be infrequent.

Response to Question 16-313:

A response to this question will be provided by May 3, 2010.

Question 16-314:

OPEN ITEM

Provide the additional information and update the following RAI response for the Electrical Power System Tech Spec item identified, based on the results of Audit Meeting between AREVA NP and NRC Staff on 6/24/09.

Request for Additional Information No. 110 (1331)

16-237

a) FSAR Markup for AC Sources - Operating Bases B 3.8.1, SURVEILLANCE REQUIREMENTS, states “this value allows for a combined variation in voltage and frequency of 60% when considering voltage drop to the terminals of 6600 V motors whose minimum operating voltage is specified as 90% or 5940 V.” The combined variation in voltage and frequency should be 10% instead of 60%.

b) FSAR Markup for AC Sources - Operating Bases B 3.8.1, SURVEILLANCE REQUIREMENTS, specifies “NEMA MG 1-2006 (Ref. 1).” The Reference number should be 11 instead of 1.

Response to Question 16-314:

A response to this question will be provided by May 3, 2010.

Question 16-315:

OPEN ITEM

Provide the additional information and update the following RAI response for Post Accident Monitoring (PAM) Instrumentation Tech Spec 3.3.2.

Request for Additional Information No. 110 (1295)

16-212

The response to Question 16-212 removes the current list of PAM Instrumentation and associated discussions from U.S. EPR FSAR Tier 2, Chapter 16 Technical Specifications Section 3.3.2, and U.S. EPR FSAR Tier 2, Chapter 16 Technical Specification Bases B 3.3.2, on the basis that PAM variable selection criteria in RG 1.97, Rev. 4, depend on prior development of Emergency Procedure Guidelines (EPGs), Emergency Operating Procedures (EOPs), and Abnormal Operating Procedures (AOPs) (guidelines and procedures that cannot be completed prior to COL issuance).

The staff has reviewed its current position, as stated in the STS Reviewer's Note, regarding which accident monitoring instrumentation should be in technical specifications, in comparison to Regulatory Guide 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," Revision 4, June 2008. It is the NRC staff's position that technical specifications should include (1) all Regulatory Guide 1.97, Revision 4, Type A instruments, and (2) all Regulatory Guide 1.97, Revision 4, Type B and Type C instruments in accordance with the unit's Regulatory Guide 1.97 Safety Evaluation Report. Therefore, a COL applicant should include a technical specification that meets this staff position if the applicant references Regulatory Guide 1.97, Revision 4.

Identification of Regulatory Guide 1.97, Revision 4, Type A, Type B, and Type C accident monitoring instrumentation functions depends on development of emergency operating procedures (EOPs) and abnormal operating procedures (AOPs), which is a post-COL activity. Therefore COL applicants implementing Regulatory Guide 1.97, Revision 4, should use guidance from DC/COL-ISG-8, "Necessary Content of Plant-Specific Technical Specifications When a Combined License Is Issued," December 2008, in order to complete the plant-specific technical specification list of PAM instrumentation functions. This guidance provides three options:

Option 1 involves the use of plant-specific information. Option 1 appears impracticable for PAM instrumentation technical specifications because the list of Type A, Type B, and Type C PAM instrumentation functions cannot be finalized before COL issuance.

Option 2 involves the use of useable bounding information. Option 2 may be practical if the COL applicant is able to develop a truly bounding list of Type A, Type B and Type C PAM instrumentation functions to be included in the plant-specific technical specifications. However, if a Regulatory Guide 1.97, Revision 4, analysis considering plant-specific EOPs and AOPs, which are based on the as-built plant, shows that additional PAM instrumentation functions are necessary, then the COL holder would need to request a license amendment to make changes to the plant-specific technical specification PAM instrumentation required functions list. The NRC would need to approve this amendment before the COL holder would be allowed to load fuel.

Option 3 involves an administrative program to control PAM instrumentation functions. Option 3 would require establishing a plant-specific administrative controls program technical specification that would require using an NRC-approved methodology to determine the required PAM instrumentation

functions, and maintaining the list of required PAM instrumentation functions in a specified document with appropriate regulatory controls. Option 3 may be practical because the approved methodology, Regulatory Guide 1.97, Revision 4, is already established, and FSAR Section 7.5.2.2.1 already commits the COL holder to establish a list of all types of PAM instrumentation. This approach is advantageous because COL holders would not necessarily need to request a license amendment to make changes to the PAM instrumentation required functions list post COL. However, the program technical specification would need to be developed prior to COL issuance.

The applicant is requested to propose changes as described in the Attachment 1.

Attachment 1

The standard technical specifications (STS) for Westinghouse pressurized water reactors (PWRs) include a specification, STS 3.3.3, to govern post-accident monitoring (PAM) instrumentation. The bases for STS 3.3.3, which is based on Regulatory Guide 1.97, Revision 3, state:

> PAM instrumentation that meets the definition of Type A in Regulatory Guide 1.97 satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii). Category 1, non-Type A, instrumentation is retained in the Technical Specifications because it is intended to assist operators in minimizing the consequences of accidents. Therefore, these Category 1, non-Type A variables are important for reducing public risk.

STS 3.3.3 contains a Reviewer's Note for applicants or licensees who propose to incorporate STS 3.3.3 into their plant's technical specifications. The Note requires replacing the bracketed list of PAM functions in STS Table 3.3.3-1 with a list of all Regulatory Guide 1.97 Type A instruments, and the Category 1, non-Type A instruments specified in the plant's Regulatory Guide 1.97 Safety Evaluation Report.

STS 3.3.3 and bases, and the STS Table 3.3.3-1 Reviewer's Note are based on the May 9, 1988, T.E. Murley (NRC) to R. A. Newton (Westinghouse Owners' Group) letter, which presented the NRC staff position regarding which accident monitoring instrumentation must be in technical specifications. This letter is known as the "Split Report."

