River Bend Nuclear Station

Unit 3

Combined License Application

Part 7: Departures Report

(Includes Information on Departures and Exemptions)

Revision 0
September 2008

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1.0 DEPARTURES

A departure is a plant-specific deviation from design information in a standard design certification rule. Departures from the reference ESBWR Design Control Document (DCD) are identified and evaluated consistent with regulatory requirements and guidance. Reference to the ESBWR DCD is understood to mean Tier 2, unless otherwise noted. Each departure is examined in accordance with 10 CFR 52 requirements.

This report includes two departures (RBS DEP 2.0-1 and RBS DEP 2.0-2) that require prior NRC approval. Since the departures involve Tier 1 information (repeated in Tier 2 information), exemptions are also required. There are also three departures that do not require prior NRC approval.

The following departures are described and evaluated in detail in this report:

Departure Number	**Description**
RBS DEP 2.0-1	Seismic Spectra Exceedance
RBS DEP 2.0-2	Minimum Shear Wave Velocity
RBS DEP 2.5-1	Settlement
RBS DEP 9.4-1	Heating, Ventilation, and Air Conditioning Exhaust Points
RBS DEP 12.2-1	Annual Airborne Releases

1.1 Departure: RBS DEP 2.0-1 – Seismic Spectra Exceedance

The Unit 3 horizontal and vertical response spectra are bounded by the ESBWR DCD horizontal and vertical response spectra, except for frequencies below approximately 0.23 Hz. FSAR Figure 2.0-201, "Unit 3 ESBWR Horizontal Design Ground Response Spectra Comparisons at Foundation Level," and FSAR Figure 2.0-202, "Unit 3 ESBWR Vertical Design Ground Response Spectra Comparison at Foundation Level," provide the site-specific horizontal and vertical Foundation Input Response Spectra (FIRS), which are bounded by the ESBWR DCD horizontal and vertical Certified Seismic Design Response Spectra (CSDRS), except for frequencies below approximately 0.23 Hz for horizontal spectra and 0.15 Hz for vertical spectra. Therefore, the ESBWR DCD Tier 1, Figure 5.1-1, "ESBWR Horizontal SSE Design Ground Spectra at Foundation Level," and the ESBWR DCD Tier 2, Figure 2.0-1, "ESBWR Horizontal SSE Design Ground Spectra at Foundation Level," are replaced by FSAR Figure 2.0-201. In addition, ESBWR DCD Tier 1, Figure 5.1-2, "ESBWR Vertical SSE Design Ground Response Spectra at Foundation Level," and ESBWR DCD Tier 2, Figure 2.0-2, "ESBWR Vertical SSE Design Ground Response Spectra at Foundation Level," are replaced by FSAR Figure 2.0-202.

This departure is discussed in FSAR Subsection 3.7.1.1.4.

As the low frequency seismic spectra exceedance is a departure from Tier 1 information, an exemption is required. Exemption Request 3.1, in Section 3.0, Exemption Requests, is presented to fulfill this requirement.

1.2 Departure: RBS DEP 2.0-2 – Minimum Shear Wave Velocity

The Unit 3 equivalent uniform shear wave velocity (Veq) does not meet the ESBWR DCD required values.

Table 5.1-1 of DCD Tier 1 and Table 2.0-1 of DCD Tier 2 require that the equivalent uniform shear wave velocity of the soil underneath the foundation be a minimum of 300 meters per second (1000 feet per second (fps)). The calculated equivalent uniform shear wave velocities for RBS Unit 3 Seismic Category I structures are less than the required minimum value. As shown in Table 2.5.2-231, the Veq of the soil column beneath the Unit 3 Category I structures are 909 fps for the RB/FB, 735 fps for the CB, and 832 fps for the FWSC.

This departure is discussed in FSAR Subsection 2.5.2.6.4.

As the site-specific equivalent uniform shear wave velocity is a departure from ESBWR DCD Tier 1 information, an exemption is required. Exemption Request 3.2, in Section 3.0, Exemption Requests, is presented to fulfill this requirement.

