

ArevaEPRDCPEm Resource

From: BRYAN Martin (EXT) [Martin.Bryan.ext@areva.com]
Sent: Thursday, April 01, 2010 1:59 PM
To: Tesfaye, Getachew
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); ROMINE Judy (AREVA NP INC); RYAN Tom (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 274, FSARCh. 2, Supplement 1
Attachments: RAI 274 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 274 on February 26, 2010. The attached file, "RAI 274 Supplement 1 Response US EPR DC.pdf" provides a technically correct and complete response to the 1 question, as committed.

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 274 Question 02-1.

The following table indicates the respective pages in the response document, "RAI 274 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 274 — 02-1	2	3

This concludes the formal AREVA NP response to RAI 274, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Martin (Marty) C. Bryan
Licensing Advisory Engineer
AREVA NP Inc.
Tel: (434) 832-3016
Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Friday, February 26, 2010 2:25 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); ROMINE Judy (AREVA NP INC); WILLIFORD Dennis C (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 274, FSARCh. 2

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 274 Response US EPR DC.pdf" provides a schedule since a technically correct and complete response to the question is not provided.

The following table indicates the respective pages in the response document, "RAI 274 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 274 — 02-1	2	3

A complete answer is not provided for the question. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 274 — 02-1	April 2, 2010

Sincerely,
Martin (Marty) C. Bryan
Licensing Advisory Engineer
AREVA NP Inc.
Tel: (434) 832-3016
Martin.Bryan@areva.com

From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Friday, August 21, 2009 2:34 PM
To: ZZ-DL-A-USEPR-DL
Cc: Harvey, Brad; Patel, Jay; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 274 (3521), FSARCh. 2

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on August 12, 2009, and on August 20, 2009, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. The question in this RAI is considered a potential open item 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. If RAI 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,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 1279

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB7105BAC496)

Subject: Response to U.S. EPR Design Certification Application RAI No. 274, FSARCh. 2, Supplement 1
Sent Date: 4/1/2010 1:58:42 PM
Received Date: 4/1/2010 1:59:12 PM
From: BRYAN Martin (EXT)

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Files	Size	Date & Time
MESSAGE	3471	4/1/2010 1:59:12 PM
RAI 274 Supplement 1 Response US EPR DC.pdf		210055

Options

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

Response to

Request for Additional Information No. 274(3521), Supplement 1, Revision 1

8/21/2009

U.S. EPR Standard Design Certification

AREVA NP Inc.

Docket No. 52-020

SRP Section: 02 - Site Characteristics and Site Parameters

Application Section: FSAR Tier 2, Chapter 2

QUESTIONS for EPR Projects Branch (NARP)

Question 02-1:**POTENTIAL OPEN ITEM**

Staff requests the applicant clarify the use of terms “site characteristics” and “site parameters” in FSAR Tier 2, Section 2.0, “Site Characteristics”, and COL Information Item 2.0-1 in FSAR Tier 1, Table 1.8-2, “U.S. EPR Combined License Information Items”. 10 CFR 52.1 (a) provides the following definitions:

Site parameters are the postulated physical, environmental and demographic features of an assumed site. Site parameters are specified in a standard design approval, standard design certification, or manufacturing license.

Site characteristics are the actual physical, environmental and demographic features of a site. Site characteristics are specified in an early site permit or in a final safety analysis report for a combined license.

The staff requests the applicant consider rephrasing FSAR Tier 2, Section 2.0, “Site Characteristics,” as follows:

The U.S. EPR standard design is based on a set of conservatively established site parameters. These parameters represent more demanding site conditions than normally expected for most U.S. nuclear power plant sites. These site-related design basis parameters are provided in Table 2.1-1—U.S. EPR Site Design Envelope.

A COL applicant that references the U.S. EPR design certification will compare site-specific data to the design parameter data in Table 2.1-1. If the specific data for the site falls within the assumed design parameter data in Table 2.1-1, then the U.S. EPR standard design is bounding for the site. For site-specific characteristics that are outside the bounds of the assumptions presented in Table 2.1-1, the COL applicant will confirm that the U.S. EPR design acceptably meets any additional requirements that may be imposed by the more limiting site-specific characteristic, and that the design maintains conformance to the design commitments and acceptance criteria described in this FSAR.

The staff also requests the applicant consider rephrasing COL Information Item 2.0-1 in FSAR Tier 1, Table 1.8-2, “U.S. EPR Combined License Information Items,” as follows:

A COL applicant that references the U.S. EPR design certification will compare site-specific data to the design parameter data in Table 2.1-1. If the specific data for the site falls within the assumed design parameter data in Table 2.1-1, then the U.S. EPR standard design is bounding for the site. For site-specific characteristics that are outside the bounds of the assumptions presented in Table 2.1-1, the COL applicant will confirm that the U.S. EPR design acceptably meets any additional requirements that may be imposed by the more limiting site-specific characteristic, and that the design maintains conformance to the design commitments and acceptance criteria described in this FSAR.