The staff has reviewed its current position, as stated in the STS Reviewer's Note, regarding which accident monitoring instrumentation should be in technical specifications, in comparison to Regulatory Guide 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," Revision 4, June 2008. It is the NRC staff's position that technical specifications should include (1) all Regulatory Guide 1.97, Revision 4, Type A instruments, and (2) all Regulatory Guide 1.97, Revision 4, Type B and Type C instruments in accordance with the unit's Regulatory Guide 1.97 Safety Evaluation Report. Therefore, a COL applicant should include a technical specification that meets this staff position if the applicant references Regulatory Guide 1.97, Revision 4.

Identification of Regulatory Guide 1.97, Revision 4, Type A, Type B, and Type C accident monitoring instrumentation functions depends on development of emergency operating procedures (EOPs) and abnormal operating procedures (AOPs), which is a post-COL activity. Therefore COL applicants implementing Regulatory Guide 1.97, Revision 4, should use guidance from DC/COL-ISG-8, "Necessary Content of Plant-Specific Technical Specifications When a Combined License Is Issued," December 2008, in order to complete the plant-specific technical specification list of PAM instrumentation functions. This guidance provides three options:

- Option 1 involves the use of plant-specific information. Option 1 appears impracticable for PAM instrumentation technical specifications because the list of Type A, Type B, and Type C PAM instrumentation functions cannot be finalized before COL issuance.

- Option 2 involves the use of useable bounding information. Option 2 may be practical if the COL applicant is able to develop a truly bounding list of Type A, Type B and Type C PAM instrumentation functions to be included in the plant-specific technical

specifications. However, if a Regulatory Guide 1.97, Revision 4, analysis considering plant-specific EOPs and AOPs, which are based on the as-built plant, shows that additional PAM instrumentation functions are necessary, then the COL holder would need to request a license amendment to make changes to the plant-specific technical specification PAM instrumentation required functions list. The NRC would need to approve this amendment before the COL holder would be allowed to load fuel.

- Option 3 involves an administrative program to control PAM instrumentation functions. Option 3 would require establishing a plant-specific administrative controls program technical specification that would require using an NRC-approved methodology to determine the required PAM instrumentation functions, and maintaining the list of required PAM instrumentation functions in a specified document with appropriate regulatory controls. Option 3 may be practical because the approved methodology, Regulatory Guide 1.97, Revision 4, is already established, and DCD Section 7.5.2.2.1 already commits the COL holder to establish a list of all types of PAM instrumentation. This approach is advantageous because COL holders would not necessarily need to request a license amendment to make changes to the PAM instrumentation required functions list post COL. However, the program technical specification would need to be developed prior to COL issuance.

As noted above, NRC staff has concluded that accident monitoring instrumentation Type A, Type B and Type C, as defined Regulatory Guide 1.97, Revision 4, are similar to the Type A and the Category 1, non-Type A defined in Regulatory Guide 1.97, Revision 3. Since standard technical specifications (STS) for Westinghouse pressurized water reactors (PWRs) include a technical specification to govern post-accident monitoring (PAM) instrumentation, the staff concludes that requirements for PAM instrumentation must be included in the EPR generic technical specifications. The staff believes the following is an option for such a set of generic technical specification requirements:

(1) Revise Generic Technical Specification 3.3.2, “Post-Accident Monitoring (PAM) Instrumentation,” to include a table that specifies the required PAM functions (Table 3.3.2-1). The specified PAM functions should be consistent with Westinghouse Standard Technical Specification Table 3.3.3-1.

(2) Place brackets around Generic Technical Specification Table 3.3.2-1, which lists the required PAM functions.

(3) Add a Reviewer’s Note to Generic Technical Specification Table 3.3.2-1 to be consistent with Regulatory Guide 1.97, Revision 4, and the reviewer’s note for STS Table 3.3.3-1. Also add a second Reviewer’s Note to explain that in lieu of the table listing the PAM functions in the technical specifications, a COL applicant may adopt Specification 5.5.xx (as noted in item 6 below), and include the list of PAM instrumentation functions in a document as described in FSAR Section 7.5.2.2.1.

(4) Replace Generic Technical Specification Limiting Condition for Operation (LCO) 3.3.2 with:

> The [required number of channels of each] Type A, B, and C PAM instrumentation Function[s] [in Table 3.3.2-1] shall be OPERABLE.

(5) Make suitable conforming changes to the bases for Generic Technical Specification 3.3.2, consistent with the bases for STS 3.3.3. The LCO section of the bases for Generic Technical Specification 3.3.2 should contain bracketed discussions of the specified Type A, Type B, and Type C PAM instrumentation functions. Revise the Background and the Applicable Safety Analysis sections of the bases to also include discussions of PAM instrumentation types (Type A, B, and C).

(6) Establish a bracketed new specification in Generic Technical Specification Section 5.5 similar to the following model. This would enable COL applicants to choose Option 3 of DC/COL-ISG-8 to complete the technical specifications for PAM instrumentation without having to obtain an exemption from the generic technical specifications.

The following programs shall be established, implemented, and maintained.

[5.5.xx <u>Post-Accident Monitoring (PAM) Instrumentation Program</u>

This program provides controls to establish accident monitoring instrumentation functions that are required by Specification 3.3.2, "Post-Accident Monitoring (PAM) Instrumentation." These instrumentation functions shall be those designated as Type A, B, and C, as defined in Regulatory Guide (RG) 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," Revision 4, June 2006, and shall be listed in the PAM function list as described in FSAR Section 7.5.2.2.1. Changes to the list of Type A, B, and C functions shall be made in accordance with the provisions of 10 CFR 50.59 and RG 1.97, Revision 4.]

These recommendations result in a PAM instrumentation generic technical specification that includes a COL item. As discussed in DC/COL-ISG-8, a COL applicant may complete the plant-specific technical specification list of required PAM instrumentation functions either by using the bounding approach, Option 2, or by using the programmatic approach, Option 3, with a plant-specific technical specification administrative program requiring that the list of technical specification required PAM instrumentation functions be determined in accordance with an NRC approved methodology.

