

May 29, 2007

Mr. Robert E. Brown  
General Manager, Regulatory Affairs  
General Electric Company  
3901 Castle Hayne Rd, MC A-45  
Wilmington, NC 28401

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 98 RELATED TO  
ESBWR DESIGN CERTIFICATION APPLICATION

Dear Mr. Brown:

By letter dated August 24, 2005, General Electric Company (GE) submitted an application for final design approval and standard design certification of the economic simplified boiling water reactor (ESBWR) standard plant design pursuant to 10 CFR Part 52. The Nuclear Regulatory Commission (NRC) staff is performing a detailed review of this application to enable the staff to reach a conclusion on the safety of the proposed design.

The NRC staff has identified that additional information is needed to continue portions of the review. The staff's request for additional information (RAI) is contained in the enclosure to this letter. This RAI concerns Chapters 3, 4, 6, 9, 10, 12, 13, 14, and 18 of the ESBWR Design Control Document.

Chapter 3: 3.4-9, 3.5-17, 3.8-111 through 113, 3.11-6 through 12  
Chapter 4: 4.4-57 through 60  
Chapter 6: 6.1-16, 6.2-156, 6.3-81  
Chapter 9: 9.1-31 through 32, 9.2-14, 9.3-37 through 39  
Chapter 10: 10.2-20 through 25  
Chapter 12: 12.2-21 through 22  
Chapter 13: 13.6-4 through 13.6-35  
Chapter 14: 14.2-89  
Chapter 18: 18.4-26, 18.6-11 through 12

To support the review schedule, you are requested to respond to these RAI questions by July 12, 2007.

R. Brown

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If you have questions or comments concerning this matter, you may contact me at (301) 415-2875 or aec@nrc.gov.

Sincerely,

***/RA/***

Amy E. Cabbage, Senior Project Manager  
ESBWR/ABWR Projects Branch 1  
Division of New Reactor Licensing  
Office of New Reactors

Docket No. 52-010

Enclosure: As stated

cc w/encl: See next page

R. Brown

-2-

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\*See previous concurrence  
ACCESSION NO. ML071450138

OFFICE	NGE1/PM*	NGE1/PM*	NGE1/BC*
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DATE	05/29/2007	05/29/2007	05/29/2007

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**Requests for Additional Information (RAIs)**  
**ESBWR Design Control Document (DCD), Revision 3**

**Chapter 3, Design of Structures, Components, Equipment, and Systems**

RAI Number	Reviewer	Question Summary	Full Text
3.4-9	Shum D	Provide calculations to demonstrate resulting flood level in various areas. Include physical dimensions of each area, and maximum volume of flood water in each area.	<p>With regard to internal flooding additional information is needed to support the following conclusions in DCD Tier 2, Revision 3, section 3.4.1:</p> <ul style="list-style-type: none"> <li>* The resulting flood level in the Reactor Building (RB) lower elevation is 20 cm (8 in) and that maximum flood level is lower than the Control Rod Drive Hydraulic Control Unit room elevation.</li> <li>* Safety-related components in the lower elevation of RB are located above the maximum flood level.</li> <li>* The maximum water depth of 40 cm (16 in) in the lowest floor of the Control Building (CB) is below Distributed Control and Information System room floor elevation.</li> <li>* Water in the lower elevation of the CB from pipe failures in the heating, ventilation and air conditioning (HVAC) rooms is retained in the HVAC rooms by the installation of 200 mm (8 in) high curbs in the access doors, chases and other floor openings, as well as by normally closed isolation valves in the drain lines.</li> </ul> <p>GE should provide calculations to demonstrate the resulting flood level in each of the above cited areas. The calculations should include physical dimensions (e.g., floor length, width and height, and calculated floor areas) of each area, and maximum volume of flood water in each area.</p>

3.5-17	Tsao J	Justify changes to Revision 3 of the DCD Tier 2, Section 3.5.1.1.1.2 regarding turbine missile generation.	<p>In Revision 3 of the DCD Tier 2, Section 3.5.1.1.1.2 (page 3.5-4) states that “The COL holder will provide an evaluation of the probability of turbine missile generation which concludes that the probability of turbine missile generation, P1, is less than <math>1 \times 10^{-5}</math> per Subsection 10.2.5...”</p> <p>(a) The staff believes that the probability of turbine missile generation should be completed prior to license issuance so that the staff can verify that the probability of turbine missile generation is within NRC requirements and licensing basis. This means that the COL applicant should provide the information, not the COL holder. If the probability calculation is not approved by the NRC prior to license issuance, the plant owner needs to perform certain nondestructive examinations per SRP 3.5.1.3. Justify the use of “the COL holder” in lieu of “the COL applicant” in subsection 3.5.1.1.1.2.</p> <p>(b) The staff believes that a turbine system maintenance program should be submitted prior to fuel load in addition to the probability calculation of turbine missile generation. The submission of the turbine maintenance program was specified in Section 3.5.4.4 of Revision 0 but was deleted in Revision 3. Please justify this deletion.</p>
3.8-111	Chakrabarti S	Design changes in liner plate thickness and size of stiffeners	<p>The staff noted during its review of DCD Figures 3G.1-48 and 3G.1-49 that some liner plate thicknesses and the size of the stiffeners have been reduced between DCD Rev. 2 and DCD Rev.3. The applicant referenced RAI 3.8-24 as the basis for the change in the Rev. 3 Change Summary Table. The staff cannot identify any connection between RAI 3.8-24 and the design changes, other than a statement in the applicant’s response to RAI 3.8-24 that these figures were revised. The staff requests the applicant to explain why these design changes were made and to provide the technical basis for the structural adequacy of these changes.</p>