Note – Entergy expects that this departure can be deleted in Revision 1 of the COLA when the FSAR is updated to incorporate ESBWR DCD Revision 5.

1.3 Departure: RBS DEP 2.5-1 – Settlement

The Unit 3 maximum settlement values for Seismic Category I buildings are bounded by the ESBWR Maximum Settlement Values for Seismic Category I Buildings with the exception of the average settlement at the four corners of the Control Building basemat. FSAR Table 2.0-201, "Comparison of ESBWR DCD Site Parameters With Unit 3 Site Characteristics," provides the site specific settlement values which are bounded by the ESBWR settlement values except for the average settlement at four corners of the Control Building basemat. The settlement analysis described in FSAR Section 2.5.4 shows the average settlement at the four corners of the Control Building basemat exceeds the values found in ESBWR DCD Tier 2 Table 2.0-1. The long-term (post-construction) average settlement at the four corners of the Control Building basemat is 0.5 inch per Tier 2 ESBWR DCD Table 2.0-1. The site-specific average settlement at the four corners of the Control Building basemat is 0.7 inch.

This departure is discussed in FSAR Subsection 2.5.4.10.4.

This departure has been evaluated against the criteria of a future Section VIII.B.5 of the future design certification rule for the ESBWR DCD. As the settlement has been found to not adversely impact the structural integrity or the performance of the design functions of the Control Building, it does not:

- Increase the probability of occurrence or the consequences of an accident or equipment important to safety previously evaluated;
- Create the possibility of an accident or malfunction of equipment important to safety of a different type than any previously evaluated;
- Reduce the margin of safety for any of the proposed technical specifications; or

- Substantially increase the probability or consequences of a severe accident.

Thus, this departure qualifies for 50.59-like treatment under Section VIII.B.5 of the future design certification rule and may be made without prior NRC approval.

1.4 Departure: RBS DEP 9.4-1 – Heating, Ventilation, and Air Conditioning Exhaust Points

A multiple plant stack configuration consistent with ESBWR DCD Revision 5 is applied instead of a single plant stack. In Revision 4 of the ESBWR DCD, the Reactor Building Heating, Ventilating and Air Conditioning System (RBVS), Turbine Building HVAC System (TBVS), Fuel Building HVAC System (FBVS), and Radwaste Building HVAC System (RWVS) exhaust to a single plant vent stack. In Revision 5 of the ESBWR DCD, the plant design is changed to provide three vent stacks: the Reactor Building / Fuel Building vent stack, the Turbine Building vent stack, and the Radwaste Building vent stack.

This departure is identified in FSAR Subsections 9.4.2, 9.4.3, 9.4.4, 9.4.6, and 9.5.1.11 where these systems are described. References to the 'plant vent stack' in these sections are replaced by a reference to the appropriate building vent stack. This departure is also identified in FSAR Subsection 12.2.2.2 and Tables 12.2-15R and 12.2-17R, where separate releases from for each vent stack are described. In conjunction with updated airborne releases described in Departure 12.2-1, the χ/Qs based on multiple vent stack release points are used to determine the plant-specific offsite doses from normal operation.

Note – Entergy expects that this departure can be deleted in Revision 1 of the COLA when the FSAR is updated to incorporate ESBWR DCD Revision 5.

This departure has been evaluated against the criteria of a future Section VIII.B.5 of the future design certification rule for the ESBWR DCD. The new exhaust points have been included in the ESBWR DCD Revision 5, which is currently in NRC review. As the dose consequence analyses considering the new exhaust points meet regulatory criteria, this departure does not:

- Increase the probability of occurrence or the consequences of an accident or equipment important to safety previously evaluated;

- Create the possibility of an accident or malfunction of equipment important to safety of a different type than any previously evaluated;
- Reduce the margin of safety for any of the proposed technical specifications; or
- Substantially increase the probability or consequences of a severe accident.

Thus, this departure qualifies for 50.59-like treatment under Section VIII.B.5 of the future design certification rule and may be made without prior NRC approval.