In the alternative, instead of each COL applicant having to choose an option to complete the PAM COL item, the technical specification administrative program approach (DC/COL-ISG-8, Option 3) could be implemented in the generic technical specifications. This approach would better promote standardization of PAM requirements in plant-specific technical specifications because the administrative program technical specification would be developed on a generic basis for the design center, instead of for each COL applicant. Also, since PAM requirements would no longer be a COL item, the guidance in DC/COL-ISG-8 would not apply, and COL applicants could incorporate by reference the generic administrative program technical specification for PAM instrumentation into the plant-specific technical specifications. Therefore, Areva is requested to consider the alternative of revising PAM instrumentation requirements in the EPR generic technical specifications as follows.

(1) Establish a new specification in Generic Technical Specification Section 5.5 similar to the following model:

The following programs shall be established, implemented, and maintained.

5.5.XX Post-Accident Monitoring (PAM) Instrumentation Program

This program provides controls to establish accident monitoring instrumentation functions that are required by Specification 3.3.2, "Post-Accident Monitoring (PAM) Instrumentation." These instrumentation functions shall be those designated as Type A, B, and C, as defined in Regulatory Guide (RG) 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," Revision 4, June 2006, and shall be listed in the PAM function list as described in FSAR Section 7.5.2.2.1. Changes to the list of Type A, B, and C functions shall be made in accordance with the provisions of 10 CFR 50.59 and RG 1.97, Revision 4.

(2) Replace Generic Technical Specification Limiting Condition for Operation (LCO) 3.3.2 with:

> The required number of channels of each Type A, B, and C PAM instrumentation Function shall be OPERABLE.

(3) Make suitable conforming changes to the bases for Generic Technical Specification 3.3.2, consistent with the bases for STS 3.3.3. The LCO section of the bases for Generic Technical Specification 3.3.2 need not discuss the specified Type A, B, and C PAM instrumentation functions. Revise the Background and the Applicable Safety Analysis sections of the bases to also include discussions of PAM instrumentation types (Type A, B, and C).

Response to Question 16-315:

A response to this question was provided in RAI 110, Supplement 4, Question 16-212.

U.S. EPR Final Safety Analysis Report Markups

The U.S. EPR design complies with guidance from ANSI/ANS 57.1 (Reference 1) and ANSI/ANS 57.3 (Reference 2) with regards to criticality prevention for fresh fuel storage and handling. In addition, the U.S. EPR complies with ANSI/ANS 57.2 (Reference 3) and RG 1.13 with regard to criticality prevention for spent fuel storage and handling.

In lieu of the installation of a criticality monitoring system, design and analysis requirements specified in 10 CFR 50.68(b) are followed to prevent criticality.

16-310

For the new fuel storage racks, the maximum k_{eff} must not exceed 0.95 at a 95 percent probability, 95 percent confidence level when flooded with unborated water, and must not exceed 0.98 at a 95 percent probability, 95 percent confidence level assuming optimum moderation.

16-310

For the spent fuel storage racks, with credit for soluble boron, the maximum k_{eff} must not exceed 0.95 at a 95 percent probability, 95 percent confidence level when flooded with borated water, ~~and~~ must be less than 1.0 at a 95 percent probability, 95 percent confidence level when flooded with unborated water.

16-310

All criticality safety analyses are calculated using the maximum fuel assembly reactivity (five percent U-235 enrichment by weight). Validation of the criticality analysis codes is discussed in Reference 4.

9.1.1.2 Facilities Description

The NFSF includes the new fuel assembly storage racks, the concrete storage ~~vault~~area containing those storage racks, and auxiliary components. The SFSF includes the spent fuel storage racks, the spent fuel storage pool containing those racks, and the associated equipment storage ~~pits~~areas. The design and layout of the NFSF and SFSF are described in Section 9.1.2. ~~As described in Section 9.1.2.2, the design of the new and spent fuel storage racks is the responsibility of the COL applicant.~~

9.1.1.3 Safety Evaluation

~~A COL applicant that references the U.S. EPR design certification will demonstrate that the design satisfies the criticality analysis requirements for the new and spent fuel storage racks, and describe the results of the analyses for normal and credible abnormal conditions, including a description of the methods used, approximations and assumptions made, and handling of design tolerances and uncertainties.~~

~~The criticality analysis performed by the COL applicant will demonstrate that the geometric configuration of the racks in combination with the integral neutron absorbing material is sufficient to maintain the fuel matrix in a subcritical condition. The value of the effective multiplication factor (k_{eff}) must be less than or equal to 0.95 with new fuel of the highest anticipated enrichment (5 percent U-235 by weight) and~~

Next File

~~assuming the area is flooded with potential moderators (e.g., high-pressure water spray). For a postulated accident (PA) condition in which the new fuel storage area is subject to optimum moderation and there are full storage racks of the maximum enrichment fuel assemblies, the value of k_{eff} must not exceed 0.98.~~

~~The COL applicant will show that the U.S. EPR design complies with the guidance of ANSI/ANS 57.1 (Reference 1) and ANSI/ANS 57.3 (Reference 2) with regards to criticality prevention for fresh fuel storage and handling. In addition, the COL applicant will demonstrate that the U.S. EPR complies with ANS 57.1, 57.2 (Reference 3), and RG 1.13 with regard to criticality prevention for spent fuel storage and handling.~~