3.8-112	Chakrabarti S	Control Building design	<p>DCD Tier 2, Rev 3, included changes to the design of the Control Building, including the addition of a new floor slab. The design has not the case, when will it be completed and by whom? Also, the information in Section 3G.2 of DCD Tier 2, Rev 3, needs to be updated to completely reflect the change in design. For example, Figure 3G.2-11 still indicates that the building above grade is Seismic Category II. Also, all the tables in Section 3G.2 need to be updated to report the applicable information for the walls in the Control Building above EL 4650 and the floor slabs at EL 9060 and EL 13500.</p>
3.8-113	Chakrabarti S	Structural effects of Spent Fuel Pool boiling	<p>Provide the technical details about how temperature effects were considered in the design of Spent Fuel Pool structure, to account for boiling of the pool water for up to 72 hours at 212 degrees F. Identify which load category (e.g., <math>T_a</math> or <math>T_o</math>) and load combinations in DCD, Tier 2, Table 3.8-15 include consideration of this thermal condition for the reinforced concrete walls. This information needs to be documented in the DCD.</p>
3.11-6	Pal A	Provide basis for equipment qualification (EQ) list being provided by the COL holder.	<p>In DCD Tier 2, Rev 3, section 3.11.1, the applicant stated that electrical equipment within the scope of EQ includes all three categories of 10 CFR 50.49(b). The applicant further stated that a list of all 10 CFR 50.49(b) electrical equipment that is located in a harsh environment area shall be included in the equipment qualification document to be prepared by COL holder. Provide basis for EQ list being provided by the COL holder.</p>
3.11-7	Pal A	Provide basis for environmental qualification of 10 CFR 40.49(b) electrical equipment being addressed by the COL holder	<p>In DCD Tier 2, Rev 3, Section 3.11.5, the applicant stated that the COL holders shall prepare the environmental qualification document summarizing the qualification results for all equipment identified in DCD Section 3.11.1. Provide the basis for environmental qualification of 10 CFR 50.49(b) electrical equipment being addressed by the COL holder.</p>

3.11-8	Pal A	Confirm that digital instrumentation and control components are included in the scope of EQ.	In DCD Tier 2, Rev 3, Section 3.11, the applicant discussed EQ shall be based on limiting design conditions for electrical equipment (including instrumentation and control components) and safety-related mechanical equipment. Confirm that digital instrumentation and control components are included.
3.11-9	Pal A	Provide examples Of EQ methods and standards for electrical equipment (including I&C and digital I&C) located in mild environments, and surveillance and maintenance programs.	In Section 3.11.2.2, of ESBWR DCD, Tier 2, Rev 3, states that vendors of equipment located in a mild environment are required to submit a certificate of compliance certifying that the equipment has been qualified to assure its required safety-related function in its applicable environment. The DCD also states that a surveillance and maintenance program shall be developed to ensure the operability during its design life. Provide examples of the environmental qualification methods and standards for electrical equipment (including I&C and digital I&C) located in mild environments, and the surveillance and maintenance program to be developed to ensure functionality during their design life.
3.11-10	Pal A	Confirm that submergence, aging, and synergistic effects are included in the equipment qualification program.	In Appendix 3H of the DCD, Tier 2, Rev 3, the environmental parameters listed include thermodynamic, radiation, and chemical spray parameters. The equipment qualification program must also include submergence (if subject to being submerged), aging (equipment qualified by test must be preconditioned by natural or artificial aging), and synergistic effects in accordance with 10 CFR 50.49(e). Confirm that these elements are included in the equipment qualification program.
3.11-11	Pal A	Provide justification for deviation from IEEE 323-1974.	In DCD Tier 2, Rev 3, section 3.11.2.2 , the applicant stated that 10 CFR 50.49(b) electrical equipment that is located in a harsh environment is qualified by test or other methods as described in IEEE 323-2003. IEEE 323-2003 has not been endorsed by the NRC staff. Provide appropriate justification for deviation from IEEE 323-1974 consistent with current regulatory practice.

3.11-12	Pal A	Provide details regarding qualification methods to qualify electronic equipment for gamma dose $<10^4$ rads.	In DCD Tier 2, Rev 3, Appendix 3H, Table 3H-6, the applicant stated that electronic equipment is qualified for gamma dose $< 10^4$ rads. The NRC staff's position as discussed in SRP 3.11, Revision 3, is that a mild radiation environment for electronic equipment is a total integrated dose less than $10^3$ rads. Provide details regarding qualification methods to qualify electronic equipment for gamma dose $<10^4$ rads.
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**Chapter 4, Reactor**

<b>RAI number</b>	<b>Reviewer</b>	<b>Summary</b>	<b>Full Text</b>
4.4-57	Klein V	Regional mode decay ratio for AOOs	DCD Tier 2, Rev. 3, Table 4D-4 shows that only core and channel decay ratios were calculated for the two limiting AOO's. Provide regional mode decay ratios for these two cases.
4.4-58	Klein V	Chimney fine nodalization	The stability calculations to support the DCD should be performed with the fine-nodalization chimney model of TRACG to guarantee that chimney oscillations do not affect the core stability.
4.4-59	Klein V	Margin to Instability During low-pressure Startup	Establish a maximum heat-up rate for the low pressure start-up in terms of MW per hour that will not be exceeded by the licensee. Show margin to instability by simulating the start-up path using a larger heat-up rate that bounds the established maximum. Use neutronic feedback.
4.4-60	Klein V	Startup with Transient Xenon and BOP model	Provide a calculation demonstrating margin through the ascension to full-pressure phase of the startup. Use the transient Xenon capability in TRACG/PANAC and add the relevant components of the balance of plant model to show plant response.
14.2-89	Klein V	Startup testing to characterize flow-regime instability	<p>Staff calculations indicate that the flow regime in the ESBWR chimney will transition from slug/churn to annular regime between 30 percent and 70 percent power. Each chimney partition will transition at a different power level. During the transition, flow oscillations may develop in the chimney partitions, which will affect the void fraction and local power of their associated fuel bundles.</p> <p>Provide a startup testing plan to identify the impact, if any, of operation at reduced power levels where flow-transition-induced flow oscillations may be possible. One possible methodology to perform these startup tests would involve frequency-domain analysis of data from LPRM detectors at different power levels.</p>