1.5 Departure: RBS DEP 12.2-1 – Annual Airborne Releases

The annual airborne releases used to calculate normal operation offsite doses have been adjusted to be consistent with NUREG-0016. These releases are identified in FSAR Table 12.2-16R, which is derived from the table in ESBWR DCD Revision 5. In Revision 5, the release rates for many isotopes have been updated based on the models, assumptions, and parameters now reported in a newly created DCD Revision 5, Appendix 12B.

This departure is also identified in FSAR Subsection 11.1.2 where the normal operational Argon-41 release rate is revised to be consistent with NUREG-0016. The design basis Argon-41 release rate is deleted as it is no longer in the analysis. This departure is also identified in FSAR Subsection 12.2.2.2, where the annual releases are documented. In conjunction with multiple vent stack release points described in Departure 9.4-1, these annual releases are used to determine the plant-specific offsite doses from normal operation. ESBWR DCD Table 12.2-16 is replaced by FSAR Table 12.2-16R, which is derived from the corresponding table in Revision 5 of the ESBWR DCD.

Note – Entergy expects that this departure can be deleted in Revision 1 of the COLA when the FSAR is updated to incorporate ESBWR DCD Revision 5.

This departure has been evaluated against the criteria of a future Section VIII.B.5 of the design certification rule for the ESBWR DCD. The new release data has been included in the ESBWR DCD Revision 5, which is currently in NRC review. As the dose consequence analyses considering the new airborne releases meet regulatory criteria, this departure does not:

- Increase the probability of occurrence or the consequences of an accident or equipment important to safety previously evaluated;
- Create the possibility of an accident or malfunction of equipment important to safety of a different type than any previously evaluated;
- Reduce the margin of safety for any of the proposed technical specifications; or
- Substantially increase the probability or consequences of a severe accident.

Thus, this departure qualifies for 50.59-like treatment under Section VIII.B.5 of the future design certification rule and may be made without prior NRC approval.

2.0 VARIANCES

A variance is a plant-specific deviation from one or more of the site characteristics, design parameters, or terms and conditions of an ESP or from the site safety analysis report (SSAR).

River Bend Station Unit 3 is not an ESP site, therefore this section is not applicable.

3.0 EXEMPTION REQUESTS

An exemption must be obtained if information proposed in the COL application is inconsistent with one or more NRC regulation(s). Exemptions are submitted pursuant to 10 CFR 52.7 and 52.93 and must comply with the special circumstances in 10 CFR 50.12(a). Additionally, exemptions from DCD Tier 1 are governed by Section VIII.A.4 of the future design certification rule.

10 CFR 52.79(d)(1) states that the FSAR must demonstrate that the site characteristics fall within the site parameters in the DCD. As discussed below, some of the site characteristics for RBS are not bounded by the site parameters in Tier 1 of the DCD. Accordingly, Subsections 3.1 and 3.2 contain requests for specific exemptions from requirements contained in 10 CFR 52.79 and Section VIII.A.4 of the future design certification rule.

3.1 Seismic Spectra Exceedance Exemption Request

Pursuant to 10 CFR 52.7 and Section VIII.A.4 of the future design certification rule for the ESBWR, the Applicants hereby request an exemption from the requirements of 10 CFR 52.79(d)(1) and Tier 1 of the ESBWR Design Control Document (DCD), which require the Final Safety Analysis Report to demonstrate that the site characteristics fall within the site parameters specified in the design certification. At low frequencies, the site seismic response spectra exceed the Certified Seismic Design Response Spectra (CSDRS). Since, the CSDRS are Tier 1 information, any exceedance from the spectra requires an exemption from 10CFR 52.79(d)(1) and Tier 1, in accordance with 10 CFR 52.7 and Section VIII.A.4 of the future design certification rule for the ESBWR.

Entergy hereby requests an exemption from the requirements of 10 CFR 52.79(d)(1), which requires the FSAR to demonstrate that the site characteristics fall within the site parameters specified in the design certification and Tier 1 of the ESBWR DCD. Table 5.1-1 of DCD Tier 1 specifies a Certified Seismic Design Response Spectra (CSDRS) as provided in DCD Tier 1 Figures 5.1-1 and 5.1-2. The RBS Unit 3 Foundation Input Response Spectra (FIRS) exceeds the CSDRS in the low frequency range of the spectra.