~~The criticality analyses performed by the COL applicant will demonstrate that the fuel remains subcritical under normal and credible abnormal conditions (GDC 62). The fuel rack design and resulting criticality analyses will prevent an increase in effective multiplication factor (k_{eff}) beyond safe limits based on the requirements in 10 CFR 50.68(b). For dry storage of new fuel assemblies, k_{eff} will not exceed 0.95 if the storage area is flooded with unborated water. In addition, k_{eff} will not exceed 0.98 if the storage area is filled with an optimum moderator (e.g., fire extinguishing foam), assuming fuel of the maximum reactivity. Therefore, a criticality monitor will not be required.~~The fuel is maintained in a subcritical condition in normal and credible abnormal conditions by using minimum assembly separation, integral neutron absorbing material, and soluble boron (for abnormal conditions). The criticality control design confirms that the effective multiplication factor (k_{eff}) of the storage rack configuration is no greater than an upper subcritical limit (USL) for the most reactive configuration. The USL includes an administrative safety margin of 0.005. Credible boron dilution events do not impact criticality safety since the maximum k_{eff} is less than 1.0 at a 95 percent probability, 95 percent confidence level when flooded with unborated water. The criticality safety analysis for the new and spent fuel racks is provided in Reference 4.

16-310

The new and spent fuel storage racks consist of a structural metal and boron carbide-aluminum metal matrix composite (MMC) neutron absorber.

9.1.1.4 References

1. ANSI/ANS-57.1-1992; R1998; R2005 (R=Reaffirmed): "Design Requirements for Light Water Reactor Fuel Handling Systems," American National Standards Institute/American Nuclear Society, 2005.

2. ANSI/ANS-57.3-1983: "Design Requirements for New Fuel Storage Facilities at Light Water Reactor Plants," American National Standards Institute/American Nuclear Society, 1983.

fuel storage rack modules are composed of a rectangular grid of connected cells, each cell designed to store a single fuel assembly. Center-to-center spacing of the assemblies in the new fuel racks is provided in TN-Rack.0101, "U.S. EPR New and Spent Fuel Storage Rack Technical Report" (Reference 3). The new fuel storage racks are vertically supported by the concrete floor of the new fuel storage room and laterally supported against the walls of the new fuel storage room. The rack module is not anchored to the NFSF. The NFSF includes solid hatch cover designed so that they do not fall and damage the fuel or fuel rack during a seismic event.

Building features such as door thresholds, curbs, and floor openings are provided to prevent entry of water or other moderation media into the ~~NFSF~~new fuel storage room.

The new fuel storage room is provided with a drain system connected to the NI drain and vent sumps. The new fuel storage cells are each designed with an opening in the bottom of the cell in the base plate which can drain unanticipated water sources.

Refer to Section 3.2 for the seismic and system quality group classification of the new fuel racks. Non-safety-related equipment or structures not designed to Seismic Category I criteria that are located in the vicinity of the NFSF are evaluated to confirm that their failure could not cause an increase in the k_{eff} value beyond the maximum allowable.

9.1.2.2.2 Spent Fuel Storage

The spent fuel pool provides storage space for a minimum of 10 years worth of irradiated fuel assemblies, plus the capability for a full core offload from the reactor. The spent fuel storage racks provide a maximum storage capacity of 1247 fuel assemblies. The pool is a reinforced concrete structure (refer to Section 3.8.4) with a stainless steel liner having a nominal depth of ~~45~~47 feet, ~~7~~3 inches (approximately 29 feet above the tops of the stored fuel assemblies). Borated water is used in the spent fuel pool and is maintained at greater than or equal to 1700 ppm boron isotopically enriched to ≥ 37 percent B-10. The concentration required for sub-criticality for spent fuel is approximately ~~1334 ppm (nominal enriched boron at ≥37 percent B-10)~~582 ppm boron isotopically enriched to ≥ 37 percent B-10. Figure 3.8-42 through Figure 3.8-46 and Figure 3.8-50 through Figure 3.8-52 show the spent fuel pool and other related fuel handling areas. A simplified cross-section of the spent fuel pool showing elevations is provided in Figure 9.1.2-3. Fresh unirradiated fuel assemblies are either stored in the NFSF or in the fuel storage pool (or both). Unirradiated rod control clusters and thimble plug assemblies are normally stored in the fuel assemblies in the SFP.

16-310

The underwater fuel storage racks are located in the spent fuel storage pool inside the Fuel Building. ~~The design of the spent fuel storage racks are the responsibility of the~~

~~COL applicant. A COL applicant that references the U.S. EPR design certification will describe the spent fuel storage racks, including a description of confirmatory structural dynamic and stress analyses and thermal-hydraulic cooling analyses.~~ The racks ~~must be shown to~~ meet Seismic Category I requirements. Spent fuel rack materials ~~will be~~are compatible with the pool storage environment. Rack structural materials ~~must be~~ are corrosion-resistant and compatible with the expected water chemistry of the SFP.

~~Figure 9.1.2-1 shows the spent fuel rack storage location within the spent fuel pool.~~

~~Figure 9.1.2-9 provides a typical sketch of the new and spent fuel storage racks. The rack modules will be designed as cellular structures so that each storage cell has a square opening with conforming lateral support and a flat horizontal bearing surface. Each storage cell will have a hole in or near the bottom and a rectangular opening on the top of the cell to allow cooling water to flow through the storage cell. To provide reasonable assurance that no fuel can be damaged, each storage cell will be designed to prevent any portion of a fuel assembly or core component from extending above the top of the rack. The spent fuel storage racks will also be designed to withstand the impact resulting from a falling fuel assembly under normal loading and unloading conditions and will be designed to meet Seismic Category I requirements.~~

The spent fuel storage racks consist of an assembly of tubes with neutron absorber plates sandwiched between the tubes. The tube assembly is supported by a stainless steel frame structure consisting of a base plate, four corner angles, bottom horizontal bands, three sets of intermediate horizontal bands equally spaced along the rack's length, and top support and bottom support grid assemblies which are welded to the external frame structure. The top and bottom grid assemblies provide lateral restraint to the tube assembly. The top grid assembly also provides axial restraint to the tubes and neutron absorber plates. Each rack module is vertically supported by 6 legs on the SFP floor without anchoring. The grid structures are designed so that a fuel assembly cannot be inserted between the cells.