The staff also requests the applicant consider rephrasing the title of FSAR Tier 2, Section 2.0 to “Site Parameters”(including all other applicable sections where Section 2.0 is mentioned).

Response to Question 02-1:

AREVA NP agrees that the term “site parameter” should be used for the assumed site of the U.S. EPR FSAR and the term “site characteristic” should be used for a site-specific COL FSAR. U.S. EPR FSAR Tier 2, Sections 1.2.2, 2.0, 2.3, 2.4.5, 2.5.2.6, 3.3, 3.8.5.5, and 16.0, and Tables 1.8-1 and 1.8-2 will be revised to reflect this distinction.

This response addresses related questions in RAI 288, Supplement 1, Question 02-2 and Question 02.03.01-16 and RAI 306, Question 03.03.01-4. The NRC reviewer’s comments that are included in RAI 288, Question 02-2 replaces the markup of Section 2.0 listed in the above question 02-1 based on the request made in RAI 288.

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 1.2.2, 2.0, 2.3, 2.4.5, 2.5.2.6, 3.3, 3.8.5.5, and 16.0, and Tables 1.8-1 and 1.8-2 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

probabilistic approach to define these events and assess the specific measures available for their management. Consistent with international and U.S. probabilistic safety objectives, the CDF is less than 10^{-5} /reactor-year, including all events and all reactor states. Additionally, the overall mean LRF of radioactive materials to the environment from a core damage event is less than 10^{-6} /reactor-year.

Innovative features result in the low probability of energetic scenarios that could lead to early containment failure. Design provisions for the reduction of the residual risk, core melt mitigation, and the prevention of large releases are as follows:

- Prevention of high pressure core melt by high reliability of decay heat removal systems, complemented by primary system overpressure protection (OPP).
- Primary system discharge into the containment in the event of a total loss of secondary side cooling.
- Features for corium spreading and cooling.
- Prevention of hydrogen detonation by reducing the hydrogen concentration in the containment at an early stage with catalytic hydrogen recombiners.
- Control of the containment pressure increase by a dedicated severe accident heat removal system (SAHRS) consisting of a spray system with recirculation through the cooling structure of the melt stabilization system.
- Collection of leaks and prevention of bypass of the containment.

External hazards (e.g., explosion pressure wave (EPW), seismic events, tornado-generated missiles, wind, fire) and aircraft hazards have been considered in the design of Safeguard Buildings and the hardening of the Shield Building.

1.2.2 Site Description

The U.S. EPR is a standard plant design that can be built on a site with parameters as described in Section 1.3 and in Table 1.3-1—U.S. EPR Comparison with Similar Facilities. These site parameters relate to the seismology, hydrology, meteorology, geology, heat sink, and other site-related aspects that form the basis for ~~site characteristics used for~~ the U.S. EPR design. Figure 1.2-1—3-Dimensional Conceptual Configuration of U.S. EPR Buildings, Figure 1.2-2—U.S. EPR Cutaway, and Figure 1.2-3—Plant Configuration, show the layout and configuration of a generic U.S. EPR. General Arrangement drawings of the following structures are identified below:

Reactor Building, Safeguards Buildings, Fuel Buildings, Emergency Power Generating Buildings, Essential Service Water Building Plan – Section 3.8.

Nuclear Auxiliary Building – Figures 1.2-4 through 1.2-17.

**Table 1.8-1—Summary of U.S. EPR Plant Interfaces with Remainder of Plant
Sheet 1 of 2**

Item No.	Interface	Interface Type	Section
1-1	Switchgear Building	U.S. EPR Interface	1.2, 8.3, 8.4
1-2	Access Building	U.S. EPR Interface	1.2, 3.7.2
1-3	Turbine Building	U.S. EPR Interface	1.2, 3.7.2
1-4	Fire Protection Storage Tanks and Building	U.S. EPR Interface	1.2, 3.7.2
2-1	Envelope of U.S. EPR site related design	Site Parameter	2.0, Table 2.1-1
2-2	Consequences of potential hazards from nearby industrial, transportation and military facilities	Site Parameter	2.2
2-3	Site-specific χ/Q values based on site-specific meteorological data at the exclusion area boundary (EAB), low population zone (LPZ), and control room	Site Parameter	2.3
2-4	Site-specific seismic parameters characteristics	Site Parameter	2.5, 3.7
2-5	Soil conditions and profiles	Site Parameter	2.5, 3.7
2-6	Bearing pressure of soil beneath the nuclear island basemat	Site Parameter	2.5
2-7	Foundation settlements	Site Parameter	2.5
3-1	Missiles generated from nearby facilities	Site Parameter	3.5
3-2	Missiles generated by tornadoes or extreme winds	Site Parameter	3.5
3-3	Aircraft hazards	Site Parameter	3.5
3-4	Site-specific loads that lie within the standard plant design envelope for Seismic Category I structures	Site Parameter	3.8
3-5	Buried conduit and duct banks, and pipe and pipe ducts	U.S. EPR Interface	3.8
8-1	Off-site ac power transmission system connections to the switchyard and the connection to the plant power distribution system	U.S. EPR Interface	8.2
8-2	On-site ac power transmission system connections to the switchyard and the connection to the plant power distribution system	U.S. EPR Interface	8.3
8-3	Auxiliary power and generator transformer areas	U.S. EPR Interface	8.2
8-4	Lightning protection and grounding system grid	U.S. EPR Interface	8.3.1
9-1	New fuel and spent fuel storage racks	U.S. EPR Interface	9.1.1, 9.1.2