Discussion

As discussed in departure RBS DEP 2.0-1, the Unit 3 horizontal and vertical response spectra are bounded by the ESBWR horizontal and vertical response spectra, except for frequencies below approximately 0.23 Hz. FSAR Figure 2.0-201, “Unit 3 ESBWR

Horizontal Design Ground Response Spectra Comparison at Foundation Level," and FSAR Figure 2.0-202, "Unit 3 ESBWR Vertical Design Ground Response Spectra Comparison at Foundation Level," provide the site-specific horizontal and vertical Foundation Input Response Spectra (FIRS), which are bounded by the ESBWR horizontal and vertical CSDRS, except for frequencies below approximately 0.23 Hz for horizontal spectra and 0.15 Hz for vertical spectra. Therefore, the ESBWR DCD Tier 1, Figure 5.1-1, "ESBWR Horizontal SSE Design Ground Spectra at Foundation Level" is replaced FSAR Figure 2.0-201, "ESBWR Horizontal Design Ground-Motion Response Spectra Comparisons at Foundation Level." In addition, ESBWR Tier 1, Figure 5.1-2, "ESBWR Vertical SSE Design Ground Response Spectra at Foundation Level" is replaced by FSAR Figure 2.0-202, "ESBWR Vertical Design Ground-Motion Response Comparisons at Foundation Level."

As stated in FSAR 3.7.1.1.4, the low frequency exceedance in the horizontal and vertical spectra does not have an adverse impact on the seismic design of the ESBWR standard plant because:

a. There are no frequencies below 0.23 Hz in the frequency range of interest for the structural response. The CSDRS are bounding for all frequencies greater than or equal to 0.23 Hz. The lowest structural frequencies are 1.19 Hz for RB/FB, 2.84 Hz for CB, and 4.73 Hz for FWSC at soft sites in accordance with DCD Tier 2 Tables 3A.7-1, 3A.7-8, and 3A.7-15, respectively.

b. Although pools in Reactor Building/Fuel Building (RBFB) have sloshing frequencies less than 0.23 Hz, sloshing response is only a small portion of overall seismic-induced hydrodynamic loads on the pool structure and does not govern. The majority of hydrodynamic loads are due to the impulsive response of the water. Impulsive response is a function of the pool structure response at structural frequencies. Appendix D of GE Document 26A6651, Revision 3, RB Structural Design Report, provides summary results of hydrodynamic loads in various pools due to Certified Seismic Design Response Spectra (CSDRS) loading. The FIRS are enveloped by the CSDRS in the frequency range of interest for the structural response (i.e., frequencies greater than 0.23 Hz). The impulsive response inherent in the CSDRS-based design is typically an order of magnitude higher than the sloshing response at lower accelerations of the FIRS.

c. The CSDRS for the Fire Water Service Complex (FWSC) is 1.35 times the RBFB/Control Building (CB) CSDRS. The FWSC sloshing frequency is 0.24

Hz and is enveloped by the CSDRS. DCD Tier 2 Tables 3A.7-15 through 3A.7-18 shows sloshing frequencies (Modes 1 & 2 in eigenvalue analysis) as 0.24 Hz for all site conditions

d. The higher FIRS below 0.23 Hz is irrelevant to the CB because the CB does not contain water pools. DCD Tier 2 Figures 1.2-2 through 1.2-5 show that there are no pools in the CB. DCD Tier 2 Tables 3A.7-8 through 3A.7-11 show the eigenvalue analysis results for various generic site conditions. The lowest structural frequency is 2.84 Hz for a soft-soil site.

e. The vertical exceedance at frequencies below 0.15 Hz is inconsequential because the vertical earthquake components do not induce sloshing.

Therefore, the adequacy of CSDRS is confirmed for Unit 3 application.

Conclusion

As the exceedance is minimal and is in a frequency range which has little to no effect on the facility, the change has been evaluated and does not result in a significant decrease in the level of safety otherwise provided by the certified design.