Low density storage (Region 1 racks) will be used for freshly discharged fuel. There are 382 available storage cells in the low density storage racks in the spent fuel pool arranged in five 10x8 free standing modules divided into arrays of 9 inch ID square tubes. Figure 9.1.2-4 shows a cross-section of the Region 1 storage racks. Region 2 racks use the same tubes surrounded by poison material, but no flux traps, and a reduced assembly pitch (see Reference 3) to provide 865 usable storage spaces provided by 12 free-standing modular racks of varying size. Figure 9.1.2-5 shows a cross section of the Region 2 storage racks. If freshly discharged fuel is required to be stored in the high density storage racks (Region 2), the assemblies are required to be stored in a checkerboard or other pattern that confirms that adequate cooling can be maintained consistent with Technical Specification restrictions.

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15.10 Spent Fuel Pool Criticality and Boron Dilution Analysis

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Spent fuel pool criticality and boron dilution events are discussed in Section 9.1.1.

~~As addressed in RG 1.206, Appendix A, borated demineralized reactor makeup water is used to fill and to supplement water inventory in the spent fuel pool, but boration is not essential for maintaining the subcriticality of the stored fuel assemblies (refer to Section 9.1.2.2.2, Spent Fuel Storage). The fuel rack is a vendor-supplied component that is selected by the COL applicant. The rack supplier provides the criticality analysis.~~

3.7 PLANT SYSTEMS

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3.7.15 Spent Fuel ~~Storage~~ Pool Boron Concentration and Enrichment

~~----------REVIEWER'S NOTE----------~~
~~The design of the spent fuel storage racks is to be provided by the COL applicant. The required boron concentration will be provided as a part of the spent fuel rack design.~~
~~----------~~

LCO 3.7.15 The spent fuel ~~storage~~ pool boron concentration shall be ≥ ~~[1334]~~ 1700 ppm enriched boron ~~and boron enrichment shall be ≥ 37%~~.

APPLICABILITY: When fuel assemblies are stored in the spent fuel ~~storage~~ pool and a spent fuel ~~storage~~ pool verification has not been performed since the last movement of fuel assemblies in the spent fuel ~~storage~~ pool.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Spent fuel ~~storage~~ pool boron concentration or enrichment not within limit.	----------NOTE---------- LCO 3.0.3 is not applicable. ----------	
	A.1 Suspend movement of fuel assemblies in the spent fuel ~~storage~~ pool.	Immediately
	AND	
	A.2.1 Initiate action to restore spent fuel ~~storage~~ pool boron concentration and enrichment to within limits.	Immediately
	OR	
	A.2.2 Initiate action to perform a spent fuel ~~storage~~ pool verification.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.15.1	Verify the spent fuel ~~storage~~ pool boron concentration is within limit.	7 days
SR 3.7.15.2	Verify the isotopic concentration of B-10 in the spent fuel ~~storage~~ pool is ~~within limit~~≥ 37%.	24 months

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3.7 PLANT SYSTEMS

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3.7.16 Spent Fuel Storage

LCO 3.7.16 The combination of initial enrichment and burnup of each new or spent fuel assembly stored in the spent fuel storage racks shall be within the following configurations:~~Fuel shall be stored in approved locations in the spent fuel storage pool.~~

a. New or irradiated fuel assemblies may be allowed for unrestricted storage in Region 1 of the spent fuel pool provided the maximum initial enrichment of the fuel assembly is ≤ 5.0 wt% U-235; or

b. New or irradiated fuel assemblies may be stored in Region 2 of the spent fuel pool in accordance with these limits:

1. Irradiated fuel assemblies may be stored in any storage rack location in Region 2 provided the combination of burnup and initial enrichment is in the acceptable range of Figure 3.7.16-1; or

2. New or irradiated fuel assemblies with a combination of burnup and initial enrichment that are not in the acceptable range of Figure 3.7.16-1 may be stored in Region 2 in a checkerboard arrangement (rack location is surrounded on all four adjacent faces by empty rack cells or other non-reactive materials).

~~----------REVIEWER'S NOTE----------~~
~~The design of the spent fuel storage racks is to be provided by the COL applicant. The required spent fuel storage configuration will be provided as a part of the spent fuel rack design.~~
~~----------~~

APPLICABILITY: Whenever any fuel assembly is stored in the spent fuel pool.~~Whenever any fuel assembly is stored in the spent fuel storage racks.~~

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Requirements of the LCO not met.	A.1 ----------NOTE---------- LCO 3.0.3 is not applicable. ---------- Initiate action to move the noncomplying fuel assembly to the correct location. ~~Initiate action to restore fuel storage to within requirements.~~	Immediately

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SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.16.1	Verify by administrative means the planned spent fuel pool location is acceptable for the fuel assembly being stored.~~Verify by administrative means that fuel assemblies are stored in approved locations.~~	Prior to storing the fuel assembly in the spent fuel ~~storage~~ pool