02-1



Table 1.8-2—U.S. EPR Combined License Information Items
Sheet 3 of 47

Item No.	Description	Section	Action-Required by COL Applicant	Action-Required by COL Holder
2.0-1	<p>A COL applicant that references the U.S. EPR design certification will compare <u>the characteristics of its proposed site-specific data</u> to the <u>design site parameters data</u> in Table 2.1-1. If the <u>specific data for characteristics of</u> the site falls within the assumed <u>design site parameters data and characteristics</u> in Table 2.1-1, then the U.S. EPR standard design is bounding for the site. For site-specific <u>design parameter data or characteristics</u> that are outside the bounds of the assumptions presented in Table 2.1-1, the COL applicant will <u>confirm demonstrate</u> that the U.S. EPR design acceptably meets <u>any additional the regulatory requirements, that may be imposed by given</u> the more limiting site-specific <u>design parameter data or characteristic</u>. <u>In such an instance, the COL applicant will also demonstrate and</u> that the <u>design maintains conformance to the</u> design commitments and acceptance criteria described in <u>this the FSAR do not need to be changed, or will propose new design commitments or acceptance criteria, or both.</u></p>	2.0	¥	
2.1-1	A COL applicant that references the U.S. EPR design certification will provide site-specific information related to site location and description, exclusion area authority and control, and population distribution.	2.1	¥	
2.2-1	A COL applicant that references the U.S. EPR design certification will provide site-specific information related to the identification of potential hazards stemming from nearby industrial, transportation, and military facilities within the site vicinity, including an evaluation of potential accidents (such as explosions, toxic chemicals, and fires).	2.2	¥	

02-1

Table 1.8-2—U.S. EPR Combined License Information Items
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Item No.	Description	Section	Action-Required by COL Applicant	Action-Required by COL Holder
2.3-1 02-1	If a COL applicant that references the U.S. EPR design certification identifies site-specific meteorology values outside the range of the design site parameters in Table 2.1-1, then the COL applicant will demonstrate the acceptability of the site-specific values in the appropriate sections of the Combined License application.	2.3	✘	
2.3-2	A COL applicant that references the U.S. EPR design certification will provide site-specific characteristics for regional climatology.	2.3.1	✘	
2.3-3	A COL applicant that references the U.S. EPR design certification will provide site-specific characteristics for local meteorology.	2.3.2	✘	
2.3-4	A COL applicant that references the U.S. EPR design certification will provide the site-specific, onsite meteorological measurement program.	2.3.3	✘	
2.3-5	A COL applicant that references the U.S. EPR design certification will provide a description of the atmospheric dispersion modeling used in evaluating potential design basis events to calculate concentrations of hazardous materials (e.g., flammable or toxic clouds) outside building structures resulting from the onsite and/or offsite airborne releases of such materials.	2.3.4	✘	
2.3-6	A COL applicant that references the U.S. EPR design certification will confirm that site-specific χ/Q values, based on site-specific meteorological data, are bounded by those specified in Table 2.1-1 at the EAB, LPZ and the control room. For site-specific χ/Q values that exceed the bounding χ/Q values, a COL applicant that references the U.S. EPR design certification will demonstrate that the radiological consequences associated with the controlling design basis accident continue to meet the dose reference values given in 10 CFR 50.34 and the control room operator dose limits given in GDC 19 using site-specific χ/Q values.	2.3.4	✘	

Table 1.8-2—U.S. EPR Combined License Information Items
Sheet 6 of 47

Item No.	Description	Section	Action-Required by COL Applicant	Action-Required by COL Holder
2.4-4	A COL applicant that references the U.S. EPR design certification will verify that the site-specific potential hazards to the safety-related facilities due to the failure of upstream and downstream water control structures are within the hydrogeologic design basis.	2.4.4	✘	
2.4-5	A COL applicant that references the U.S. EPR design certification will provide site-specific information on the probable maximum surge and seiche flooding and determine the extent to which safety-related plant systems require protection. The applicant will also verify that the site-specific characteristic parameter envelope is within the design maximum flood level, including consideration of wind effects.	2.4.5	✘	
2.4-6	A COL applicant that references the U.S. EPR design will provide site-specific information and determine the extent to which safety-related facilities require protection from tsunami effects, including Probable Maximum Tsunami Flooding.	2.4.6	✘	
2.4-7	A COL applicant that references the U.S. EPR design certification will provide site-specific information regarding ice effects and design criteria for protecting safety-related facilities from ice-produced effects and forces with respect to adjacent water bodies.	2.4.7	✘	
2.4-8	A COL applicant that references the U.S. EPR design certification will evaluate the potential for freezing temperatures that may affect the performance of the ultimate heat sink makeup, including the potential for frazil and anchor ice, maximum ice thickness, and maximum cumulative degree-days below freezing.	2.4.7	✘	
2.4-9	A COL applicant that references the U.S. EPR design certification will provide site-specific information and describe the design basis for cooling water canals and reservoirs used for makeup to the UHS cooling tower basins.	2.4.8	✘	