**Chapter 6, Engineered Safety Features**

<b>RAI Number</b>	<b>Reviewer</b>	<b>Question Summary</b>	<b>Full Text</b>
6.1-16	Diaz-Castillo Y	DCD, Tier 2, Rev. 3, Section 6.1.3.1 COL items should be “applicant” and not “holder.”	<p>DCD, Tier 2, Rev. 3, Section 6.1.3.1, GE stated that the COL Holder will perform the following COL items:</p> <ol style="list-style-type: none"> <li>1. Indicate the total amount of protective coatings and organic materials used inside containment that do not meet the requirements of ASTM D-5144 and Regulatory Guide 1.54.</li> <li>2. Evaluate the generation rate, as a function of time, of combustible gases that can be formed from these unqualified organic materials under DBA conditions.</li> <li>3. Provide the technical basis and assumptions used for this evaluation.</li> </ol> <p>These COL items should be the responsibility of the COL Applicant and not the COL Holder. Please revise the DCD accordingly.</p>
6.2-156	Drozd A Goel R	Clarify text in DCD, Tier 2, Section 6.2.2.2.2	DCD Tier 2, Rev. 3, Section 6.2.2.2.2 states: “The system is designed as a passive system with no components that must actively function, and it is also designed for conditions that equal or exceed the upper limits of containment reference severe accident capability.” This appears to be a editorial mistake for which the author made a note to “reference the severe accident capability.” Please clarify this sentence.

RAI Number	Reviewer	Question Summary	Full Text
6.3-81	Klein V Landry R	Uncertainty for LOCA analyses	<p>The staff noted in the safety evaluation report pertaining to the applicability of TRACG to the LOCA in the ESBWR design that an uncertainty analysis had not been performed. The staff noted this as a confirmatory item to be addressed at the design certification phase. The staff noted in the acceptance letter pertaining to the ESBWR Design Certification Document that the confirmatory items had not been addressed for the LOCA analysis.</p> <p>Please demonstrate how the LOCA analysis performed in support of the ESBWR design certification complies with the requirement of 10 CFR 50.46(a)(1)(i) that reads in part:</p> <p>ECCS cooling performance must be calculated in accordance with an acceptable evaluation model ...and uncertainties in the analysis method and inputs must be identified and assessed so that the uncertainty in the calculated results can be estimated. This uncertainty must be accounted for, so that, when the calculated ECCS cooling performance is compared to the criteria set forth in paragraph (b) of this section, there is a high level of probability that the criteria would not be exceeded.</p> <p>The analysis that has been provided in the design certification document is based on a single calculation assuming limiting nominal conditions.</p>

**Chapter 9, Auxiliary Systems**

<b>RAI Number</b>	<b>Reviewer</b>	<b>Question Summary</b>	<b>Full Text</b>
9.1-31	Hernandez J	Clarify the discrepancy between RAI response 9.1-14 and DCD Tier 2, Rev. 3, Section 9.1.3.2 and revise the DCD accordingly.	In its response to RAIs 9.1-14, the applicant stated that the value for the boil-off rate in the spent fuel pool is calculated based on the most limiting condition, which includes the decay heat from 10 years of accumulated spent fuel in the spent fuel pool as well as the shutdown power from the full core discharged to the ICS immediately following a scram. However, DCD Tier 2, Rev. 3, Section 9.1.3.2 states that the maximum SFP heat load conditions are from a full core off-load plus irradiated fuel resulting from 20 years of operation. Please clarify the discrepancy and revise the DCD accordingly.
9.1-32	Hernandez J	Clarify how many FAPCS makeup lines discharge into the IC/PCCS pools and update DCD Tier 1 and Tier 2 accordingly.	<p>DCD Tier 2, Rev. 3, Section 9.1.3 states that pipes equipped with normally closed manual valves are provided for establishing flow paths from off-site emergency water supplies or the Fire Protection System to refill the isolation condenser/passive containment cooling system (IC/PCCS) pools and Spent Fuel Pool following a design basis loss of coolant accident. DCD Tier 2, Rev. 3, Section 6.2.2 states that the fuel and auxiliary pool cooling system (FAPCS) provides safety-related dedicated makeup piping, independent of any other piping, which provides an attachment connection at grade elevation in the station yard outside the reactor building, whereby a post-LOCA water supply can be connected.</p> <p>Clarify how many FAPCS makeup lines discharge into the IC/PCCS pools since there are two expansion pools which are not normally connected. If only one line is provided clarify how the redundancy requirements as related to GDC 38 are met to ensure long term cooling. In addition, revise Tier 1, Figure 2.6.2-1 and Tier 2, Figure 9.1-1 to reflect this information.</p>