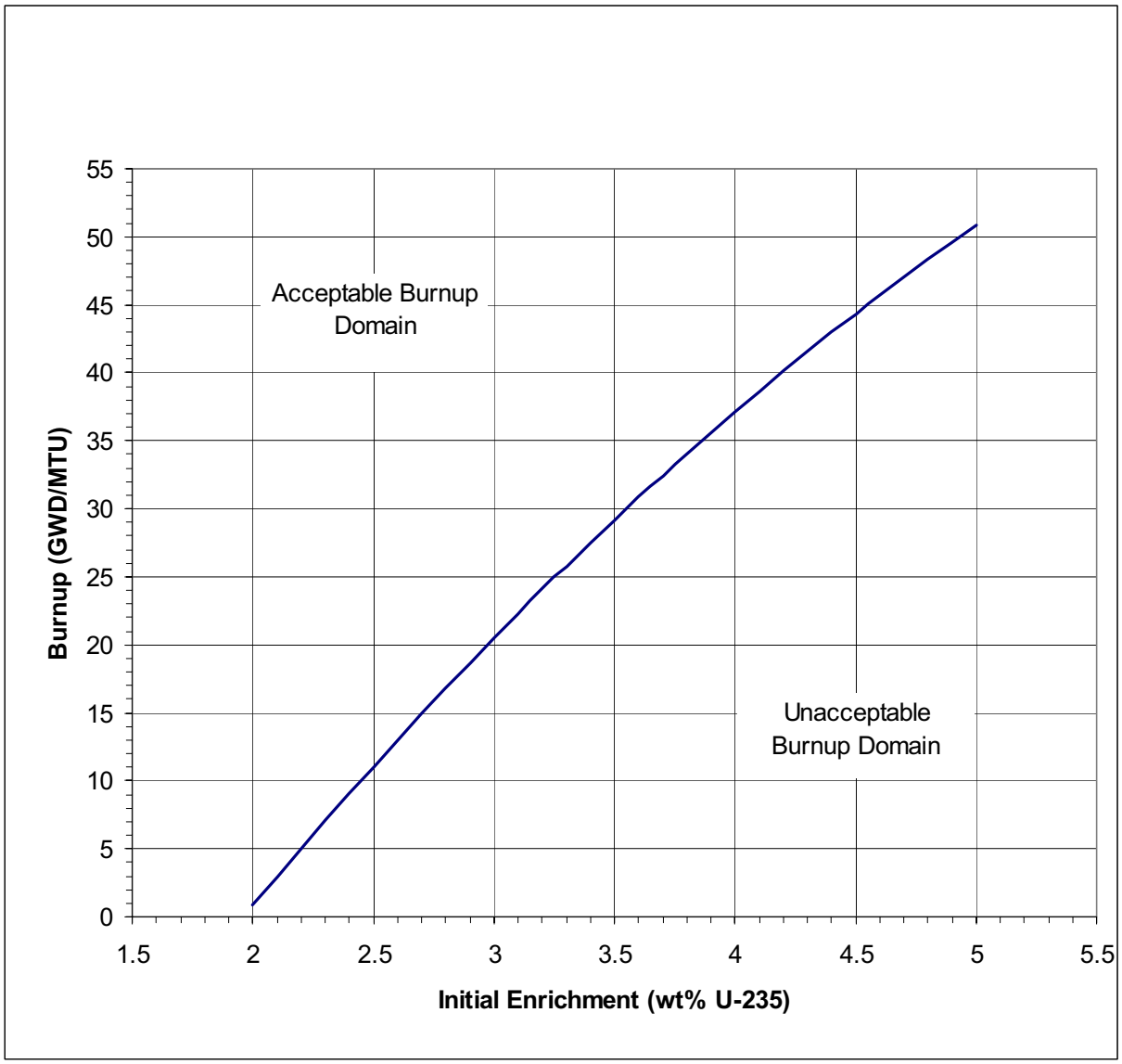

Figure 3.7.16-1
Fuel Assembly Burnup Versus Initial Enrichment for Region 2 Storage

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4.0 DESIGN FEATURES

4.1 Site Location

[A COL applicant that references the U.S. EPR design certification will provide site-specific information for Section 4.1, Site Location.]

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 241 fuel assemblies. Each assembly shall consist of a matrix of fuel rods clad with a zirconium based alloy with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

4.2.2 Control Rod Assemblies

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The reactor core shall contain 89 control rod assemblies. The control material shall be silver indium cadmium as approved by the NRC.

~~----------REVIEWER'S NOTE----------~~
~~The design of the spent fuel storage racks is to be provided by the COL applicant. The required boron concentration will be provided as a part of the spent fuel rack design.~~
~~----------~~

4.3 Fuel Assembly Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. Fuel assemblies having a maximum U-235 enrichment of 5.0 weight percent;

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b. k_{eff} ~~≤~~< ~~0.95~~1.0 if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1.1, "Criticality Safety of New and Spent Fuel Storage and Handling,"~~;~~ and

4.0 DESIGN FEATURES

4.3 Fuel Assembly Storage (continued)

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c. k_{eff} ≤ 0.95 if fully flooded with water borated to 582 ppm enriched, which includes an allowance for uncertainties as described in Section 9.1.1, "Criticality Safety of New and Spent Fuel Storage and Handling"; ~~A nominal [11.28] inch center to center distance between fuel assemblies placed in the spent fuel storage racks.~~

d. A nominal 11.22 inch center-to-center distance between fuel assemblies placed in Region 1;

e. A nominal 9.50 inch center-to-center distance between fuel assemblies placed in Region 2; and

f. Neutron absorber installed between fuel assemblies in the Region 1 and 2 storage racks.

4.3.1.2 The new fuel storage racks are designed and shall be maintained with:

a. Fuel assemblies having a maximum U-235 enrichment of 5.0 weight percent;

b. k_{eff} ≤ 0.95 if fully flooded with unborated water, which includes an allowance for uncertainties as described in ~~FSAR~~ Section 9.1.1, "Criticality Safety of New and Spent Fuel Storage and Handling";

c. k_{eff} ≤ 0.98 if moderated by aqueous foam, which includes an allowance for uncertainties as described in ~~FSAR~~ Section 9.1.1, "Criticality Safety of New and Spent Fuel Storage and Handling"; and

d. A nominal 11.22 ~~[11.28]~~ inch center-to-center distance between fuel assemblies placed in the storage racks.

~~REVIEWER'S NOTE~~
~~Storage rack uncertainties are discussed in the FSAR or COLA Section 9.1~~

4.3.2 Drainage

The spent fuel ~~storage~~ pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 23 ft.

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4.3.3 Capacity

The spent fuel ~~storage~~ pool is designed and shall be maintained with a storage capacity limited to no more than ~~[1121]~~1247 fuel assemblies.