02-1

the site-specific characteristic parameter



Table 1.8-2—U.S. EPR Combined License Information Items
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Item No.	Description	Section	Action-Required by COL Applicant	Action-Required by COL Holder
2.4-15	A COL applicant that references the U.S. EPR design certification will describe any emergency measures required to implement flood protection in safety-related facilities and to verify there is an adequate water supply for shutdown purposes.	2.4.14	✘	
2.5-1	A COL applicant that references the U.S. EPR design certification will use site-specific information to investigate and provide data concerning geological, seismic, geophysical, and geotechnical information.	2.5.1	✘	
2.5-2	A COL applicant that references the U.S. EPR design certification will review and investigate site-specific details of seismic, geophysical, geological, and geotechnical information to determine the safe shutdown earthquake (SSE) ground motion for the site and compare site-specific ground motion to the Certified Seismic Design Response Spectra (CSDRS) for the U.S. EPR.	2.5.2	✘	
2.5-3	<div data-bbox="181 1220 305 1262" style="border: 1px solid red; padding: 2px;">02-1</div> → compare the final site-specific soil characteristics with the U.S. EPR design generic soil parameters and verify that the site-specific seismic parameters_ characteristics are enveloped by the CSDRS (anchored at 0.3 g PGA) and the 10 generic soil profiles discussed in Sections 2.5.2, 2.5.4.7 and 3.7.1 and summarized in Table 3.7.1-6. <div data-bbox="899 1247 976 1289" style="border: 1px solid red; padding: 2px; margin-left: 10px;">02-1</div> ←	2.5.2.6 2.5.4.7	✘	
2.5-4	A COL applicant that references the U.S. EPR design certification will verify that site-specific foundation soils beneath the foundation basemats of Seismic Category I structures have the capacity to support the bearing pressure with a factor of safety of 3.0 under static conditions.	2.5.4.10.1	✘	

Table 1.8-2—U.S. EPR Combined License Information Items
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Item No.	Description	Section	Action-Required by COL Applicant	Action-Required by COL Holder
2.5-9	A COL applicant that references the U.S. EPR design certification will reconcile the site-specific soil properties with those used for design of U.S. EPR Seismic Category I structures and foundations described in Section 3.8	2.5.4.2	¥	
2.5-10	A COL applicant that references the U.S. EPR design certification will investigate and determine the uniformity of the underlying layers of site specific soil conditions beneath the foundation basemats. The classification of uniformity or non-uniformity will be established by a geotechnical engineer.	2.5.4.10.3	¥	
3.1-1	A COL applicant that references the U.S. EPR design certification will identify the site-specific QA Program Plan that demonstrates compliance with GDC-1.	3.1.1.1.1	¥	
3.2-1	A COL applicant that references the U.S. EPR design certification will identify the seismic classification of applicable site-specific SSC that are not identified in Table 3.2.2-1.	3.2.1	¥	
3.2-2	A COL applicant that references the U.S. EPR design certification will identify the quality group classification of applicable site-specific SSC important to safety that are not identified in Table 3.2.2-1.	3.2.2	¥	
3.3-1	<div data-bbox="181 1465 300 1514" style="border: 1px solid red; padding: 2px;">02-1</div> → <div data-bbox="308 1423 935 1633" style="border: 1px solid red; padding: 5px;"> <p style="color: red; margin: 0;">design parameters</p> <p style="color: green; margin: 0;"><u>characteristics</u> and compare these to the standard plant criteria. If the site-specific wind and tornado <u>characteristics are not bounded by the site parameters, postulated for the certified design.</u> are not bounded, then the COL applicant will evaluate the design for site-specific wind and tornado events and demonstrate that these loadings will not adversely affect the ability of safety-related structures to perform their safety functions during or after such events.</p> </div>	<div data-bbox="976 1339 1062 1388" style="border: 1px solid red; padding: 2px;">3.3.2</div>	¥	