RAI Number	Reviewer	Question Summary	Full Text
9.2-14	Li C	Clarify HWS design	<p>According to the description of the hot water system (HWS) in Section 9.2.9.2 and Table 3.2-1 of the DCD Tier 2, Revision 3. The HWS is a non-safety system going through all over the plant without being seismically qualified. "All over the plant" includes the containment. Following a seismic event, a failure of the system components and piping could be assumed because the system is non-seismic. Clarify the following aspects of the system.</p> <ol style="list-style-type: none"> <li>(1) Whether the system piping penetrates the containment and meets the requirements of the containment penetration and isolation.</li> <li>(2) Whether the portions of the system inside the containment have proper seismic design.</li> <li>(3) How the system meets GDC 2 as related to RG 1.29, Revision 3, Positions C.1 and C.2.</li> </ol>
9.3- 37	Diaz-Castillo Y	Clarify ownership of COL Action Items: COL Applicant vs. COL Holder in DCD Section 9.3.9.6, related to the Hydrogen Water Chemistry system.	<p>In DCD, Tier 2, Rev. 3, Section 9.3.9.6 you stated that the <i>COL Holder</i> will perform the following COL item:</p> <ol style="list-style-type: none"> <li>1. Determine Oxygen and Hydrogen demand requirements and supply system, if implemented.</li> </ol> <p>However, in Section 9.3.10 you stated that the <i>COL Applicant</i> shall define site storage requirements for the Oxygen Injection System. Please clarify whether the above COL item should be the responsibility of the <i>COL Applicant</i> or the <i>COL Holder</i> and the basis for it. In addition, please clarify whether the decision to implement the Hydrogen Water Chemistry System is the responsibility of the <i>COL Applicant</i> or the <i>COL Holder</i> and why.</p>
9.3-38	Diaz-Castillo Y	Clarify compliance with EPRI Report NP-5283-SR-A.	<p>Clarify whether the means for storing and handling oxygen comply with EPRI Report NP-5283-SR-A "Guidelines for Permanent BWR Hydrogen Water Chemistry Installations." In addition, please clarify whether the decision to implement the Oxygen Injection System relies on the <i>COL Applicant</i> or the <i>COL Holder</i> and the basis for it.</p>

RAI Number	Reviewer	Question Summary	Full Text
9.3-39	Diaz-Castillo Y	Clarify ownership of COL Action Items: COL Applicant vs. COL Holder in Section 9.3.11.6, related to the Zinc Injection system.	<p>In Section 9.3.11.6 you stated that the <i>COL Applicant/Holder</i> shall perform the following items:</p> <ol style="list-style-type: none"> <li>1. Determine if a Zinc Injection System is required based on site-specific water quality requirements.</li> <li>2. Furnish necessary information on System Description, Test and Inspection when vendor information becomes available.</li> </ol> <p>Please clearly state whether the <i>COL Applicant</i> or the <i>COL Holder</i> is responsible for providing the above information and the basis for it. In addition, please clarify whether the decision to implement the Zinc Injection System is the responsibility of the <i>COL Applicant</i> or the <i>COL Holder</i> and why.</p>

**Chapter 10, Steam and Power Conversion System**

<b>RAI Number</b>	<b>Reviewer</b>	<b>Question Summary</b>	<b>Full Text</b>
10.2-20	Hernandez J	Justify removal of COL Holder item for turbine inservice test and inspection program.	DCD Tier 2, Rev. 2, Section 10.2.5 stated that the details of the turbine inservice test and inspection program (as requested in SRP 10.2.3) will be provided in a COL FSAR update, after the turbine has been purchased. However, this COL Holder item was removed in DCD Revision 3. Provide a justification for its removal.
10.2-21	Tsao J	Justify changes to Revision 3 of the DCD Tier 2, Section 10.2.5.1 regarding turbine missile generation.	DCD Tier 2, Rev. 3, Section 10.2.5.1 states that the COL holder will provide an evaluation of the probability of turbine missile generation using criteria in accordance with NRC requirements. The probability of turbine missile generation should be completed prior to license issuance so that the staff can verify whether the probability of turbine missile generation is within the NRC requirements. This means that the COL applicant should provide the information, not the COL holder. Justify the use of “the COL holder” in lieu of “the COL applicant” in subsection 10.2.5.1.
10.2-22	Tsao J	Revise changes to COL Action Items related to documentation associated with the main turbine.	<p>In DCD, Tier 2, Revision 0, several COL action items were specified. Specifically, Subsection 10.2.5.1 specifies that the COL applicant will provide turbine material property data and assure sufficient turbine warmup time. Subsection 10.2.5.2 specifies that the COL applicant will provide the basis for the turbine overspeed. Subsection 10.2.5.3 specifies that the COL applicant will provide the turbine inservice test and inspection requirements. However, none of these three subsections is shown in Section 10.2.5 of Revision 3.</p> <p>The staff noticed that the overspeed basis report and the inservice test and inspection report are incorporated in Section 10.2.3.4 (page 10.2-11). However, it is not clear in Section 10.2.3.4 who provides these reports and when. Also, the submission of turbine material property data and warmup time is not specified in Section 10.2.3. Therefore, GE needs to either reinstate all three COL Action Items, or state in Subsection 10.2.3.4 that the COL applicant will submit the relevant documents.</p>