B 3.7 PLANT SYSTEMS

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B 3.7.15 Spent Fuel Pool Boron Concentration and Enrichment

~~REVIEWER'S NOTE~~
~~The design of the spent fuel storage racks is to be provided by the COL applicant. The required boron concentration will be provided as a part of the spent fuel rack design.~~

BASES

BACKGROUND

The water in the spent fuel pool normally contains soluble boron, which would result in large subcriticality margins under actual operating conditions. For storage of fuel assemblies in the spent fuel storage racks, the design basis for preventing criticality outside the reactor is that there is a 95 percent probability at a 95 percent confidence level, without soluble boron, that the effective multiplication factor (k_{eff}) of the fuel assembly array will be less than 1.0, including uncertainties and tolerances. 10CFR50.68(b)(4) specifies a limiting k_{eff} of 1.0 for normal storage in the absence of soluble boron. Hence, the design is based on the use of unborated water, which maintains a subcritical condition for the allowed loading patterns (Ref. 1). ANSI/ANS-57.2-1983 (Ref. 2) requires that the criticality safety analyses demonstrate that criticality could not occur without at least two unlikely, independent and concurrent incidents or abnormal occurrences. Therefore, credit is allowed for soluble boron under abnormal and accident conditions since only a single accident scenario need be considered at a time.~~As described in the following LCO 3.7.16, "Spent Fuel Storage," fuel assemblies are stored in the spent fuel racks without restriction. Although the water in the spent fuel pool is normally borated to ≥ [1700] ppm with boric acid enriched to ≥ 37% B-10, the criteria that limit storage of a fuel assembly to specific locations are conservatively developed without taking credit for boron.~~

APPLICABLE SAFETY ANALYSES

Abnormal or accident scenarios can be postulated in the spent fuel pool that could have more than a negligible positive reactivity effect. An example is the misplacement of a fuel assembly with the maximum allowed enrichment in specific locations in the Region 2 storage racks. The spent fuel pool k_{eff} storage limit of 0.95 is maintained during this event by a minimum boron concentration of 582 ppm enriched boron established by the criticality analysis (Ref. 3). Compliance with the LCO minimum enriched boron concentration limit of 1700 ppm results in the credited concentration being available.

~~REVIEWER'S NOTE~~
~~The design of the spent fuel storage racks is the responsibility of the COL applicant. A COL applicant that references the U.S. EPR design certification will demonstrate that the design satisfies the criticality analysis requirements for the spent fuel storage racks.~~

BASES

APPLICABLE SAFETY ANALYSES (continued)

The concentration and enrichment of dissolved boron in the spent fuel ~~storage~~ pool satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The spent fuel pool enriched boron concentration is required to be ≥ 1700 ppm enriched boron. The specified concentration of dissolved boron in the spent fuel pool preserves the assumptions used in the analyses of the potential critical accident scenarios as described in References 1 and 3. This concentration of dissolved boron is the minimum required concentration for fuel assembly storage and movement within the spent fuel pool.~~The spent fuel pool boron concentration is required to be ≥ [1334] ppm boron enriched to ≥ 37% B-10. The specified concentration and enrichment of dissolved boron in the spent fuel pool preserves the assumptions used in the analyses of the potential critical accident scenarios as described in Reference 1. This concentration of dissolved boron is the minimum required concentration and enrichment for fuel assembly storage and movement within the spent fuel pool.~~

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BASES

APPLICABILITY

This LCO applies whenever fuel assemblies are stored in the spent fuel pool and a spent fuel pool verification has not been performed since the last movement of fuel assemblies in the spent fuel pool.~~This LCO applies whenever fuel assemblies are stored in the spent fuel pool, until a complete spent fuel pool verification has been performed following the last movement of fuel assemblies in the spent fuel pool. This LCO does not apply following the verification, since the verification would confirm that there are no misloaded fuel assemblies. With no further fuel assembly movements in progress, there is no potential for a misloaded fuel assembly or a dropped fuel assembly.~~

ACTIONS

A.1, A.2.1, and A.2.2

The Required Actions are modified by a Note indicating that LCO 3.0.3 does not apply.

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When the concentration or enrichment of boron in the spent fuel pool is less than required, immediate action must be taken to preclude the occurrence of an accident or to mitigate the consequences of an accident in progress. This is most efficiently achieved by immediately suspending the movement of fuel assemblies. The concentration or enrichment of boron is restored simultaneously with suspending movement of fuel assemblies. Alternatively, beginning a verification of the spent fuel ~~storage~~ pool fuel assembly locations, to ensure proper locations of the fuel assembly, can be performed. However, prior to resuming movement of fuel assemblies, the concentration and enrichment of boron must be restored. This does not preclude movement of a fuel assembly to a safe position.

~~The Required Actions are modified by a Note indicating that LCO 3.0.3 does not apply.~~ If the LCO is not met while moving irradiated fuel assemblies in MODE 5 or 6, LCO 3.0.3 would not be applicable. If moving irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the fuel assembly movement is independent of reactor operation. Therefore, inability to suspend movement of fuel assemblies is not sufficient reason to require a reactor shutdown.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.15.1

This SR verifies that the concentration of boron in the spent fuel ~~storage~~ pool is within the required limit. As long as this SR and SR 3.7.13.2 are met, the analyzed accidents are fully addressed. The 7 day Frequency is appropriate because no major replenishment of pool water is expected to take place over such a short period of time.

SR 3.7.15.2

Verification every 24 months that the B-10 enrichment is ≥ 37%~~within limit~~ ensures that the B-10 concentration assumed in the accident analyses is available. Since the boron in the spent fuel pool is not exposed to a significant neutron flux, 24 months is considered conservative.

REFERENCES

1. Section 9.1.1

2. ANSI/ANS-57.2-1983: “Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Plants,” American National Standards Institute/American Nuclear Society, 1983.