Table 1.8-2—U.S. EPR Combined License Information Items
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Item No.	Description	Section	Action-Required by COL Applicant	Action-Required by COL Holder
3.8-4	A COL applicant that references the U.S. EPR design certification will provide a description of Seismic Category I buried conduit and duct banks.	3.8.4.1.8	✘	
3.8-5	A COL applicant that references the U.S. EPR design certification will provide a description of Seismic Category I buried pipe and pipe ducts.	3.8.4.1.9	✘	
3.8-6	A COL applicant that references the U.S. EPR design certification will confirm that site-specific loads lie within the standard design envelope for RB internal structures, or perform additional analyses to verify structural adequacy.	3.8.3.3	✘	
3.8-7	A COL applicant that references the U.S. EPR design certification will confirm that site-specific conditions for Seismic Category I buried conduit, electrical duct banks, pipe, and pipe ducts satisfy the requirements specified in Section 3.8.4.4.5 and those specified in AREVA NP Topical Report ANP-10264NP-A.	3.8.4.5	✘	
3.8-8	A COL applicant that references the U.S. EPR design certification will address site-specific Seismic Category I structures that are not described in this section.	3.8.4.1	✘	
3.8-9	A COL applicant that references the U.S. EPR design certification will describe site-specific foundations for Seismic Category I structures that are not described in this section.	3.8.5.1	✘	
3.8-10	A COL applicant that references the U.S. EPR design certification will evaluate site-specific methods for shear transfer between the foundation basemats and underlying soil for <u>site-specific soil characteristics parameters</u> that are not within the envelope <u>of the soil parameters</u> specified in Section 2.5.4.2.	3.8.5.5 02-1 ↙	✘	
3.8-11	A COL applicant that references the U.S. EPR design certification will evaluate and identify the need for the use of waterproofing membranes and epoxy coated rebar based on site-specific groundwater conditions.	3.8.5.6.1	✘	

Table 1.8-2—U.S. EPR Combined License Information Items
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Item No.	Description	Section	Action-Required by COL Applicant	Action-Required by COL Holder
14.2-12	<u>A COL applicant that references the U.S. EPR design certification will provide site-specific test abstract information for plant laboratory equipment.</u>	14.2.12		
14.3-1	A COL applicant that references the U.S. EPR design certification will provide ITAAC for emergency planning, physical security, and site-specific portions of the facility that are not included in the Tier 1 ITAAC associated with the certified design (10 CFR 52.80(a)).	14.3	¥	
14.3-2	A COL applicant that references the U.S. EPR design certification will describe the selection methodology for site-specific SSC to be included in ITAAC, if the selection methodology is different from the methodology described within the FSAR, and will also provide the selection methodology associated with emergency planning and physical security hardware.	14.3	¥	
14.3-3	<u>A COL applicant that references the U.S. EPR design certification will identify a plan for implementing DAC. The plan will identify 1) the evaluations that will be performed for DAC, 2) the schedule for performing these evaluations, and 3) the associated design processes and information that will be available to the NRC for audit.</u>	14.3		
16.0-1	Reviewer's Notes and brackets are used to identify information or <u>parameters</u> characteristics that are plant specific or are based on preliminary design information. A COL applicant that references the U.S. EPR design certification will provide the necessary information in response to the Reviewer's Notes and replace preliminary information provided in brackets of the Technical Specifications and Technical Specification Bases with plant specific values.	16.0	¥	

02-1

← 16.0

2.0 Site Characteristics

The U.S. EPR standard design is based on a set of conservatively established site ~~characteristics~~parameters. These ~~characteristics~~site parameters represent more demanding site conditions than normally expected for most U.S. nuclear power plant sites. These site-related design basis parameters are provided in Table 2.1-1—U.S. EPR Site Design Envelope.

02-1 →

A COL applicant that references the U.S. EPR design certification will compare the characteristics of its proposed site ~~-specific data~~ to the ~~design~~site parameters ~~data~~ in Table 2.1-1. If the ~~specific data~~characteristics ~~offer~~ the site falls within the assumed ~~design~~site parameters ~~data and characteristics~~ in Table 2.1-1, then the U.S. EPR standard design is bounding for the site. For site-specific ~~design parameter data or~~ characteristics that are outside the bounds of the assumptions presented in Table 2.1-1, the COL applicant will ~~confirm~~demonstrate that the U.S. EPR design acceptably meets the regulatory ~~any additional~~ requirements, ~~given that may be imposed by~~ the more limiting site-specific ~~design parameter data or~~ characteristic. In such an instance, the COL applicant will also demonstrate and that the design maintains conformance to the design commitments and acceptance criteria described in this the FSAR do not need to be changed, or will propose new design commitments or acceptance criteria, or both.

2.1 Geography and Demography

A COL applicant that references the U.S. EPR design certification will provide site-specific information related to site location and description, exclusion area authority and control, and population distribution.

2.1.1 Site Location and Description

The site location and description is site-specific and will be addressed by the COL applicant, including:

- Specific location by longitude and latitude, Universal Transverse Mercator (UTM) coordinates, and political subdivisions; the site's relative location with respect to natural and man-made features of the area such as highways, railways, and waterways; and local population distribution.
- A map of the site area of suitable scale (with explanatory text as necessary) showing relevant features such as the plant property lines, site and exclusion area boundaries (EAB), location and orientation of principal plant structures within the site area, and highways, railways and waterways that traverse or are adjacent to the site.