RAI Number	Reviewer	Question Summary	Full Text
10.2-23	Tsao J	Justify design limits not consistent with SRP 10.2.3.II.1.	DCD Tier 2, Rev. 3, Section 10.2.3.1 (Page 10.2-10, third paragraph) states that the fracture appearance transition temperature will be no higher than +30 degrees F; and that the Cv energy at the minimum operating temperature will be at least 45 ft-lbs for a large integral rotor. Justify these two design limits because they are not consistent with SRP 10.2.3.II.1.
10.2-24	Tsao J	Discuss the method that will be used to obtain fracture toughness properties of the turbine in accordance with SRP 10.2.3.II.2.	DCD Tier 2, Rev. 3, Section 10.2.3.2 is not consistent with SRP 10.2.3.II.2 because it is not clear how fracture toughness properties of the turbine rotor are obtained. SRP 10.2.3.II.2 specifies 4 methods (a, b, c, and d) for obtaining fracture toughness properties for the turbine rotor. Discuss the method that will be used in accordance with SRP 10.2.3.II.2.
10.2-25	Tsao J	Discuss whether pre-service visual examinations of forgings will be conducted in accordance with SRP 10.2.3.II.3.	DCD Tier 2, Rev. 3, Section 10.2.3.5 (Page 10.2-11) describes the specific codes or standards to which the pre-service examinations (ultrasonic and surface) of forgings will be adhered as recommended in SRP 10.2.3.II.3. Discuss whether pre-service visual examinations of forgings will be conducted.

**Chapter 12, Radiation Protection**

<b>RAI Number</b>	<b>Reviewer</b>	<b>Question Summary</b>	<b>Full Text</b>
12.2-21	Dehmel J-C	In Revision 3 of the DCD Tier 2, Section 12.2.4.2, the COL action item is incomplete in demonstrating compliance with NRC regulations for airborne effluents.	In Revision 3 of the DCD Tier 2, Section 12.2.4.2, the COL action item is incomplete in demonstrating compliance with NRC regulations for airborne effluents. In addition to demonstrating compliance with the dose objectives of Sections II.B and II.C of Appendix I to 10 CFR Part 50, the COL applicant needs to also demonstrate compliance with Section II.D of Appendix I to Part 50; airborne effluent concentration limits of Appendix B (Table 2, Column 1) to 10 CFR Part 20; and dose limits of Parts 20.1301 and 20.1302 to members of the public. Accordingly, update this COL action in the DCD for the purpose of fully reflecting all applicable NRC regulations.
12.2-22	Dehmel J-C	In Revision 3 of the DCD Tier 2, Section 12.2.4.3, the COL action item is incomplete in demonstrating compliance with NRC regulations for liquid effluents.	In Revision 3 of the DCD Tier 2, Section 12.2.4.3, the COL action item is incomplete in demonstrating compliance with NRC regulations for liquid effluents. In addition to demonstrating compliance with the dose objectives of Section II.A of Appendix I to 10 CFR Part 50, the COL applicant needs to also demonstrate compliance with Section II.D of Appendix I to Part 50; liquid effluent concentration limits of Appendix B (Table 2, Column 2) to 10 CFR Part 20; and dose limits of Parts 20.1301 and 20.1302 to members of the public. Accordingly, update this COL action in the DCD for the purpose of fully reflecting all applicable NRC regulations.

**Chapter 13, Conduct of Operations**

<b>RAI Number</b>	<b>Reviewer</b>	<b>Question Summary</b>	<b>Full Text</b>
13.6-4	Tardiff A	Provide an analysis that determines the delay provided by the vital area walls and provide the design of the locked and controlled access portals to vital areas.	13.6.1.1.2, "Physical Barriers". Provide an analysis of the delay provided by the vital area walls when challenged by the design basis threat of radiological sabotage. The vital area wall makes up one of the two required physical barriers as described in 10 CFR 73.55(c)(1). Provide the design of the locked and controlled access portals to vital areas within the protected area. Barriers, such as vital area walls, as defined in 10 CFR 73.2, should be designed such that the integrity of the wall is not lessened by any opening. Therefore the access portals to vital areas should be of such a design that they take advantage of the delay time provided by the vital area wall. Locks utilized in the design of the portals should be manipulative resistant as identified in RG 5.12; or equivalent. The requirement to have a physical protection system that is designed to protect against the design basis threat of radiological sabotage as stated in § 73.1(a); is described in 10 CFR 73.55(a). Please update the DCD to include this information.
13.6-5	Tardiff A	Provide, at a minimum, conduit pathway design or other means of accommodating fiber-optics and electric utilities for design features such as detection aids and positive control devices at vital areas.	13.6.1.1.3, "Detection Aids." Provide, at a minimum, conduit pathway design or other means of accommodating fiber-optics and electric utilities for design features such as detection aids and positive control measures. Detection aids and positive control for vital areas, are required as described in 10 CFR 73.55 (d)(7)(i)(B) and (D), respectively. Detection aids could be such items as balanced magnetic switches on vital area doors and positive control could include a means of personnel and vehicle access control such as electronic card or biometric readers at vital area doors. Please update the DCD to include this information.
13.6-6	Tardiff A	Provide a reference to the security lighting performance requirements as described in 10 CFR 73.55.	13.6.1.1.6, "Security Lighting." Provide information that ensures that security lighting will be designed to meet the performance requirements as described in 10 CFR 73.55(c)(5). Please update the DCD to include this information.