3. TN-Rack.0101, Revision 0, "US EPR New and Spent Fuel Storage Rack Technical Report," AREVA Transnuclear Inc., December 2009.~~1. ANSI/ANS 8.1-1998 "Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors."~~

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B 3.7 PLANT SYSTEMS

B 3.7.16 Spent Fuel Storage

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~~REVIEWER'S NOTE~~

~~The design of the spent fuel storage racks is to be provided by the COL applicant. The required spent fuel storage configuration will be provided as a part of the spent fuel rack design.~~

BASES

BACKGROUND

The spent fuel storage pool as described in Ref. 1 consists of 17 modular racks of various sizes. The spent fuel storage pool is divided into two separate and distinct regions. Region 1, with 382 storage locations, is designed to accommodate new fuel assemblies with a maximum nominal enrichment of 5.0 wt% U-235 or spent fuel assemblies regardless of the discharge burnup. Region 2, with a maximum of 865 storage locations is designed to accommodate spent fuel assemblies in all locations which comply with the combination of initial enrichment and burnup specified in Figure 3.7.16-1. Additionally, new or irradiated fuel assemblies with a combination of burnup and initial enrichment that are not in the acceptable range of Figure 3.7.16-1 may be stored in Region 2 in a checkerboard arrangement (rack location is surrounded on all four adjacent faces by empty rack cells or other non-reactive materials). The spent fuel pool storage racks have been analyzed for the storage of fuel assemblies which meet the requirements of LCO 3.7.16.

The water in the spent fuel pool normally contains soluble boron, which would result in large subcriticality margins under actual operating conditions. For storage of fuel assemblies in the spent fuel storage racks, the design basis for preventing criticality outside the reactor is that there is a 95 percent probability at a 95 percent confidence level, without soluble boron, that the k_{eff} remains below 1.0 (subcritical). A discussion of how soluble boron is credited for the storage of fuel assemblies in the spent fuel pool is contained in the Background for TS 3.7.15. Storage configurations are defined in the criticality analyses (Ref. 2) with a resulting k_{eff} less than 1.0 with no soluble boron under normal storage conditions, including tolerances and uncertainties. Soluble boron credit is then used to maintain k_{eff} less than or equal to 0.95 and to mitigate the worst accidental reactivity insertion. A soluble boron concentration of 582 ppm enriched boron is required to maintain k_{eff} less than or equal to 0.95 for allowable storage configurations, which is well within the 1700 ppm enriched boron requirement of LCO 3.7.15.

Prior to movement of an assembly, it is necessary to verify that SR 3.7.15.1 is current.~~The spent fuel storage facility as described in Reference 1 has a capacity of at least [1020] fuel assemblies. The spent fuel storage racks are designed to accommodate fuel with a maximum enrichment of 5.0 weight percent U-235. The spent fuel storage racks are designed for unrestricted spent fuel assembly storage.~~

BASES

APPLICABLE SAFETY ANALYSES

Hypothetical accidents can only take place during or as a result of the movement of a fuel assembly (Ref. 1). For these accident occurrences, the presence of soluble boron in the spent fuel pool (controlled by LCO 3.7.15, "Spent Fuel Pool Boron Concentration and Enrichment") prevents criticality in both regions. By closely controlling the movement of each fuel assembly and by checking the location of each fuel assembly after movement, the time period for potential accidents may be limited to a small fraction of the total operating time. During the remaining time period with no potential for accidents, the operation may be under the auspices of the accompanying LCO.

The configuration of fuel assemblies in the spent fuel pool satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

~~APPLICABLE SAFETY ANALYSES~~

~~----------REVIEWER'S NOTE----------~~
~~The design of the spent fuel storage racks is the responsibility of the COL applicant. A COL applicant that references the U.S. EPR design certification will demonstrate that the design satisfies the criticality analysis requirements for the spent fuel storage racks.~~
~~----------~~

~~The criticality analysis shows that the fuel remains subcritical under all credible abnormal conditions.~~

~~The design shows acceptable prevention of an increase in effective multiplication factor (k-effective) beyond safe limits based on the guidelines in Reference 2.~~

~~The configuration of fuel assemblies in the fuel storage pool satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).~~

LCO

The restrictions on the placement of fuel assemblies within the spent fuel pool, in accordance with LCO 3.7.16, maintains the k_{eff} of the spent fuel pool < 1.0, assuming the pool to be flooded with unborated water and ≤ 0.95 with a boron concentration ≥ 582 ppm enriched.~~Unrestricted storage of fuel assemblies within the spent fuel pool is allowed provided that the maximum U-235 enrichment is equal to or less than 5.00 weight percent. This ensures the k-effective of the spent fuel pool will always remain less than 0.95 assuming the pool is flooded with [unborated water].~~

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BASES

APPLICABILITY

This LCO applies whenever any fuel assembly is stored in the spent fuel pool.

ACTIONS

A.1

Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply.

When the configuration of fuel assemblies stored in the spent fuel pool is not in accordance with the LCO, the immediate action is to initiate action to move the noncomplying fuel assembly to the correct location make the necessary fuel assembly movement(s) to bring the configuration into compliance.

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Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply. If unable to move irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not be applicable. If unable to move irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the action is independent of reactor operation. Therefore, inability to move fuel assemblies is not sufficient reason to require a reactor shutdown.

SURVEILLANCE REQUIREMENTS

SR 3.7.16.1

This SR verifies by administrative means that the fuel assembly is in accordance with the configurationsplanned spent fuel pool location is acceptable for the fuel assembly being stored as specified in the accompanying LCO.

REFERENCES

1. FSAR Section 9.1.2

2. TN-Rack.0101, Revision 0, “US EPR New and Spent Fuel Storage Rack Technical Report,“ AREVA Transnuclear Inc., December 2009.10CFR 50.68, "Criticality Accident Requirements."