2.3 Meteorology

The U.S. EPR design is based on meteorological parameters (e.g., air temperature extremes, humidity, precipitation such as rainfall, snow and ice, maximum wind speeds, tornado wind speeds, and atmospheric stability characteristics) provided in Section 2.1, Table 2.1-1—U.S. EPR Site Design Envelope. If a COL applicant that references the U.S. EPR design certification identifies site-specific meteorology values outside the range of the design site parameters in Table 2.1-1, then the COL applicant will demonstrate the acceptability of the site-specific values in the appropriate sections of the Combined License application.

02-1 →

2.3.1 Regional Climatology

The following information is provided in Section 2.1, Table 2.1-1:

- Weight of the normal winter precipitation event and the weight of the extreme winter precipitation event.
- 100-year, 3-second gust wind speed.
- Tornado parameters.
- Dry bulb and wet bulb temperatures.

2.3.1.1 Basis for Meteorological Parameters

The design parameters for the dry-bulb and wet-bulb temperatures are based on the EPRI ALWR Utility Requirements Document (Reference 1) and available Early Site Permit applications. The two percent annual exceedance dry and wet bulb temperature values, as recommended by RG 1.206 and SRP 2.3.1, are not provided in Table 2.1-1. However, the two percent annual exceedance dry and wet bulb temperature values are bounded by the provided zero percent annual exceedance and one percent annual exceedance dry and wet bulb temperature values.

SRP 2.3.1 and RG 1.206 also recommend that the 100-year maximum dry bulb and coincident wet bulb temperature values, the 100-year maximum non-coincident wet bulb temperature value, and the 100-year minimum dry bulb temperature values be provided. Instead, the zero percent exceedance values for these parameters have been provided. Zero percent exceedance values are based on conservative estimates of historical high and low values for potential sites.

The prescribed loads included in the combination of normal live loads are based on the weight of the normal winter precipitation event recorded at ground level. Winter precipitation loads to be included in the combination of extreme live loads is based on the addition of the weight of the extreme frozen or liquid precipitation event,

2.4.5 Probable Maximum Surge and Seiche Flooding

A COL applicant that references the U.S. EPR design certification will provide site-specific information on the probable maximum surge and seiche flooding and determine the extent to which safety-related plant systems require protection. The applicant will also verify that the site-specific characteristic parameter envelope is ← 02-1 within the design maximum flood level, including consideration of wind effects.

2.4.6 Probable Maximum Tsunami Flooding

A COL applicant that references the U.S. EPR design will provide site-specific information and determine the extent to which safety-related facilities require protection from tsunami effects, including Probable Maximum Tsunami Flooding.

2.4.7 Ice Effects

A COL applicant that references the U.S. EPR design certification will provide site-specific information regarding ice effects and design criteria for protecting safety-related facilities from ice-produced effects and forces with respect to adjacent water bodies.

The ultimate heat sink (UHS) and mechanical draft cooling towers are described in Section 9.2.5. The water temperature in each of the four UHS cooling tower basins is monitored and in the event that basin water temperature drops to 40°F, an alarm alerts the operator to place the associated train in operation to prevent the formation of ice in the basin. Under extended low load/low ambient temperature conditions, it may be necessary to have all four essential service water (ESW) trains operating. Chemicals may also be added to the ESW system to lower the point at which cooling water freezes. The UHS cooling tower fans are also capable of operation in reverse direction for short periods to minimize ice buildup at the air inlets.

Makeup water to the UHS cooling tower basin is site-specific. A COL applicant that references the U.S. EPR design certification will evaluate the potential for freezing temperatures that may affect the performance of the ultimate heat sink makeup, including the potential for frazil and anchor ice, maximum ice thickness, and maximum cumulative degree-days below freezing.

2.4.8 Cooling Water Canals and Reservoirs

For the U.S. EPR, the UHS is provided by mechanical draft cooling towers, as described in Section 9.2.5. Makeup water to the UHS cooling tower basin is site-specific. A COL applicant that references the U.S. EPR design certification will provide site-specific information and describe the design basis for cooling water canals and reservoirs used for makeup to the UHS cooling tower basins.

velocities in each profile are taken to be strain-compatible values during seismic events.

Refer to Section 3.7.1 and Section 3.7.2 for additional description of soil-structure interaction analyses performed for the U.S. EPR. Liquefaction of soils and stability of slopes is addressed in Section 2.5.4.8 and Section 2.5.5, respectively.

2.5.2.1 Seismicity

Seismicity is site specific and will be addressed by the COL applicant.

2.5.2.2 Geologic and Tectonic Characteristics of the Site and Region

Geologic and tectonic characteristics are site specific and will be addressed by the COL applicant.

The guidance of RG 1.208 and RG 1.165 will be met, as appropriate, in performing the required studies to determine the SSE using probabilistic seismic hazard analyses.

2.5.2.3 Correlation of Earthquake Activity with Seismic Sources

Correlation of earthquake activity with seismic sources is site specific and will be addressed by the COL applicant, consistent with the guidance of RG 1.208 and RG 1.165, as appropriate.