This exemption request was evaluated per Section VIII.A.4 of the future design certification rule which requires that 1) the change will not result in a significant decrease in the level of safety otherwise provided by the design; 2) the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security; 3) special circumstances are present as specified in 10 CFR 50.12(a)(2); and 4) the special circumstances outweigh any decrease in safety that may result from the reduction in standardization caused by the exemption. As shown below, each of these four criteria are satisfied.

(1) As discussed above, the change does not have an adverse impact and therefore will not result in a significant decrease in the level of safety otherwise provided by the design.

(2) The exemption is not inconsistent with the Atomic Energy Act or any other statute and therefore is authorized by law. As discussed above, the change does not have an adverse impact and therefore will not present an undue risk to the public health and safety. The change does not relate to security and does not otherwise pertain to the common defense and security.

(3) Special circumstances are present as specified in 10CFR 50.12(a)(2). Specifically, special circumstance (ii) is present, since application of Section 52.79(d)(1) and the site parameters in Tier 1 of the DCD are not necessary in this case to achieve the underlying purpose of the rules. The analysis described above shows that the exceedance from the CSDRS does not affect the design. Additionally, special circumstance (iii) is present, since compliance would necessitate relocating the facility to another site, which would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted.

(4) The special circumstances outweigh any decrease in safety that may result from the reduction in standardization (due to the low frequency exceedance) caused by the exemption. Specifically, the change does not have an adverse impact and does not affect the configuration of the plant or the manner in which the plant is operated.

As demonstrated above, this exemption request complies with the requirements in Section VIII.A.4 of the future design certification rule for the ESBWR. Therefore, the exemption also satisfies the requirements in 10 CFR 52.7 for an exemption from 10 CFR 52.79(d)(1), since the criteria in 10 CFR 52.7 are a subset of the criteria in Section VIII.A.4 of the future design certification rule for the ESBWR.

It is expected that this request for exemption is temporary and will be removed in a later revision of the COLA when Revision 5 of the ESBWR DCD is incorporated. Revision 5 of Section 5.1 of the ESBWR DCD Tier 1 allows deviations from the specified seismic design parameters in Table 5.1-1 of DCD Tier 1 to be justified with a site-specific soil-structure interaction (SSI) analysis. Incorporation of DCD Revision 5 and the performance of the SSI will obviate the need for this exemption request.

3.2 Shear Wave Velocity Exemption Request

Pursuant to 10 CFR 52.7 and Section VIII.A.4 of the future design certification rule for the ESBWR, the Applicants hereby request an exemption from the requirements of 10 CFR 52.79(d)(1) and Tier 1 of the ESBWR Design Control Document (DCD), which require the Final Safety Analysis Report to demonstrate that the site characteristics fall within the site parameters specified in the design certification. Since the minimum equivalent uniform shear wave velocity is Tier 1 information, a site-specific value below the DCD requirement requires an exemption from 10CFR 52.79(d)(1) and Tier 1, in accordance with 10 CFR 52.7 and Section VIII.A.4 of the future design certification rule for the ESBWR.

Entergy hereby requests an exemption from the requirements of 10 CFR 52.79(d)(1), which requires the FSAR to demonstrate that the site characteristics fall within the site parameters specified in the design certification and Tier 1 of the ESBWR DCD. Table 5.1-1 of DCD Tier 1 specifies a minimum shear wave velocity of 300 m/s (1000 ft/s). The Unit 3 equivalent uniform shear wave velocity (Veq) does not meet the ESBWR DCD required values.

Discussion

As shown in Table 2.5.2-231, the Veq of the soil column beneath the Unit 3 Category I structures are 909 feet per second for the RB/FB, 735 feet per second for the CB, and 832 feet per second for the FWSC, which are less than the minimum shear wave velocity of 300 meters per second (1000 feet per second) specified in Table 5.1-1 of DCD Tier 1.

The calculated equivalent uniform shear wave velocity for Unit 3 is not expected to impact the ability of the ESBWR Category I structures to satisfy the standard design seismic requirements because:

- RBS experiences relatively low ground motion acceleration as described in FSAR Section 2.5.2.

- Margins exist between the DCD CSDRS and the site specific foundation input response spectra.