RAI Number	Reviewer	Question Summary	Full Text
13.6-7	Tardiff A	Provide preliminary design information that indicates the approximate physical size and capacity of the secondary power supply	13.6.1.1.7, "Security Power Supply." Provide preliminary design information that indicates the approximate physical size and capacity of the secondary power supply. The onsite secondary power supply systems for alarm annunciator equipment and non-portable communications is required as described in 10 CFR 73.55(e)(1). Refer to NUREG/CR-0509, November 1979, and Inspection procedure 81058 Security System Power Supply, May 9, 1984, for technical guidance. By considering the approximate capacity and subsequent physical size of the secondary power supply, greater assurance is gained that the location identified for the power supply will have adequate physical dimensions and that the capacity of the final power supply will be adequate. Please update the DCD to include this information.
13.6-8	Tardiff A	Provide recommended testing and maintenance for any physical barriers and equipment identified in the ESBWR design.	13.6.1.1.8, "Testing and Maintenance of Security Systems." Provide recommended testing and maintenance for any physical barriers and equipment identified in the ESBWR design. Testing and maintenance of security systems is required as described in 10 CFR 73.55(g). Physical barriers are included in the scope of the requirements for testing and maintenance of security systems. Please update the DCD to include this information.
13.6-9	Tardiff A	Provide a more comprehensive listing of references in section 13.6.6.1.4.	13.6.6.1.4, "References." Provide a more comprehensive listing of references in the DCD. The listed references neither includes 10 CFR 50.54 (security plans) nor 10 CFR 74 (material control and accounting). NRC Inspection Manual, Inspection Procedures: 81058 Security System Power Supply (05/09/84), 81066 Assessment Aids (05/09/84), and 81080 Detection Aids (05/09/84) should be added and could be used to identify NRC expectations. These recommended additions do not comprise a comprehensive listing of additions.

RAI Number	Reviewer	Question Summary	Full Text
13.6-10	Tardiff A	Provide additional information that includes the design location of the central alarm station and the secondary power supply. Provide the design of the location and cabling pathways of the secondary power supply.	13.6.2.2, "Vital Areas." Provide the exact location of the central alarm station and the secondary power supply. Both the central alarm station and the secondary power supply are required to be in an area designated as a vital area as described in 10 CFR 73.55 (e)(1). Provide the design of the location and design (e.g., within walls non-accessible, hardened conduit, fire resistant) of the cabling pathways for the required secondary power supply. Please update the DCD to include this information.
13.6-11	Tardiff A	Provide additional information describing the design of the security features related to rapid ingress, egress and alarming of vital area emergency exits	13.6.2.3, "Normal Access Control Measures." Provide the design of the security features related to the rapid, ingress, egress and alarming of vital area emergency exits. Requirements for the rapid ingress or egress for vital areas is described in 10 CFR 73.55(d)(7)(i)(D)(ii) and alarm requirements for all emergency exits in the and vital area are described in 10 CFR 73.55(e)(3). Please update the DCD to include this information.
13.6-12	Tardiff A	Provide additional information that describes the location of and the design of barriers for unattended openings that cross or intersect a security boundary or area.	13.6.2.4, "Additional Access Control Measures." Provide the location and design of the barriers for all unattended openings that cross or intersect a vital area boundary. To preclude unauthorized vital area personnel access those unattended openings that have dimensional characteristics of 96 square inches of cross-sectional open area and greater than six inches in any one dimension that cross a vital area boundary should have barriers installed. Barriers are defined in 10 CFR 73.2. Requirements for barriers are as described in 10 CFR 73.55(c). Regulatory guidance for unattended openings may be found in Regulatory Guide 5.65 and Regulatory Information Summary 2005-04. Please update the DCD to include this information.

RAI Number	Reviewer	Question Summary	Full Text
13.6-13	Tardiff A	Provide additional information that describes the location of specific security areas located within vital areas. Provide design information with respect to the location and type of cabinets to be located within these areas.	13.6.2.4, "Additional Access Control Measures." Provide additional information that identifies the location of the specific security rooms within vital areas that are referenced by this section. Provide additional information with respect to the cabinets to be placed in these rooms (i.e., materials of construction, location), design of the tamper alarms for those cabinets and locks for the cabinets. Physical barriers are required as described in 10 CFR 73.55(c) and tamper alarms are required as described in 10 CFR 73.55 (e)(2). Please update the DCD to include this information.
13.6-14	Tardiff, A.	Provide specific details regarding bullet minimum bullet resisting requirements for the main control room and the central alarm station and the design of that bullet resistance.	13.6.2.5,"Bullet Resisting Vital Areas." Provide additional information that specifies the minimum bullet resistance for the main control room and central alarm station, and the design of the bullet resistance and bullet resistant features of the main control room and central alarm station. Provide information that can clearly indicate that the central alarm station is located and designed in such a manner that the interior is not visible from the protected area. Provide the description of the design features of the central alarm station that would assist a COL applicant referencing the ESBWR design to meet the "no single act" requirement. Minimum bullet resistance specified should be UL 652 Level IV or NIJ Standard 0108.01 Type III. The requirements for bullet resistance of the control room and central alarm station are described in 10 CFR 73.55(c)(6) and (e)(1), respectively. Requirement for the interior of the central alarm station not to be viewed from the protected area is described in 10 CFR 73.55(e)(1). The requirement that the central alarm station shall be located so that no single act can remove the capability of calling for assistance or otherwise responding to an alarm is described in 10 CFR73.55(e)(1). Please update the DCD to include this information.
13.6-15	Tardiff A	Provide line supervision alarm design.	13.6.2.6.2, "Mitigation Through Early Detection." Provide design information on those line supervision alarms as stated in the second paragraph of this Section. Tamper alarms, which include line supervision alarms, are required as described in 10 CFR 73.55 (b)(3). Resolution of this RAI is utilized by a COL applicant to address COL action Item 13.6-9. Please update the DCD to include this information.