2.5.2.4 Probabilistic Seismic Hazard Analysis and Controlling Earthquake

The probabilistic seismic hazard analysis is site specific and will be addressed by the COL applicant, consistent with the guidance of NUREG/CR-6372 (Reference 1), RG 1.165, and RG 1.208, as appropriate.

2.5.2.5 Seismic Wave Transmission Characteristics of the Site

Seismic wave transmission characteristics are site specific and will be addressed by the COL applicant.

2.5.2.6 Ground Motion Response Spectrum

A COL applicant that references the U.S. EPR design certification will compare the final site-specific soil characteristics with the U.S. EPR design generic soil parameters and verify that the site-specific seismic parameters characteristics are enveloped by the CSDRS (anchored at 0.3g PGA) and the 10 generic soil profiles discussed in Section 2.5.2 and Section 3.7.1 and summarized in Table 3.7.1-6. The applicant develops site-specific ground motion response spectra (GMRS) and foundation input response spectra (FIRS). The applicant will also describe site-specific soil conditions and evaluate the acceptability of the U.S. EPR standard design described in Section 3.7.1 for the particular site. In making this comparison, the applicant will

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refer to Sections 3.7.1 and 3.7.2 for a description of the soil-structure interaction analyses performed for the U.S. EPR in addressing the following evaluation guidelines.

1. The applicant will confirm that the peak ground acceleration for the GMRS is less than 0.3g.
2. The applicant will confirm that the low-strain, best-estimate, value of shear wave velocity at the bottom of the foundation basemat of the NI Common Basemat Structures and other Seismic Category I structures is 1000 fps, or greater. This comparison will confirm that the NI Common Basemat Structures and other Seismic Category I structures are founded on competent material.
3. The applicant will demonstrate that the FIRS ~~are~~ for the NI Common Basemat Structures is enveloped by the CSDRS. In addition, the applicant will demonstrate that the input motion, which considers the difference in elevation between each structure and the NI Common Basemat Structures, the embedment of the ESWB, and SSI effect of the NI Common Basemat Structures is less than the modified CSDRS used for the design of the EPGB and the ESWB (see Section 3.7.1.1.1). ~~for the U.S. EPR using the guidance provided in Section 3.7.1.1.1.~~
4. The applicant will demonstrate that the site-specific profile is laterally uniform by confirming that individual layers with the profile ha 02-1 angle of dip no greater than 20 degrees.
5. The applicant will compare the final site-specific soil characteristics including backfill with the U.S. EPR design generic soil parameters and demonstrate that the idealized strain-compatible site soil profile is similar to or bounded by the 10 generic soil profiles used for the U.S. EPR. The 10 generic profiles include a range of uniform and layered site conditions. The applicant also considers the assumptions used in the SSI analyses including backfill, as described in Section 3.7.1 and Section 3.7.2. Site soil properties of soil columns beneath Category I structures must be bounded by design soil properties listed in Tables 3.7.1-6 and 3.7.2-9. The soil column beneath the embedded NI Common Basemat and the soil column, starting at grade, for the EPGB and ESWB must meet this requirement.
6. If the conditions of steps one through five are met, the characteristics of the site fall within the site parameters for the U.S. EPR and the site is acceptable.
7. If the conditions of steps one through five are not met, the applicant will demonstrate by other appropriate means that the U.S. EPR is acceptable at the proposed site. The applicant may perform intermediate-level additional studies to demonstrate that the particular site is bounded by the design of the U.S. EPR. An example of such studies is to show that the site-specific motion at top-of-basemat level, with consideration of the range of structural frequencies involved, is bounded by the U.S. EPR design.
8. If the evaluations of step 7 are not sufficient, the applicant will perform detailed site-specific SSI analyses for the particular site. This site-specific evaluation will include dynamic seismic analyses and development of in-structure response

3.3 Wind and Tornado Loadings

Seismic Category I structures are designed to withstand the effects of wind and tornado loadings. A combined license (COL) applicant that references the U.S. EPR

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design certification will determine site-specific wind and tornado ~~design~~ parameterscharacteristics and compare these to the standard plant criteria. If the site-specific wind and tornado parameterscharacteristics are not bounded by the site parameters, postulated for the certified design, then the COL applicant will evaluate

the design for site-specific wind and tornado events and demonstrate that these loadings will not adversely affect the ability of safety-related structures to perform their safety functions during or after such events.

3.3.1 Wind Loadings

The U.S. EPR wind pressure loads are determined in conformance with ASCE/SEI Standard 7-05, “Minimum Design Loads for Buildings and Other Structures” (Reference 1). A COL applicant that references the U.S. EPR design certification will demonstrate that failure of site-specific structures or components not included in the U.S. EPR standard plant design, and not designed for wind loads, will not affect the ability of other structures to perform their intended safety functions.

3.3.1.1 Design Wind Velocity

The design basic wind speed is a 3-second gust speed at 33 feet above ground. The basic wind speed (V) is 145 mph in open terrain, exposure category C associated with a 50-year mean recurrence interval. The basic wind speed is increased by an importance factor of 1.15 to obtain a 100-year mean recurrence interval for the design of safety-related and quality-related structures.