- Conservative approaches were used in the determination of the equivalent uniform shear wave velocity (Veq). The ESBWR DCD defines the Veq to be taken over the entire soil column at seismic strain, which is a lower bound value after taking into account uncertainties. This lower bound used in the comparison equates to the minus one-sigma value. Assigning this value accounts for a large amount of uncertainty and is considered conservative. If more reasonable values for the uncertainty are considered, then the Veq magnitudes are closer to meeting or exceeding DCD requirements. Another conservative approach was the variability and confinement of the fill. The reduction of the Veq values for uncertainty was applied to the entire soil column including the engineered fill that will replace the upper 75 feet of the soil column. A reduction of the Veq values for the native soils may be a reasonable approach based on the natural variation of soils. Reducing the Veq of the engineered fill to account for potential variability is very conservative given that the engineered fill will be placed in a controlled manner.

- This conclusion is consistent with that of another near-term applicant that also saw similar shear wave velocity results and completed a preliminary SSI. Those SSI results supported a similar conclusion.

A site-specific SSI analysis will be performed to confirm the applicability of the ESBWR design for the RBS site. The final SSI analysis will be provided in Revision 1 of the COLA.

Therefore, the departure from the minimum shear wave velocity specified in Tier 1 of the DCD will not have an adverse impact on the ESBWR Standard Plant design.

Conclusion

This exemption request was evaluated in accordance with the expected Section VIII.A.4 of the future design certification rule which requires that: 1) the change will not result in a significant decrease in the level of safety otherwise provided by the design; 2) the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security; 3) special circumstances are present as specified in 10 CFR 50.12(a)(2); and 4) the special circumstances outweigh any decrease in safety that may result from the reduction in standardization caused by the exemption. As shown below, each of these four criteria are satisfied.

(1) As described above, the exemption does not have an adverse impact on the ESBWR Standard Plant design and therefore will not result in a significant decrease in the level of safety otherwise provided by the design.

(2) The exemption is not inconsistent with the Atomic Energy Act or any other statute and therefore is authorized by law. As discussed above, the exemption does not have an adverse impact on the ESBWR Standard Plant design and therefore will not present an undue risk to the public health and safety. The exemption does not relate to security and does not otherwise pertain to the common defense and security.

(3) Special circumstances are present as specified in 10 CFR 50.12(a)(2). Specifically, special circumstance (ii) is present, since application of Section 52.79(d)(1) and the site parameters in Tier 1 of the DCD is not necessary to achieve the underlying purpose of the rules. The evaluation described above shows that the reduction in the minimum shear wave velocity will not affect the ESBWR Standard Plant design. Additionally, special circumstance (iii) is present, since compliance would

necessitate relocating the facility to another site, which would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted. Further, special circumstance (vi) is present in that there are material circumstances not considered during development of the DCD (i.e., minimum shear wave velocities due to soil conditions in the Gulf Coast region). Given the need for power in Louisiana, it is in the public interest to allow construction of the reactor at the RBS site.

(4) The special circumstances outweigh any decrease in safety that may result from the reduction in standardization (due to the reduction in the minimum shear wave velocity) caused by the exemption. Specifically, the exemption does not change the ESBWR Standard Plant design and does not affect the configuration of the plant or the manner in which the plant is operated.

As demonstrated above, this exemption request complies with the requirements in the expected Section VIII.A.4 of the future design certification rule for the ESBWR. Therefore, the exemption also satisfies the requirements in 10 CFR 52.7 for an exemption from 10 CFR 52.79(d)(1), since the criteria in 10 CFR 52.7 are a subset of the criteria in Section VIII.A.4 of the future design certification rule for the ESBWR.

It is expected that this request for exemption is temporary and will be removed in a later revision of the COLA, when Revision 5 of the ESBWR DCD is incorporated. Revision 5 of Section 5.1 of the ESBWR DCD Tier 1 allows deviations from the specified soil parameters in Table 5.1-1 of DCD Tier 1 to be justified with a site-specific SSI analysis. Incorporation of DCD Revision 5 and the performance of the SSI will obviate the need for this exemption request.