RAI Number	Reviewer	Question Summary	Full Text
13.6-16	Tardiff A	Specify those components that would generate system or process alarms or that would be regularly tested and provide the design of those system or process alarms.	13.6.2.6.2, "Mitigation Through Early Detection." Specify those components that would generate system or process alarms or that would be regularly tested and provide the design of those system or process alarms. Identify the regular test intervals for those applicable components as stated in the third paragraph of this Section. These measures would assist a COL applicant referencing the ESBWR design in meeting the general performance objectives as described in 10 CFR 73.55(a). Resolution of this RAI is utilized by a COL applicant to address COL action Item 13.6-10. Please update the DCD to include this information.
13.6-17	Tardiff A	Provide alarm design for detected component failures.	13.6.2.6.3, "Detection and Mitigation with state of the Art Electronics for Plant Control and Instrumentation." Provide the design of the alarms generated for detected component failures; as stated in paragraph one of this Section. These measures would assist a COL applicant referencing the ESBWR design in meeting the general performance objectives as described in 10 CFR 73.55(a). Implementation of these alarms generated for component failure into a site physical protection system is COL Action item 13.6-11. Please update the DCD to include this information.
13.6-18	Tardiff A	Provide the design of the annunciation in the main control room; due to the condition as stated in the second paragraph of this Section.	13.6.2.6.3, "Detection and Mitigation with state of the Art Electronics for Plant Control and Instrumentation." Provide the design of the annunciation in the main control room, due to the condition as stated in the second paragraph of this Section. These measures would assist a COL applicant referencing the ESBWR design in meeting the general performance objectives as described in 10 CFR 73.55(a). Implementation of this annunciation into a site physical protection system is COL Action Item 13.6-12. Please update the DCD to include this information.
13.6-19	Tardiff A	Provide design of the alarms in the main control room for the current monitors.	13.6.2.6.3, "Detection and Mitigation with state of the Art Electronics for Plant Control and Instrumentation." Identify the design of the alarms provided in the main control room for the current monitors as stated in the third paragraph of this Section. These measures would assist a COL applicant referencing the ESBWR design in meeting the general performance objectives as described in 10 CFR 73.55(a). Implementation of the alarms for those current monitors into a site physical protection system is COL Action Item 13.6-13. Please update the DCD to include this information.

<b>RAI Number</b>	<b>Reviewer</b>	<b>Question Summary</b>	<b>Full Text</b>
13.6-20	Tardiff A	Provide the design of the separate raceways or conduits for the component's wiring or other data pathway features (i.e., fiber optic lines).	13.6.2.6.3, "Detection and Mitigation with state of the Art Electronics for Plant Control and Instrumentation." Provide the design of the separate raceways or conduits for the component's wiring or other data pathway features (i.e., fiber optic lines) as described in the fourth paragraph of this Section. These measures would assist a COL applicant referencing the ESBWR design in meeting the general performance objectives as described in 10 CFR 73.55(a). Please update the DCD to include this information.
13.6-21	Tardiff A	Provide the design of the procedures for the manual actuation of components.	13.6.2.6.3, "Detection and Mitigation with state of the Art Electronics for Plant Control and Instrumentation." Provide the design of the procedures for the manual actuation of components, as stated in the fifth paragraph of this Section. These measures would assist a COL applicant referencing the ESBWR design in meeting the general performance objectives as described in 10 CFR 73.55(a). Design of a physical protection system that can take credit for these operator actions during a security incident is COL Action item 13.6-14. Please update the DCD to include this information.
13.6-22	Tardiff A	Provide design of the cabinets and locks for the cabinets that address the first recommended security measure listed at the end of this Section.	13.6.2.7.2, Gravity Driven Cooling System." Provide design of the cabinets and locks for the cabinets that address the first recommended security measure listed at the end of this Section. Physical barriers are required as described in 10 CFR 73.55(c). Please update the DCD to include this information.
13.6-23	Tardiff A	Provide design of the cabinets that contain a tamper alarm.	13.6.2.7.2, Gravity Driven Cooling System." Provide design of the cabinets as described in the second security measure listed at the end of this Section, to contain a tamper alarm. Tamper alarms are required as described in 10 CFR 73.55(e)(2). Please update the DCD to include this information.
13.6-24	Tardiff A	Provide design of the cabinets and locks for the cabinets.	13.6.2.7.3, "Standby Liquid Control System." Provide design of the cabinets and locks for the cabinets as described in the first security measure listed at the end of this Section. Physical barriers are required as described in 10 CFR 73.55(c). Please update the DCD to include this information.

<b>RAI Number</b>	<b>Reviewer</b>	<b>Question Summary</b>	<b>Full Text</b>
13.6-25	Tardiff A	Provide design of the cabinets that contain a tamper alarm.	13.6.2.7.3, "Standby Liquid Control System." Provide design of the cabinets, as described in the second security measure listed at the end of this Section, to contain a tamper alarm. Tamper alarms are required as described in 10 CFR 73.55(e)(2). Please update the DCD to include this information.
13.6-26	Tardiff A	Provide the design location and room to house components, design of the locks, and the design of the room or enclosure to accommodate security alarm devices.	13.6.2.7.3, "Standby Liquid Control System." Provide the design location and room (or other suitable enclosure that acts as a physical barrier) to house components, design of the locks, and the design of the room or enclosure to accommodate security alarm devices, as described in the fourth security measure of this Section. Physical barriers are required as described in 10 CFR 73.55(c). Please update the DCD to include this information.
13.6-27	Tardiff A	Provide the design of the locking devices, as described at the end of the, "Scram Function," subsection.	13.6.2.7.4, "Control Rod Drive System." Provide the design of the locking devices, as described at the end of the, "Scram Function," subsection. Physical barriers are required as described in 10 CFR 73.55(c). Please update the DCD to include this information.
13.6-28	Tardiff A	Provide the design, location and locks for the cabinets, as described in the first security measure.	13.6.2.7.5, "Automatic Depressurization System." Provide the design, location and locks for the cabinets, as described in the first security measure listed at the end of this Section. Physical barriers are required as described in 10 CFR 73.55(c). Please update the DCD to include this information.
13.6-29	Tardiff A	Provide the design of the cabinets to accommodate a tamper alarm, as described in the second security measure listed at the end of this Section.	13.6.2.7.5, "Automatic Depressurization System." Provide the design of the cabinets to accommodate a tamper alarm, as described in the second security measure listed at the end of this Section. Tamper alarms are required as described in 10 CFR 73.55(e)(2). Please update the DCD to include this information.