3.3.1.2 Determination of Applied Wind Forces

Wind velocity is converted into an effective pressure to be applied to surfaces of structures in conformance with Reference 1.

Effective wind design velocity pressure (q_z) on structural elements is calculated in conformance with Reference 1, Equation 6-15, as follows:

$$q_z = 0.00256 K_z K_{zt} K_d V^2 I \text{ (lb/ft}^2\text{)},$$

Where:

q_z = velocity pressure in pounds per square foot at height “z”.

K_z = velocity pressure exposure coefficient at height “z” for Exposure Category C, which is determined in conformance with Reference 1, Table 6-3, but not less than 0.87.

The design of Seismic Category I foundations is generally controlled by load combinations containing SSE seismic loads. Stresses and strains are within the ACI 349-01 limits, with the exceptions previously listed. Limits for allowable loads on concrete embedments and anchors are in accordance with Appendix ~~BD~~ of ACI 349-2006 (with exceptions stated in Section 3.8.1.2.1, Codes) and guidance given in RG 1.199. Portions of the NI Common Basemat Structure foundation basemat that support the RCB/~~RSB~~ are within the limits in accordance with ASME BPV Code, Section III, Division 2.

Seismic Category I foundations are required to satisfy the factors of safety against overturning, sliding, and flotation defined in Table 3.8-11. The calculated minimum factors of safety for the NI Common Basemat Structure are provided in Table 3.8-12—Minimum Factors of Safety Against Overturning, Sliding, and Flotation for Foundations – NI Common Basemat Structure. ~~For the load combination containing seismic loads, the calculated minimum factors of safety are less than the values provided in NUREG-0800, for overturning and sliding of the NI Common Basemat Structure. The acceptability of these calculated values is further addressed in the following section for the NI Common Basemat Structure foundation basemat.~~

Acceptance criteria for soil conditions for the media supporting Seismic Category I foundations are addressed in Section 2.5.

Acceptance criteria for settlement for Seismic Category I foundations are addressed in Section 2.5.

Additional acceptance criteria for critical areas of these structures are described in Appendix 3E.

An as-built report is prepared to summarize deviations from the approved design and confirm that the as-built Seismic Category I foundations are capable of withstanding the design basis loads described in Section 3.8.5.3 without loss of structural integrity or safety-related functions.

A COL applicant that references the U.S. EPR design certification will evaluate site-specific methods for shear transfer between the foundation basemats and underlying soil for site-specific soil parameters characteristics that are not within the envelope of the soil parameters specified in Section 2.5.4.2.

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3.8.5.5.1 Nuclear Island Common Basemat Structure Foundation Basemat

Appendix 3E provides details of the design of the NI Common Basemat Structure foundation basemat critical areas.

16.0 TECHNICAL SPECIFICATIONS

INTRODUCTION

The U.S. EPR Technical Specifications are provided as required by 10 CFR 50.36, "Technical specifications," and 10 CFR 50.36a, "Technical specifications on effluents from nuclear power reactors". The U.S. EPR Generic Technical Specifications (GTS) were developed utilizing Revision 3.1 of the Standard Technical Specifications (STS), NUREGs -1430, -1431, -1432, and -1434, as deemed appropriate to the U.S. EPR design. The U.S. EPR Generic Technical Specifications are supported by a separate document (Chapter 16B, Bases) that provide the bases for each of the Technical Specifications other than Section 1.0, Use and Application, Section 4.0, Design Features, and Section 5.0, Administrative Controls. As with currently operating plants, the Bases are not considered to be a part of the Technical Specifications.

The criteria of 10 CFR 50.36(c)(2)(ii) have been used to identify the structures, systems, components, and design features for which Limiting Conditions for Operation (LCO) have been included in the U.S. EPR Technical Specifications. The four criteria are:

- 1) Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.
- 2) A process variable, design feature, or operating restriction that is an initial condition of a Design Basis Accident or Transient Analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
- 3) A structure, system or component that is part of the primary success path and which functions or actuates to mitigate a Design Basis Accident or Transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
- 4) Structures, systems and components which operating experience or probabilistic assessment has shown to be important to public health and safety.

The Completion Times and Surveillance Frequencies specified in STS NUREGs were generally applied to the U.S. EPR Generic Technical Specifications. For systems and features unique to the U.S. EPR, similar Completion Times and Surveillance Frequencies were adopted.

The U.S. EPR Generic Technical Specifications are intended to be a model for the development of plant specific Technical Specifications for plants that reference the U.S. EPR standard plant.

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Reviewer's Notes and brackets are used to identify information or **parameters** **characteristics** that are plant specific or are based on preliminary design information. A COL applicant that references the U.S. EPR design certification will provide the necessary information in response to the Reviewer's Notes and replace preliminary information provided in brackets of the Technical Specifications and Technical Specification Bases with plant specific values.