RAI Number	Reviewer	Question Summary	Full Text
13.6-30	Tardiff A	Provide the design of the doors themselves and the door openings to accommodate alarm devices, as described in the fourth security measure.	13.6.2.7.5, "Automatic Depressurization System." Provide the design of the doors themselves and the door openings to accommodate alarm devices, as described in the fourth security measure listed at the end of this Section. Physical barriers are required as described in 10 CFR 73.55(c). Please update the DCD to include this information.
13.6-31	Tardiff A	Provide design of the door enclosures, doors and locks to provide access control for the components, as described in the fifth security measure.	13.6.2.7.5, "Automatic Depressurization System." Provide design of the door enclosures, doors and locks to provide access control for the components, as described in the fifth security measure listed at the end of this Section. Physical barriers are required as described in 10 CFR 73.55(c). Please update the DCD to include this information.
13.6-32	Tardiff A	Provide a specific list of alternative methods (methods of??).	13.6.2.7.6, "Fuel and Auxiliary Pools Cooling System." Provide a specific list of alternative methods, as described in the last sentence of this Section. These measures would assist a COL applicant referencing the ESBWR design in meeting the general performance objectives as described in 10 CFR 73.55(a). Development of procedures that would enable the use of these alternative methods during a design basis threat attack, listed at the end of this Section, and implementation of those procedures into a site physical protection strategy is COL Action Item 13.6-32. Please update the DCD to include this information.
13.6-33	Tardiff A	Provide the design of the physical protection characteristics to include the design feature of being able to accommodate security alarm devices, for containment equipment and access portals.	13.6.2.7.10, "Containment Integrity." Provide the design of the physical protection characteristics (e.g., materials of construction, physical dimensions) to include the design feature of being able to accommodate security alarm devices, for containment equipment and access portals. Physical barriers are required as described in 10 CFR 73.55(c). Please update the DCD to include this information.

RAI Number	Reviewer	Question Summary	Full Text
13.6-34	Tardiff A	Provide a detailed analysis of the potential vulnerability of the component to the design basis threat of radiological sabotage that provides a technical basis with respect to the component's potential vulnerability.	13.6.2.7.10, "Containment Integrity." Provide a detailed analysis of the potential vulnerability of the component, as described in the last sentence of the first paragraph of this Section, to the design basis threat of radiological sabotage that provides a technical basis with respect to the component's potential vulnerability. The staff notes that the component, as described in the last sentence of the first paragraph of this Section, may be able to be disabled from performing its intended function from other locations other than the location specified in the analysis provide in this Section and the answer to this RAI should take this into account. The requirement to have a physical protection system that is designed to protect against the design basis threat of radiological sabotage as stated in § 73.1(a); is described in 10 CFR 73.55(a). Please update the DCD to include this information.
13.6-35	Tardiff A	Provide the technical basis for the why the components are precluded access.	13.6.2.7.10, "Containment Integrity." Provide the technical basis for the why the components, as described in this Section, are precluded access. The requirement to have a physical protection system that is designed to protect against the design basis threat of radiological sabotage as stated in § 73.1(a); is described in 10 CFR 73.55(a). Please update the DCD to include this information.

**Chapter 18, Human Factors Engineering**

<b>RAI Number</b>	<b>Reviewer</b>	<b>Question Summary</b>	<b>Full Text</b>
18.4-26	Bongarra J	Clarify where information for Criterion 4 will be provided	Rev. 0 of NEDO-33219, Sections 7.1 and 7.2 described a method and the documentation that was to be developed for plant performance requirements and for system level functions. Sample tables were provided that included functions, parameters, ranges and limits on parameters, and related comments. This detail was judged to acceptably address NUREG-0711, Section 4, Criterion 4. This information no longer exists in NEDO-33219, Rev. 1, and it is not clear if or where the information on the parameters and functions will be provided when the functional requirements analysis (FRAs) are completed. Section 5 of Rev. 1 provides a brief description of the results summary report but does not include the parameters of Criterion 4. Please clarify where this information will be provided.
18.6-11	Bongarra J	Provide a COL item to address 50.54(i) through (m)	NEDO-33266 addresses the minimum staffing of 10 CFR 50.54(m)(2)(i). The other staffing aspects of 50.54 are contained in 50.54(i) through (m) and are typically addressed in Chapter 13, Conduct of Operations, of an SAR/DCD. These other aspects are not discussed in either Chapter 13 or Chapter 18 of the ESBWR DCD or in NEDO-33266. Section 13.1 of the ESBWR DCD, Organizational Structure of the Applicant, states that this section is the responsibility of the COL applicant. Please provide a COL item for Chapter 18.6 that addresses the COL's responsibility to provide a full explanation of compliance with 50.54(i) through (m).
18.6-12	Bongarra J	Update DCD Ch. 18.6	Rev. 3 to DCD, Section 18.6 provides a high-level description of the Staffing and Qualifications for the ESBWR. More detail is provided in NEDO-33266. One area was noted where a discrepancy exists between the two documents. DCD Section 18.6.2 and the Plan both list the categories of personnel addressed by the staffing and qualifications program in accordance with 10CFR 50.120. However, Section 18.6.2 is missing the shift technical advisor (STA). This should be corrected.

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